May 10, 2021

L-2021-100
10 CFR 54.17

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
11545 Rockville Pike
One White Flint North
Rockville, MD 20852-2746

Point Beach Nuclear Plant Units 1 and 2
Dockets 50-266 and 50-301
Renewed License Nos. DPR-24 and DPR 27

SUBSEQUENT LICENSE RENEWAL APPLICATION - ENVIRONMENTAL REPORT SUPPLEMENT 1

References:

1. NextEra Energy Point Beach, LLC (NEPB) Letter NRC 2020-0032 dated November 16, 2020, Application for Subsequent Renewed Facility Operating Licenses (ADAMS Package Accession No. ML20329A292)
2. U.S. Nuclear Regulatory Commission (NRC) Letter dated January 15, 2021, Point Beach Nuclear Plant, Units 1 and 2 - Determination of Acceptability and Sufficiency for Docketing, Proposed Review Schedule, and Notice of Opportunity to Request a Hearing Regarding the NextEra Energy Point Beach, LLC Application for Subsequent License Renewal (EPID No. L-2020-SLR-0002) (ADAMS Accession No. ML21006A417)
3. NRC Letter dated March 15, 2021, Point Beach Nuclear Plant, Unit Nos. 1 and 2 - License Renewal Regulatory Audit Regarding the Environmental Review of the Subsequent License Renewal Application (ADAMS Accession No. ML21070A207)

NEPB, owner and licensee for Point Beach Nuclear Plant (PBN) Units 1 and 2, has submitted a subsequent license renewal application (SLRA) for the Facility Operating Licenses for PBN Units 1 and 2 (Reference 1). On January 15, 2021, the NRC determined that NEPB's SLRA was acceptable and sufficient for docketing (Reference 2), and on March 15, 2021 issued the regulatory audit plan for the environmental portion of the SLRA review (Reference 3). During this audit conducted the week of April 5, 2021, NEPB agreed to supplement the SLRA (Enclosure 3, Attachment 2 of Reference 1) with new or clarifying information. The attachments to this letter provide that information.

For ease of reference, the index of attachment supplemental information is provided on page 3 of this letter. Attachments 1 through 10 describe revisions to the SLRA, shown with deleted text indicated by ~~strikethroughs~~ and inserted text indicated by **bold red underline**. The remaining Attachments 11 through 13 provide documents requested by the NRC.

Pursuant to 10 CFR 50.91(b)(1), a copy of this letter is being forwarded to the State of Wisconsin.

Should you have any questions regarding this submittal, please contact me at (561) 691-2294 or William.Maher@fpl.com.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on the 10th day of May 2021.

Sincerely,

William Maher

Digitally signed by William Maher
DN: cn=William Maher, o=Nuclear, ou=Nuclear Licensing Projects, email=william.maher@fpl.com, c=US
Date: 2021.05.10 10:58:15 -04'00'

William D. Maher
Licensing Director - Nuclear Licensing Projects

Cc (w/o Attachments):

Environmental Project Manager, Point Beach SLR, USNRC
Administrator, Region III, USNRC
Project Manager, Point Beach Nuclear Plant, USNRC
Resident Inspector, Point Beach Nuclear Plant, USNRC
Public Service Commission Wisconsin

Attachments Index	
Attachment No.	PBN SLRA Enclosure 3 Attachment 2 Supplemental Information
1	Table 3.3-12 PBN Annual Emissions Calculator Results, 2014 – 2019
2	Document Request 1: Circ Water Plans & Sections Intake Well Drawing (File No. 68251, Microfilm No. 019613, Revision No. 11 03-03-14)
3	Document Request 2: Point Beach Intake Crib Drawing (File No. PB00509, Microfilm No. PB00509, Revision No. 5 09-03-20)
4	Document Request 3: Application for Reissuance of Wisconsin Pollutant Discharge Elimination System (WPDES) Permit Number WI-0000957-08 (December 18, 2020)
5	Document Request 4: Occupational Safety and Health Administration (OSHA) Voluntary Protection Programs (VPP) Compressed Reapproval Process (CRP) Evaluation Report (September 2019)
6	Document Request 5: OSHA Letter to NEPB dated March 4, 2020
7	Document Request 6: 2020 Water Withdrawal Report
8	Document Request 7: Wisconsin Department of Administration Letter to NextEra Energy, Inc. dated March 26, 2021, Wisconsin Coastal Management Program: Point Beach Consultation
9	Document Request 8: Wetland Delineation Report, NextEra Energy Point Beach Energy Center Wetland Delineation, Manitowoc County, Wisconsin (September 18, 2020)
10	Document Request 9: Wisconsin Department of Natural Resources (WDNR) Form 3300-77A Well Construction Report, Wisconsin Unique Well Number YG332 (September 13, 2011)
11	Document Request 10: Impingement Mortality and Entrainment Characterization Study, Point Beach Nuclear Plant (August 2007)
12	Document Request 11: NEPB Letter NPL 2018-0008 to WDNR dated January 23, 2018, Review of Source Waterbody Status and Entrainment Characterization Study Report
13	Document Request 12: Updated Site Conceptual Model, NextEra Energy Resources, LLC, Point Beach Nuclear Plant (January 2017)

Air Quality and Noise

Affected SLRA Enclosure 3, Attachment 2, Sections: List of Tables; Section 3.3

SLRA ER Page Numbers: xix, 3-38

Description of Change: Add Table 3.3-12 on same page as Table 3.3-11.

Page xix

Table 3.3-11

PBN Annual GHG Emissions Inventory Summary, 2014–2018 3-38

Table 3.3-12

PBN Annual Emissions Calculator Results, 2014–2019 3-38

Table 3.5-1

Onsite Soil Unit Descriptions(a) 3-52

Page 3-38

Table 3.3-12 PBN Annual Emissions Calculator Results, 2014–2019

	2019	2018	2017	2016	2015	2014
Carbon Monoxide	2,999	4,178	5,391	2,576	4,795	5,068
Sulfur Oxide	6.20	7.18	10.02	8.68	8.65	14.07
Particulate Matter 2.5	231	289	N/A	N/A	N/A	N/A
Particulate Matter 10	365	416	613	569	539	7989
Note: Units are pounds (rounded).						

Document Request 1

Affected SLRA Enclosure 3, Attachment 2, Sections: Chapter 10

SLRA Page Number: 10-10

Description of Change: Reference citation added to Chapter 10 and reference provided for docketing.

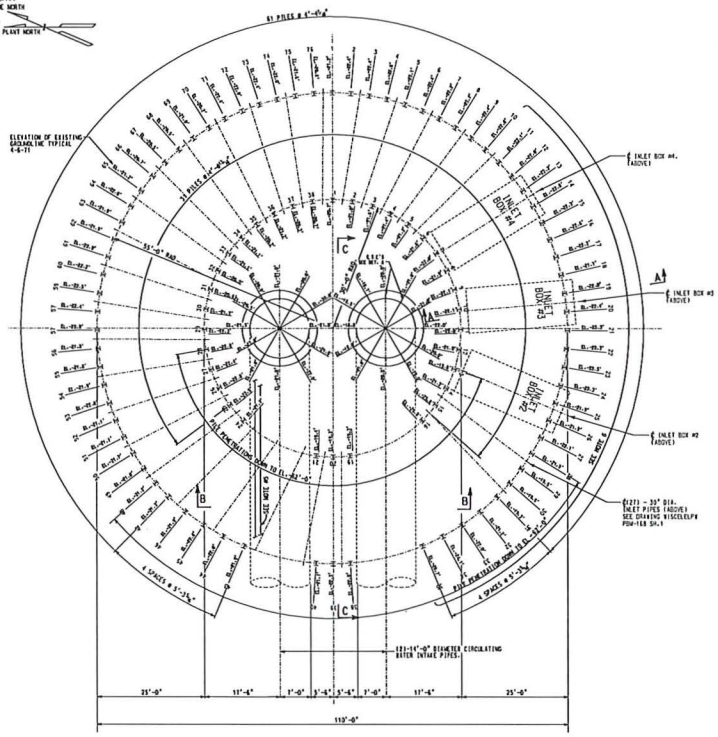
Reference pertains to: Section 2.2.3.1

Page 10-10

NEI. 2019. Model SLR New and Significant Assessment Approach for SAMA, Revision 1. August 2019.

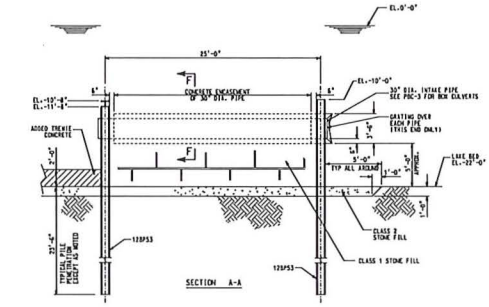
NEPB (NextEra Energy Point Beach). 2014. Circ Water Plans & Sections Intake Well Drawing (File No. 68251, Microfilm No. 019613). Point Beach N.P. Unit 1 & 2. Revision 11. March 3, 2014.

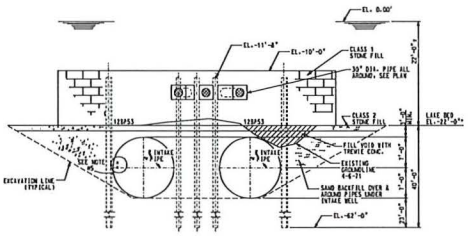
NESC (National Center for Education Statistics). 2020. Wisconsin school information. Retrieved from <https://nces.ed.gov/ccd/districtsearch/> (accessed April 12, 2020).

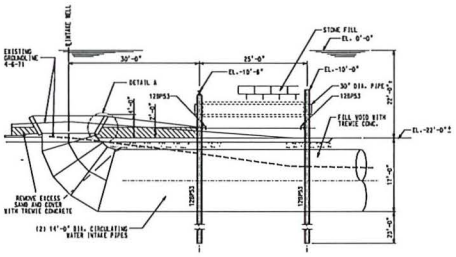


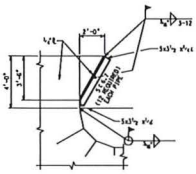
PLAN

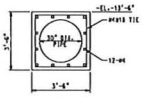
NOTES:
(33) 12DP53 COLDAIG SPACED AS NOTED ON 30'-0" RADIUS
(72) 12DP53 COLDAIG SPACED AS NOTED ON 55'-0" RADIUS











PROCEDURE:

1. CONSTRUCT A CEMENT BAG BULKHEAD AT INNER FACE OF BASIQUE SUFFICIENT TO CONTAIN PUMPED CONCRETE.
2. PUMP TREMIE CONCRETE INTO CAVITY FROM OUTSIDE FACE OF WELL. PROVIDE CEMENT BAG BULKHEADS TO CONTAIN CONCRETE.
3. PUMP OUT SAND IN BOTTOM OF WELL TO ORIGINAL GRADE OR BELOW.
4. TREMIE 24" SLAB TO COVER ENTIRE INNER SURFACE OF WELL.

NOTES:

1. FOR GENERAL NOTES SEE DWG B-2
2. ALL WORK ON THIS DWG BY LABOR&WORK CONTRACTOR ACCORDING TO SPECIFICATION G-1830 UNLESS NOTED
3. DELETED
4. DELETED
5. FOR CHLORINATION SYSTEM DETAILS SEE MCHARGE DRAWING 32-14540 SHWD-MS
6. SEE DWG PDC-3 FOR REMOVAL OF 11 30" Ø INTAKE PIPES & INSTALLATION OF BOX CULVERTS 2, 3, & 4.
7. MOD 01-001 MODIFIED INTAKE WELL. SEE DWG'S PDM-168 SH. 1,2,3, & 8 FOR INTAKE SCREENS & SCREEN SUPPORTS.

SARG04 3688 B-3

UPDATE PRIV 1
DCN: YES
MOD. REQ. 1 32-14540

REFERENCE DRAWINGS	
CIRC WATER PLAN	SARG04 3688 B-2
INTAKE CRIB LARGE PIPE INSTALL	NISCO8 PDC-3
DISCHARGE FLUME FISH SCREEN LAGGING	NISCO8 PDC-99
POINT BEACH INTAKE CRIB	NISCO8 PDM-168 SH.1-6

REV.	DATE	REVISION DESCRIPTION	DRAWN	CHK'D	APPROVED
11	03-03-14	REVISED & REDRAWN PER EC MOD1313-001	LJB	LJB	JJK
10	12-01-09	REVISED PER EC M1047	LJB	JLF	BDK
09	06-11-96	REVISED PER NSP-0553	RGW	RLB	EHP
08	12-03-90	REDRAWN AND REVISED PER NSP-0456	TLM	LJB	BCE

DRAWN DATE
CHECKED DATE
APPROVED DATE
SCALE NONE
FILE NO. 68251

NEXTERA ENERGY POINT BEACH

CIRC WATER
PLANS & SECTIONS
INTAKE WELL

POINT BEACH N.P. UNIT 1 & 2

W/CNOF FLW NO. 019613 REVISION NO. 11 DRAWING SIZE E

Document Request 2

Affected SLRA Enclosure 3, Attachment 2, Sections: Chapter 10

SLRA Page Number: 10-10

Description of Change: Reference citation added to Chapter 10 and reference provided for docketing.

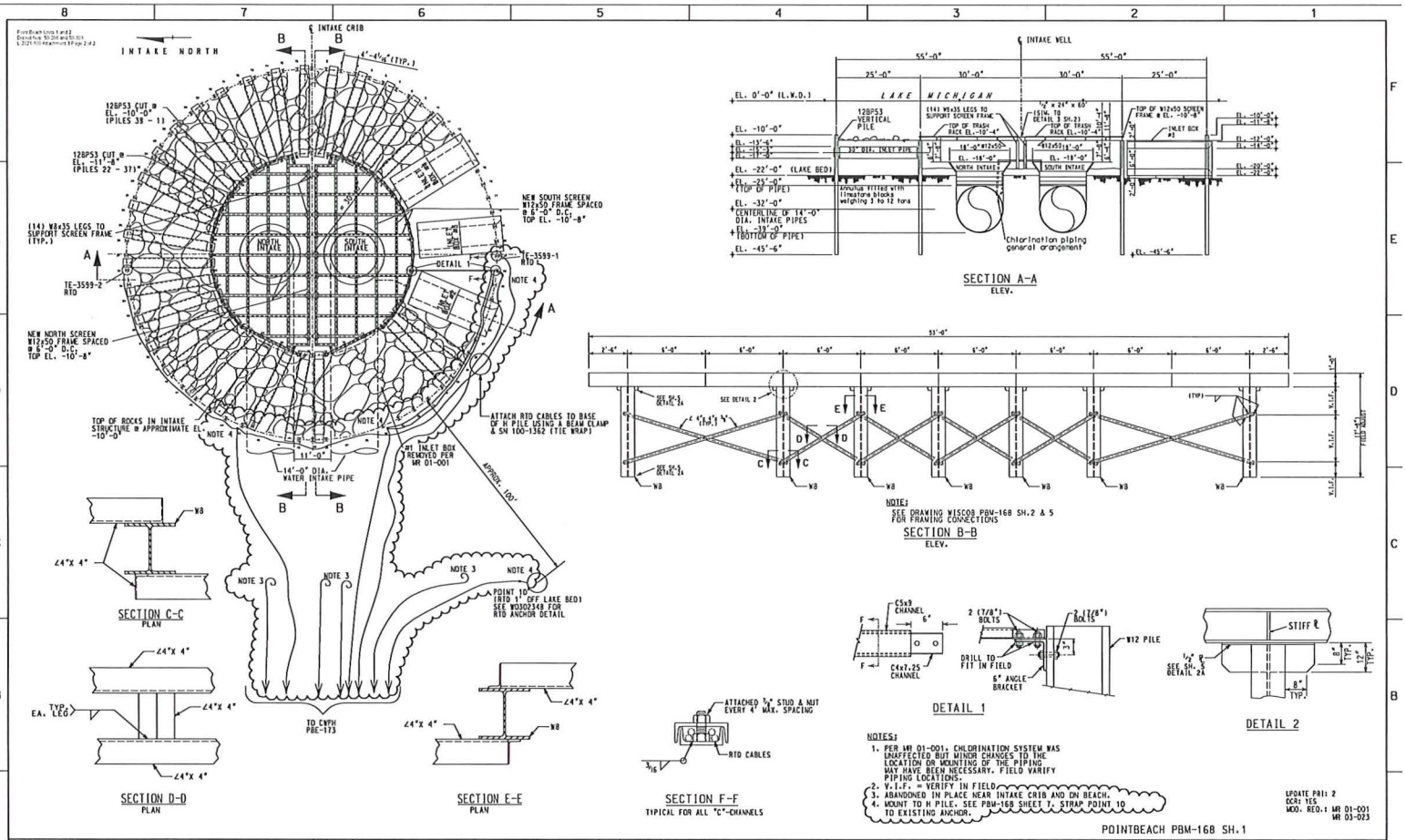
Reference pertains to: Section 2.2.3.1

Page 10-10

NEI. 2019. Model SLR New and Significant Assessment Approach for SAMA, Revision 1. August 2019.

NEPB. 2020a. Point Beach Intake Crib Drawing (File No. PB00509, Microfilm No. PB00509). Point Beach N.P. Unit 1 & 2. Revision 5. September 3, 2020.

NESC (National Center for Education Statistics). 2020. Wisconsin school information. Retrieved from <https://nces.ed.gov/ccd/districtsearch/> (accessed April 12, 2020).


INTAKE NORTH
℄ INTAKE CRIB
12BPS3 CUT @ EL. -10'-0" (PILES 38 - 1)
12BPS3 CUT @ EL. -11'-8" (PILES 22 - 37)
(14) W8x35 LEGS TO SUPPORT SCREEN FRAME (TYP.)
NEW SOUTH SCREEN W12x50 FRAME SPACED @ 6'-0" O.C. TOP EL. -10'-8"
NEW NORTH SCREEN W12x50 FRAME SPACED @ 6'-0" O.C. TOP EL. -10'-8"
NORTH INTAKE
SOUTH INTAKE
TE-3599-1 RTD
TE-3599-2 RTD
DETAIL 1
NOTE 4
TOP OF ROCKS IN INTAKE STRUCTURE @ APPROXIMATE EL. -10'-0"
ATTACH RTD CABLES TO BASE OF H PILE USING A BEAM CLAMP & SN 100-1362 (TIE WRAP)
#1 INLET BOX REMOVED PER WR 01-001
14'-0" DIA. WATER INTAKE PIPE
APPROX. 140'
NOTE 3
POINT 10 (RTD 1 OFF LAKE BED) SEE W3D02348 FOR RTD ANCHOR DETAIL
TO CWPH PBC-173
SECTION C-C
PLAN
SECTION D-D
PLAN
SECTION E-E
PLAN
℄ INTAKE WELL
55'-0"
25'-0"
30'-0"
LAKE MICHIGAN
EL. 0'-0" (L.W.D.)
EL. -10'-0"
EL. -22'-0" (LAKE BED)
EL. -23'-0" (TOP OF PIPE)
EL. -32'-0"
CENTERLINE OF 14'-0" DIA. INTAKE PIPES
EL. -39'-0" (BOTTOM OF PIPE)
EL. -45'-6"
12BPS3 VERTICAL PILE
(14) W8x35 LEGS TO SUPPORT SCREEN FRAME
TOP OF TRASH RACK EL.-10'-4"
TOP OF W12x50 SCREEN FRAME @ EL. -10'-8"
INLET BOX #1
32" DIA. INLET PIPE
NORTH INTAKE
SOUTH INTAKE
Annulus filled with limestone blocks weighing 3 to 12 tons
Chlorination piping general arrangement
SECTION A-A
ELEV.
51'-0"
SEE DETAIL 2
SEE DETAIL 2A
NOTE:
SEE DRAWING W15C08 PBM-168 SH.2 & 5 FOR FRAMING CONNECTIONS
SECTION B-B
ELEV.
C5x9 CHANNEL
C4x7.25 CHANNEL
2 (7/8") BOLTS
DRILL TO FIT IN FIELD
6" ANGLE BRACKET
W12 PILE
DETAIL 1
STIFF ℄
SEE SH. 5 DETAIL 2A
DETAIL 2
ATTACHED 5/8" STUD & NUT EVERY 4' MAX. SPACING
RTD CABLES
SECTION F-F
TYPICAL FOR ALL "C"-CHANNELS
NOTES:
1. PER WR 01-001, CHLORINATION SYSTEM WAS UNAFFECTED BUT MINOR CHANGES TO THE LOCATION OR MOUNTING OF THE PIPING MAY HAVE BEEN NECESSARY. FIELD VARIFY PIPING LOCATIONS.
2. V.I.F. = VERIFY IN FIELD
3. ABANDONED IN PLACE NEAR INTAKE CRIB AND ON BEACH.
4. MOUNT TO H PILE. SEE PBM-168 SHEET 7. STRAP POINT 10 TO EXISTING ANCHOR.
UPDATE PRI: 2
DCR: YES
MOD. REQ.: WR 01-001
WR 03-023
POINTBEACH PBM-168 SH.1
REFERENCE DRAWINGS
05 09-03-02 REVISED PER EC #393764 (08)
04 11-23-16 REVISED PER EC #251061-000
03 03-04-14 REVISED PER EC #261515-001
02 12-01-09 REVISED PER EC #11841
01 04-15-04 INCORPORATED INTO PDS PER DCN #0203-1804
DRAWN JLF JLF MJC
CHECKED JLF KJB WJB
APPROVED KJB KJB JJN
SCALE SDK
FILE NO. PB00509
DATE 03-05-03
NEXTera ENERGY POINT BEACH
POINT BEACH INTAKE CRIB
POINT BEACH N.P. UNIT 1 & 2
MICROFILM NO. PB00509
REVISION NO. 05
DRAWING SIZE D

Document Request 3

Affected SLRA Enclosure 3, Attachment 2, Sections: Chapter 10

SLRA Page Number: 10-10

Description of Change: Reference citation added to Chapter 10 and reference provided for docketing.

Reference pertains to: Sections 3.6.1.2.1, 9.5.3

Page 10-10

NEI. 2019. Model SLR New and Significant Assessment Approach for SAMA, Revision 1. August 2019.

NEPB. 2020b. Point Beach Nuclear Plant, Units 1 and 2. Application for Reissuance of WPDES Permit Number: WI-0000957-08. December 18, 2020.

NESC (National Center for Education Statistics). 2020. Wisconsin school information. Retrieved from <https://nces.ed.gov/ccd/districtsearch/> (accessed April 12, 2020).

Form 3400-178, rev. 12/13

Wisconsin Pollutant Discharge Elimination System (WPDES)
Wastewater Discharge Individual Permit Application

Permittee Name: **NextEra Energy Point Beach LLC**
Facility Name: **NEXTERA ENERGY POINT BEACH LLC**
Address: **6610 Nuclear Road, Two Rivers, WI 54241**
WPDES Permit Number: **0000957-09-0**
Proposed Permit Expiration Date: **06/30/2026**
FID #: **436034500**

Important - Please Read These Instructions

Completion of this application is required pursuant to ss. 283.37 and 283.53, Stats., and ch. NR 200, Wis. Adm. Code. Failure to provide the requested information may result in fines, forfeitures or other penalties pursuant to ss. 283.89 and 283.91, Stats. Personally identifiable information is not likely to be used by the Department of Natural Resources (DNR) for any purpose other than the reasons stated in the form or for the purpose the form is being submitted.

You must use this form (or a department-approved modification to this form) to apply for an initial permit or a reissued permit for a discharge that the DNR determines requires an individual permit under ss. NR 200.03(1)(a), (b) and (c), Wis. Adm. Code.

- Initial permit - If you are applying for an initial permit, s. NR 200.04(3), Wis. Adm. Code, requires that you file a complete application with the DNR no later than 180 days prior to the date you intend to commence discharging.
- Reissued permit - If you have an existing permit and wish to continue to discharge after expiration of the permit, s. NR 200.06, Wis. Adm. Code, requires that you must file a complete application with the DNR no later than 180 days prior to the current permit expiration date.

The application for a given permittee consists of a number of sections that may differ from another pemittee's application, based on discharge type (municipal, industrial, surface water, land treatment, land application, stormwater). If you have made changes to your facility since the last time the DNR reissued your permit and you did not inform the DNR of those changes, this application may not contain all of the correct applicable sections. The correct discharge type and number of outfalls should appear in the menu bar to the left. If the proper sections do not appear at the left, you should notify the department or you may complete this application, indicating what changes have occurred in answer to questions that ask you to report changes.

You must answer every question on the sections that apply to your facility. If you try to submit the application with required fields missing, an error message will alert you. The DNR may contact you to request additional information. Your application will not be considered complete until you supply this required information.

For some outfall types, effluent monitoring for a list of pollutants is required as part of the application. Please plan accordingly so results are available to submit with the application. Note, that some pollutants require multiple tests.

To begin, check to see if the Permittee and the Facility name shown at the top of this page are correct. If the facility name and permittee name are not correct, please report the problem to the DNR using the **Contact Us** button in the left menu. If the information is correct:

- Click on the various sections in the menu bar to the left one at a time and complete the information requested by checking boxes, clicking buttons or entering words and numbers.
- If you have questions about what information to supply for a certain question as you go about filling out the form, click on the **Instructions** button in the left menu bar to reveal instructions for the section you are working on. Useful tip: After you bring up the instructions, you may print them. However, you should understand that, the complete instructions are about 40 pages long.
- Use the **save** button as you go or as requested. Your work will automatically be saved upon exiting. You may complete some parts of the application and come back at another time to finish.
- To print a section or multiple sections at any time use the **PDF Print** button in the left menu bar, select the section(s) you want to print, open the PDF document and use the normal print function.
- When you believe a section is complete, click on the **validate** button in the left menu bar. If information is missing, a message will inform you what you need to do. If all the required information has been supplied, a red check mark will appear in the left menu bar next to the section. You may change your answer to a question in a validated section up until you **submit** your application.
- When all sections are complete and have been validated, use the **submit** button to send your application to the DNR. The Permit Application Certification Statement must be printed and then signed by the Authorized Representative. Mail the Certification Statement to the address given.

Form 3400-178, rev. 12/13

Facility Information

1. Permittee name: **NextEra Energy Point Beach LLC**

2. Facility Site Name: **NEXTERA ENERGY POINT BEACH LLC**
Site Address:**6610 NUCLEAR ROAD**
MCD: **City of TWO RIVERS**
County: **Manitowoc**

3. Responsible Party (person, parent company or organization with direct control over the facility - see instructions for complete definition).

Entity Name: Nextera Energy Point Beach LLC

Contact Person: Michael Strope

Telephone Number: [redacted]

4. Other environmental permits or approvals
Has the facility received or applied for coverage under any general WPDES permit or any other environmental permits, such as for management of hazardous wastes, emission of air pollutants or underground injection?

○ No

● Yes If yes, give the permit number(s) and briefly describe the discharge(s)

Permit Number	Description of Discharge
WI-S067857-4	TIER 2 Industrial Storm Water Permit
436034500-P32	Air Pollution Control Operation Permit
WI-0000957-08-0	WPDES
18-ETE-081	Air Pollution Control Construction Permit

5. Native American Lands

a.○ Yes ● No Is any portion of the facility located on Native American lands?

b.○ Yes ● No Does the receiving stream flow through Native American lands after it receives discharge from the treatment facility?

c.○ Yes ● No Are biosolids stored on, disposed of, or land applied on Native American lands?

If yes, to any of the above, please identify those portions of the facility or wastewaters located on Native American lands.

Facility Information	
6.	Site Map Attach to this application a detailed site map, such as a USGS topographic map, showing the area extending to at least one (1) mile beyond property boundaries. This map must show the outline of the facility, the locations of incoming wastewater, including hauled waste receiving stations, the locations of all surface water discharge points (e.g., to rivers, lakes, streams etc) and all land treatment sites (e.g., seepage cells). For surface water discharges, estimate the approximate distance from the plant to the receiving waters. For groundwater discharges, include all groundwater monitoring wells, nearby residences and all potable wells within 1,000 feet of all land treatment sites. Number all discharge points and sampling points on the map. Include the map scale and a meridian arrow showing north. ☒ Site map is attached to the Certification Statement

Contact Information

Check over the contact information below and fill in any missing information or make any needed changes. It is not necessary to have a person's name as Owner. Also, fax numbers are not required. All other fields are required.

AUTHORIZED REPRESENTATIVE	Name	**Andrew Watry**	Title	
	Address	**6610 Nuclear Rd Two Rivers,WI 54241**		
			Phone	[redacted]
	EMail	**andrew.watry@nee.co**	FAX	
OWNER OF FACILITY	Name	**Michael Strope**	Title	**Site Vice President**
	Address	**6610 Nuclear Rd Two Rivers,WI 54241**		
			Phone	[redacted]
	EMail	**michael.strope@nee.co**	FAX	
DISCHARGE MONITORING CONTACT	Name	**Jason Wiesner**	Title	
	Address	**6610 Nuclear Rd Two Rivers,WI 54241**		
			Phone	[redacted]
	EMail	**jason.wiesner@nee.co**	FAX	
FACILITY OPERATOR/PLANT MANAGER	Name	**Michael Strope**	Title	**Site Vice President**
	Address	**6610 Nuclear Road Two Rivers,WI 54241**		
			Phone	[redacted]
	EMail	**michael.strope@nee.co**	FAX	

Form 3400-178, rev. 12/13

A. Description Of Industrial Activity (see instructions)

1. Nature of Business - Provide a brief description of the facility's operations.

Nextera Energy Point Beach LLC is a nuclear-fueled steam electric power generating plant. It consists of two nuclear powered steam supply systems, which drive two turbine generators. Each unit has an electrical output of 630 megawatts.

2. Change in Operations

a. Since the issuance of your current WPDES permit, have any changes in the operations of the facility or modifications of the facility's wastewater treatment system affected either the quantity or quality of the discharges from the facility?

- ● No. (continue to b)
- ○ Yes. If yes, enter a summary of the changes and modifications, and continue to b.
- ○ Does not apply. This is a first time application.

b. In the next five years, do you intend to expand or change the operations of the facility or modify the facility's wastewater treatment system to an extent that the quantity or quality of the discharge will be affected?

- ● No. (continue to 3)
- ○ Yes If yes, enter a brief summary of the planned changes.

3. Days of Operation

24 Hours per Day, 7 Days per Week, 12 Months per Year

4. Number of Employees

Normal 550 , and Maximum 1500

5. Sanitary Wastes - Where are sanitary wastes (wastewaters from lavatories, washrooms, lunch/break room sinks, showers, etc.) discharged?

- ☐ In a septic tank system and/or subsurface absorption system
- ☒ In a privately owned treatment system owned by you or others. Identify others: NA
- ☐ In a publicly owned treatment system operated by
- ☐ Other (specify)

A. Description Of Industrial Activity (see instructions)

6. Water Supply - What are the facility's sources of water?

	Name of Source	Average Volume or Flow Rate (include units).
Municipal Supply		
Surface Water Intake	Lake Michigan	913.6 MGD 2019 avg
Private Well	PBNP Water Supply Well	0.0096 MGD 2019 avg
Other (specify)		
Other (specify)		

7. Surface Water Intake - Do you have a surface water intake? If yes, then provide more detail for each intake.

● Yes ○ No

8. Flow Diagram - Construct a line drawing showing the water flow through the facility. Indicate sources of intake water, operations contributing wastewater to the effluent, and treatment units. Construct a water balance on the line drawing by showing average flows between intakes, operations, treatment units, and outfalls. Attach a hard copy of the drawing to the Certification Statement.

☒ Line drawing is attached to the Certification Statement.

9. Storm Water Management - Select one of the following:

● The facility is covered under a WPDES tier 1, tier 2 or other storm water general permit.

○ The facility has filed a 'No Exposure Certification' with DNR.

○ The facility is not an industry type that is regulated under chapter NR216, Storm Water Discharge Permits, Wisconsin Administrative Code.

○ The facility needs to apply for a storm water permit or file a No Exposure Certification. 'Copy of No Exposure Certification Form 3400-188'

DETAILED SURFACE WATER INTAKE INFORMATION
(Use a separate copy of this section for each surface water intake)

For each of the surface water intakes named in question 6, please provide the following information:

1. Name or number used by your company to identify the intake

601 Water Intake

2. What is the name of the source water?

Lake Michigan

3. Is any water withdrawn from the source water used for cooling? ● Yes ○ No
(If No, go to question 6. If Yes, continue).

4. Approximately what percentage withdrawn is used for cooling? 100

5. Is the cooling water used in a once-through or closed cycle cooling system?

Once-through cooling

6. When was the intake installed? (Please provide dates for all major construction/installation of intake components including screens.)

Installed in 1967 and redesigned in 2002.

A. Description Of Industrial Activity (see instructions)	
7.	What is the location and configuration of the intake pipe in the source water? (E.g. onshore/offshore, at what depth, location in relation to bottom, latitude/longitude, etc.) Intake is located 1,750 feet offshore in approximately 22 feet of water.
8.	What is the maximum design intake volume? (maximum pumping capacity in gallons per day) 1,108 MGD
9.	What is the average intake volume? (average intake pump rate in gallons per day average in any 30-day period) Winter average = 697 MGD; Summer average = 1104.4 MGD
10.	How is the intake operated? (e.g. continuously, intermittently, batch) Continuously
11.	What is the size of the screen of your intake? 8 screens, 11' wide channel,10' wide screens w/ 2/9
12.	What is the intake screen flow-through area? Area = 1,544 square feet
13.	What is the intake through-screen velocity, using maximum design intake gallons per day? (Please provide your calculations in an attachment) 2.0 ft/sec ☒ Calculations are attached to the Certification Statement.
14.	What is the mechanism for cleaning the screen? (e.g. does it rotate for cleaning?) Screen rotation and screen wash spray
15.	Do you have any additional fish detraction technology on your intake? If Yes, describe. ● Yes ○ No Intake is surrounded by a 16 speaker acoustic deterrent system
16.	Have there been any studies to determine the impact of the intake on aquatic organisms? (If yes, please attach) ● Yes ○ No ☒ Study is attached to the Certification Statement.
17.	Attach a site map showing the location of the water intake in relation to the facility, shorline, water depth, etc. ☒ Site Map is attached to the Certification Statement.

Form 3400-178, rev. 12/13

Industrial Surface Water Outfall Information for Outfall 001: Condenser Cooling Water

1. Receiving Water: **LAKE MICHIGAN**

2. Outfall Location
Describe the outfall location (for example, east bank of Wisconsin River one-quarter mile down stream of Second Street bridge)

-Outfall 001 at Lake Michigan shoreline: 44 deg. 16 min. 50 sec. latitude 87 deg. 32 min. 00 sec. longitude
-Outfall 002 at Lake Michigan shoreline: 44 deg. 16 min. 50 sec. latitude 87 deg. 32 min. 10 sec. longitude

3. Wetlands - Does this outfall discharge to a wetland?
- ● No.
- ○ Yes. If yes, are you requesting increased (less restrictive) effluent limitations for this outfall or will the discharge from this outfall increase over the next 5 years?
  - ○ No.
  - ○ Yes. If yes, you may be required to submit a wetland evaluation with this application. For a description of information that needs to be submitted, see the Guidance for Requesting an Increased Discharge to Wetlands.You may attach information (paper copy) to the Certification Statement.

4. Seasonal or Intermittent Discharges (select one of following options and provide information requested)
- ● Discharge is year round.
- ○ Discharge is intermittent (describe the frequency, duration and flow rate of each discharge occurrence, except for storm water runoff and spillage or leaks).
- ○ Discharge is seasonal (specify dates)

Date From **Through Date**

5. Type of Wastewater Discharged (check all that apply to this outfall and specify the average flow in gallons per day (gpd) or million gallons per day (MGD) of each.)

		Average Flow (specify units)
☒	Noncontact Cooling Water	913.6 MGD 2019 avg
☐	Contact Cooling Water	
☒	Sanitary Wastes	0.0053 MGD 2019 avg
☒	Process Wastewater	0.1178 MGD 2019 avg
☐	Storm Water	
☒	Boiler Blowdown	0.1973 MGD 2019 avg
☐	Cooling Tower Blowdown	
☒	WT RO Reject	0.0914 MGD 2019 avg
☒	Microfiltration Unit Backwash	No flow in 2019 or 2020

Industrial Surface Water Outfall Information for Outfall 001: Condenser Cooling Water

6. Discharge Flow Rates - Specify in gallons per day (gpd) or million gallons per day (MGD) the maximum discharge flow rates that have occurred during the term of the current permit.

	Flow (specify units)	Time Period when flow occurred
Maximum Day	581.0 MGD	10/5/2015
Maximum 7-day Average	581.0 MGD	10/5-10/11/2015
Maximum 30-day Average	563.8 MGD	10/2-10/31/2015
Maximum Annual Average	492.5 MGD	2015

7. Process Streams Contributing to the Outfall Discharge - Identify and provide the Standard Industrial Classification (SIC) code for each production process that contributes wastewaters to this outfall discharge. If a technology-based effluent standard is applicable to the process wastewater, provide the production rate for the process.

Process Name	Process SIC Code	Description and production rates
Steam Electric	4911	Condenser Cooling, Water Screen Backwash, Fire Protection, Misc. Equipment Cooling, Steam Generator Blowdown, Primary Coolant Letdown, Reverse Osmosis, Neutralizing Tank

8. Treatment System Description - Describe any treatment given to wastewaters prior to discharge from this outfall.

Recirculating water is dechlorinated using sodium bisulfite when necessary based on the use of sodium hypochlorite; approximately one hour per day, 3 to 7 days per week depending on lake temperature.

9. Schematic Diagram of Treatment System - Provide a schematic diagram of your wastewater treatement system for this outfall. Show all bypasses, sample locations and treatment units and processes. Attach a paper copy of the diagram to the Certification Statement. If there is no treatment facility associated with this outfall, the flow diagram in question 8 of the Industrial Activity may suffice for this question as well

☒ The schematic diagram is attached to the Certification Statement.

10. Effluent Flow Monitoring and Sampling Devices

Flow Monitoring Type & Age:	No flow meter; use pump capacities, number of pumps, and pump run times to calculate flow
Flow Monitoring Location:	NA
Effluent Sampling Type:	Composite and grab
Effluent Composite Sample Location:	Outfall 001 or Outfall 002
Effluent Grab Sample Location:	Outfall 001 or Outfall 002

Industrial Surface Water Outfall Information for Outfall 001: Condenser Cooling Water

11. Sludge Disposal - If you have a wastewater treatment system for this outfall, does it produce a sludge?

- ● No.
- ○ Yes. If yes, where do you dispose your wastewater treatment system sludge?
  - ☐ Land Application
  - ☐ Landfill
  - ☐ Haul to or by Other Permitted Facility
    - Facility Name
    - WPDES Permit No. WI-
  - ☐ Other(specify)

12. Additives - Provide the number of biocides, water quality conditioners and process additives that you add to the waters discharged from this outfall. If zero, enter 0

2	Biocides (chlorine and other halogens, fungicides, algicides, herbicides, bacterial control chemicals, etc.)
0	How many of the biocides are used less frequently than once in any four day period?
16	Water Quality Conditioners (water and wastewater treatment chemicals including scale and corrosion inhibitors, chemical conditioning agents, pH adjustment chemicals, dechlorination chemicals, alum, ferric chloride, ferrous sulfate or chloride (pickle liquor) polymers, ammonia, phosphorus, defoamers, etc.)
2	Process Additives (limited to dyes and surfactant-based detergents)
7	How many of the water quality conditioners and process additives are used less frequently than once in any four day period?

13. Biological Toxicity Data - In the last five years, have any biological tests for acute or chronic toxicity been made on the discharge from this outfall or on the receiving water for this outfall?

- ○ No.
- ● Yes. If yes, provide all test dates and types below. Also, submit to the Department test results for those tests not previously submitted.

Dates	Type (acute or chronic)
5/14/2019	**Both**
8/20/2017	**Both**

14. Phosphorus
Alternative Technology Based Effluent Limit OR Adaptive Management/Trading OR Variance -
As of December 2010, Wisconsin's phosphorus rules, NR 217 Wis. Adm. Code, were updated to include procedures for calculating water quality based effluent limits (WQBELs) for phosphorus in addition to the existing technology based limits of 1.0 mg/L and existing provisions for requesting an alternative technology-based phosphorus limit. Options available for phosphorus compliance (based on eligibility) are listed below.

Industrial Surface Water Outfall Information for Outfall 001: Condenser Cooling Water	
a.	Alternative Technology Based Effluent Limit - If you wish to request an alternative technology-based phosphorus limit, please contact your DNR representative to determine if your facility is eligible. Should you decide to pursue an alternative technology-based phosphorus limit, please use the Alternative Phosphorus Effluent Limitation Request Checklist and attach a copy to the Certification Statement. Are you applying for an alternative technology-based phosphorus limitation? ○ Yes ● No
b.	Adaptive Management/Water Quality Trading - If you wish to request either the Adaptive Management option to achieve the phosphorus water quality criteria per s. NR 217.18, Wis. Adm.Code or the Water Quality Trading option per s. 283.84, Wis. Stats., please use the applicable form (see links below) and attach a copy to the Certification Statement. Watershed Adaptive Management Request form 3200-139 Notice to Conduct Water Quality Trading form 3400-206 Are you requesting the Adaptive Management option or Water Quality Trading option to achieve phosphorus water quality compliance? ○ Yes ● No
c.	Variance PERMITEES WITH A PHOSPHORUS WATER QUALITY BASED EFFLUENT LIMIT FOR AN EXISTING SOURCE: You may apply for a variance to the phosphorus water quality standard used to calculate the water quality based effluent limits per s. 283.15, Wis. Stats. (Variance, Form 3200-144) or per s. 283.16, Wis. Stats. (Multi-Discharger Variance, Form 3200-149). PERMITEES WITH A PERMITTED STABILIZATION POND/LAGOON SYSTEM: You may apply for a variance to the phosphorus water quality based effluent limitations if your wastewater treatment system consists primarily of a stabilization pond or lagoon system per s. NR 217.19, Wis. Adm. Code. To apply for the phosphorus variance, please use the applicable form (see links below) and attach a copy to the Certification Statement. Phosphorus Variance Application for Industrial Facilities form 3200-144 Phosphorus Multi-Discharge Variance Application form 3200-149 Phosphorus Variance Application form 3200-137 for Stabilization Ponds/Lagoon Systems Are you applying for a Phosphorus variance? ○ ●
15.	Chloride Variance - If your current permit contains a chloride variance and you wish the variance to continue, you must re-apply. If your effluent chloride concentration approaches or exceeds 1500 mg/L as a daily maximum (or 395 as a weekly average, if you discharge to a very low-flow stream) you may have trouble meeting effluent chloride limits. You may apply for a chloride variance under section NR 106, subchapter IV, Wisconsin Administrative Code. To apply, use the Chloride Variance Application Form 3400-193 and attach a copy to the Certification Statement. Are you applying for a chloride variance? ○ Yes ● No
16.	Mercury Variance - If your effluent mercury concentration approaches or exceeds 1.3 ng/L as a monthly average, and you discharge net quantities of mercury, you may have trouble meeting water quality based effluent limits for mercury. You may apply for a mercury variance (alternative mercury effluent limitation) under section NR 106.145, Wisconsin Administrative Code. To apply for a variance, use the Mercury Variance Application Form 3400-192 and attach a paper copy to the Certification Statement. Are you applying for a mercury variance? ○ Yes ● No

Industrial Surface Water Outfall Information for Outfall 001: Condenser Cooling Water	
17.	Temperature Alternative Effluent Limit (AEL) - An application for an alternative effluent limitation may be submitted by the permitee if the facility is subject to effluent temperature limitations per s. NR 106.72, Wis. Adm. Code. The application for an AEL shall include a demonstration that the effluent temperature limitations are more stringent than necessary to assure protection of aquatic life. If you wish to apply for an alternative effluent temperature limit per s. NR 106.72, please use the Notice of Application for an Alternative Effluent Limit for Temperature and attach a copy to the Certification Statement. Are you applying for an alternative effluent limitation for temperature? ○ Yes ● No
18.	Variance to a Water Quality Standard and/or Water Quality Trading a. Request for a Variance to a Water Quality Standard - If it is your intent to apply for a variance to any water quality standard not referenced above please refer to the DNR web page for variances at http://dnr.wi.gov/topic/wastewater/variances.html b. Request for Water Quality Trading - If it is your intent to use Water Quality Trading to demonstrate compliance with a water quality based effluent limitation, please refer to the DNR web page for trading at http://dnr.wi.gov/topic/surfacewater/waterqualitytrading.html
19.	Discharge Monitoring Report (DMR) Information Select one and give details, if appropriate. ○ This is a first-time permit application for a facility that does not yet have a discharge. ● I believe that data previously reported on DMRs for this outfall for the last 36 months are representative of the effluent quality. ○ Certain of the data previously reported on DMRs for this outfall for the last 36 months are not representative of the effluent quality. The data (give specific dates or date ranges) and the reasons for them not being representative are as follows.
20.	Hazardous Substances If you know or have reason to believe that any substance listed in Table 3 of the instructions is present in the discharge from this outfall, you must list the substance below, provide any monitoring data that you may have, select 'Intake' if you expect the parameter is present in the discharge solely as a result of its presence in your intake water, select 'DMR' if you have provided a sample result for the substance in a recent Discharge Monitoring Report and explain why you believe the substance is present in the discharge. (NOTE: No analytical testing is required for Table 3 substances.) ● I believe all substances in Table 3 of the instructions are absent from the discharge. ○ I believe all substances in Table 3 of the instructions are absent from the discharge with the exception of those that I have listed below.

21.	**Required Effluent Monitoring for Outfall 001 - Primary Industry Outfall**
a.	Primary industry outfalls include discharges of process wastewater, other than noncontact cooling water, from primary industries. Primary industries are categorized by EPA and listed in Table 4 of the instructions.
b.	Permittees are required to monitor and record results in the attached set of Monitoring Grids for each substance listed. You must sample the discharge and test for the parameters listed in the 'Common Pollutants' grid and the 'Metals, Cyanide, Hardness & Total Phenols' grid. You are also required to test for the parameters under each of the remaining grids as specified for your industrial category in Table 4 of the instructions. If you test any parameter more frequently than indicated by the number of rows in the Grid(s), use the Additional Values Grid to report the results. See Table 1 of the instructions for appropriate sample types, recommended analytical methods and proper sample preservation and holding times. All samples should be representative of normal operating conditions.
c.	From Table 4 of the instructions, list below the industrial category or categories that contribute process wastewaters to the discharge from this outfall and place a check mark in the box of each pollutant group that you must test. Industrial Category: Steam Electric Power Plants ☒ Volatile Organics ☒ Acid Extractable Compounds ☐ Base/Neutral Compounds ☐ Pesticides
d.	You may not be required to provide monitoring results of this outfall discharge. Indicate if one of the following conditions apply, please show which one applies and leave all or parts of the monitoring table blank. ● I am required to provide monitoring results. ○ I am NOT required to provide monitoring results because one of the following conditions apply. ○ I have two or more outfalls that discharge substantially identical wastewaters and I have received permission by contacting the responsible DNR staff person to only sample one of them. I am providing results for another substantially identical outfall. ○ This is a first-time permit application for a facility that does not yet have a discharge. ○ This outfall is no longer in use. ○ This outfall has a seasonal discharge that I was unable to sample prior to submitting the application. I will take the required samples once discharge resumes and send in the results as soon as possible. ○ I have received instructions in the application notification letter that I am exempt from certain standard monitoring requirements. ○ I have received instructions in the application notification letter that I may submit hard copies of the test results. I have attached them to the Certification Statement.

21.	**Required Effluent Monitoring for Outfall 001 - Primary Industry Outfall**
e.	If you know or have reason to believe that any parameter listed in Tables 1 and 2 of the instructions is present in the discharge from this outfall at a concentration greater than 10 microgram/L AND you have not already provided a sample result in the Monitoring Grid or a recent Discharge Monitoring Report, you must list the parameter in the Additional Values Grid and either provide at least one sample result for the parameter or indicate if you believe the parameter to be present in the discharge solely as a result of its presence in your intake water. Check the following box to indicate that you have evaluated the potential for these parameters being present in the discharge. ☒ Excluding those parameters that I have reported in either the Monitoring Grid, the Additional Values Grid or a recent Discharge Monitoring Report, I believe the parameters listed in Tables 1 and 2 of the instructions are either absent from this outfall's discharge or are present at concentrations less than 10 microgram/L. Note that the Additional Values Grid may also be used to report test results for any parameter that is tested more frequently than indicated by the number of rows in the Monitoring Grid.

Code	Name	Sample Result	Units	QC Flag	LOD	LOQ	Analytical Method	Sample Collection Date	Sample Type	Lab ID
Common Pollutants										
66	**BOD5, Total**	<2.0	mg/L	☐			SM 5210B	9/1/2020	Comp	999580010
140	**COD**	11.2	mg/L	☐			SM 5220	9/17/2020	Comp	999580010
105	**Chloride (16887-00-6)**	12.4	mg/L	☐			SM 4500 Cl-E	9/1/2020	Comp	999580010
112	**Chlorine, Total Residual**	<73.5	ug/L	☐	73.5	222.6	Field	9/1/2020	Grab	
789	**Nitrogen, Ammonia (NH3-N) Total (7664-41-7) (Submit a minimum of 4 sample results collected at least 3 days apart.)**	0.13	mg/L	☐	0.10	0.20	SM 4500 NH3 G	9/1/2020	Comp	999580010
		<0.10	mg/L	☐	0.10	0.20	SM 4500 NH3 G	9/4/2020	Comp	999580010
		0.12	mg/L	☐	0.10	0.20	SM 4500 NH3 G	9/9/2020	Comp	999580010
		<0.10	mg/L	☐	0.10	0.20	SM 4500 NH3 G	9/17/2020	Comp	999580010
330	**Nitrogen, Nitrite + Nitrate Total**	0.23	mg/L	☐	0.041	0.10	MCAWW-353.	9/1/2020	Comp	999580010
335	**Nitrogen, Total Kjeldahl**	0.41	mg/L	☐			4500 NH3 H	9/1/2020	Comp	999580010
338	**Nitrogen, Total**	0.64	mg/L	☐			EPA	9/1/2020	Comp	
651	**Oil & Grease (Hexane)**	<1.5	mg/L	☐	1.5	5.6	1664B	9/1/2020	Grab	999580010

Code	Name	Sample Result	Units	QC Flag	LOD	LOQ	Analytical Method	Sample Collection Date	Sample Type	Lab ID
457	**Suspended Solids, Total**	3.5	mg/L	☐			SM 2540D	9/1/2020	Comp	999580010
487	**Temperature**	86	deg F	☐			Field	9/1/2020	Grab	
147	**Copper, Total Recoverable (7440-50-8) (Submit a minimum of 4 sample results collected at least 3 days apart)**	12	ug/L	☐	3.5	10	200.7 Rev 4.4	9/1/2020	Comp	999580010
		4.3	ug/L	☐	3.5	10	200.7 Rev 4.4	9/4/2020	Comp	999580010
		<3.5	ug/L	☐	3.5	10	200.7 Rev 4.4	9/9/2020	Comp	999580010
		3.6	ug/L	☐	3.5	10	200.7 Rev 4.4	9/17/2020	Comp	999580010
Explanation of QC Flags										
Metals, Cyanide, Hardness and Phenols										
31	**Antimony, Total Recoverable (7440360)**	<7.8	ug/L	☐	7.8	20	200.7 Rev 4.4	9/1/2020	Comp	999580010
35	**Arsenic, Total Recoverable (7440-38-2)**	<4.2	ug/L	☐	4.2	10	200.7 Rev 4.4	9/1/2020	Comp	999580010
50	**Beryllium, Total Recoverable (7440417)**	<1.4	ug/L	☐	1.4	4.0	200.7 Rev 4.4	9/1/2020	Comp	999580010
87	**Cadmium, Total Recoverable (7440-43-9)**	<0.97	ug/L	☐	0.97	2.0	200.7 Rev 4.4	9/1/2020	Comp	999580010
127	**Chromium +6 (18540-29-9)**	<3.2	ug/L	☐	3.2	10	SM 3500 CR B	9/1/2020	Comp	999580010
133	**Chromium, Total Recoverable (7440-47-3)**	<4.4	ug/L	☐	4.4	10	200.7 Rev 4.4	9/1/2020	Comp	999580010
155	**Cyanide, Total (57-12-5)**	<3.0	ug/L	☐	3.0	10	SM 4500 CN E	9/1/2020	Grab	999580010
152	**Cyanide, Amenable (57-12-5)**	<5.0	ug/L	☐	5.0	10	SM 4500 CN G	9/1/2020	Grab	999580010
264	**Lead, Total Recoverable (7439-92-1)**	<2.6	ug/L	☐	2.6	5.0	200.7 Rev 4.4	9/1/2020	Comp	999580010
280	**Mercury, Total Recoverable (7439976)**	0.27	ng/L	☐	0.16	0.5	Subcontract	9/1/2020	Grab	999580010
315	**Nickel, Total Recoverable (7440-02-0)**	<3.0	ug/L	☐	3.0	10	200.7 Rev 4.4	9/1/2020	Comp	999580010

Code	Name	Sample Result	Units	QC Flag	LOD	LOQ	Analytical Method	Sample Collection Date	Sample Type	Lab ID
423	**Selenium, Total Recoverable (7782-49-2)**	<6.5	ug/L	☐	6.5	10	200.7 Rev 4.4	9/1/2020	Comp	999580010
430	**Silver, Total Recoverable (7440-22-4)**	<2.1	ug/L	☐	2.1	5.0	200.7 Rev 4.4	9/1/2020	Comp	999580010
494	**Thallium, Total Recoverable (7440-28-0)**	<4.6	ug/L	☐	4.6	10	200.7 Rev 4.4	9/1/2020	Comp	999580010
553	**Zinc, Total Recoverable (7440-66-6)**	7.9	ug/L	☐	7.3	20	200.7 Rev 4.4	9/1/2020	Comp	999580010
231	**Hardness, Total as CaCO3 (Submit a minimum of 4 sample results collected at 3 days apart.)**	129	mg/L	☐			SM 2340B	9/1/2020	Comp	999580010
		129	mg/L	☐			SM 2340B	9/4/2020	Comp	999580010
		144	mg/L	☐			SM 2340B	9/9/2020	Comp	999580010
		130	mg/L	☐			SM 2340B	9/17/2020	Comp	999580010
382	**Phenols, Total**	<4.1	ug/L	☐	4.1	5.0	420.4	9/1/2020	Comp	999580010
Explanation of QC Flags										
Volatile Organics										
6	**Acrolein (107-02-8)**	<23	ug/L	☐	23	100	624	9/1/2020	Grab	999580010
8	**Acrylonitrile (107-13-1)**	<4.5	ug/L	☐	4.5	20	624	9/1/2020	Grab	999580010
40	**Benzene (71-43-2)**	<0.15	ug/L	☐	0.15	0.5	624	9/1/2020	Grab	999580010
174	**Dichlorobromo- methane (bromo-dichloromethane) (75-27-4)**	<0.37	ug/L	☐	0.37	1.0	624	9/1/2020	Grab	999580010
80	**Bromoform (75-25-2)**	<0.45	ug/L	☐	0.45	1.0	624	9/1/2020	Grab	999580010
93	**Carbon tetrachloride (56-23-5)**	<0.38	ug/L	☐	0.38	1.0	624	9/1/2020	Grab	999580010
113	**Chlorobenzene (108-90-7)**	<0.39	ug/L	☐	0.39	1.0	624	9/1/2020	Grab	999580010

Code	Name	Sample Result	Units	QC Flag	LOD	LOQ	Analytical Method	Sample Collection Date	Sample Type	Lab ID
115	**Chlorodibromo-methane (124-48-1)**	<0.49	ug/L	☐	0.49	1.0	624	9/1/2020	Grab	999580010
117	**Chloroethane (75003)**	<0.51	ug/L	☐	0.51	1.0	624	9/1/2020	Grab	999580010
118	**Chloroform (67-66-3)**	<0.37	ug/L	☐	0.37	2.0	624	9/1/2020	Grab	999580010
584	**1,3-Dichloropropylene (542-75-6)**	<0.42	ug/L	☐	0.42	1.0	624	9/1/2020	Grab	999580010
568	**1,2-Dichloro- benzene**	<0.33	ug/L	☐	0.33	1.0	624	9/1/2020	Grab	999580010
581	**1,3-Dichloro- benzene (541731)**	<0.40	ug/L	☐	0.40	1.0	624	9/1/2020	Grab	999580010
587	**1,4-Dichloro- benzene (106-46-7)**	<0.36	ug/L	☐	0.36	1.0	624	9/1/2020	Grab	999580010
556	**1,1-Dichloro- ethane (75-34-3)**	<0.41	ug/L	☐	0.41	1.0	624	9/1/2020	Grab	999580010
570	**1,2-Dichloro- ethane (107-06-2)**	<0.39	ug/L	☐	0.39	1.0	624	9/1/2020	Grab	999580010
558	**1,1-Dichloro- ethylene (75-35-4)**	<0.39	ug/L	☐	0.39	1.0	624	9/1/2020	Grab	999580010
576	**1,2-trans Dichloroethylene (156-60-5)**	<0.35	ug/L	☐	0.35	1.0	624	9/1/2020	Grab	999580010
573	**1,2-Dichloropropane (78-87-5)**	<0.43	ug/L	☐	0.43	1.0	624	9/1/2020	Grab	999580010
589	**2-Chloroethyl vinyl ether (110-75-8)**	<0.77	ug/L	☐	0.77	2.0	624	9/1/2020	Grab	999580010
200	**Ethylbenzene (100414)**	<0.18	ug/L	☐	0.18	0.50	624	9/1/2020	Grab	999580010
82	**Methyl bromide (74839)**	<0.65	ug/L	☐	0.65	3.0	624	9/1/2020	Grab	999580010
120	**Chloromethane (74873)**	<0.32	ug/L	☐	0.32	1.0	624	9/1/2020	Grab	999580010
285	**Methylene chloride (75092)**	<1.6	ug/L	☐	1.6	5.0	624	9/1/2020	Grab	999580010
565	**1,1,2,2-Tetrachloro- ethane (79-34-5)**	<0.35	ug/L	☐	0.35	1.0	624	9/1/2020	Grab	999580010

Code	Name	Sample Result	Units	QC Flag	LOD	LOQ	Analytical Method	Sample Collection Date	Sample Type	Lab ID
490	**Tetrachloroethylene (127-18-4)**	<0.37	ug/L	☐	0.37	1.0	624	9/1/2020	Grab	999580010
500	**Toluene (108-88-3)**	0.27	ug/L	☐	0.15	0.50	624	9/1/2020	Grab	999580010
561	**1,1,1-Trichloro- ethane (71-55-6)**	<0.38	ug/L	☐	0.38	1.0	624	9/1/2020	Grab	999580010
563	**1,1,2-Trichloro- ethane (79-00-5)**	<0.35	ug/L	☐	0.35	1.0	624	9/1/2020	Grab	999580010
508	**Trichloro- ethylene (79-01-6)**	<0.16	ug/L	☐	0.16	0.50	624	9/1/2020	Grab	999580010
517	**Vinyl chloride (75-01-4)**	<0.20	ug/L	☐	0.20	1.0	624	9/1/2020	Grab	999580010
Explanation of QC Flags										
Acid Extractable Compounds (Phenols)										
592	**2-Chlorophenol (95-57-8)**	<0.47	ug/L	☐	0.47	3.7	625	9/1/2020	Comp	999580010
603	**2,4-Dichlorophenol (120-83-2)**	<0.89	ug/L	☐	0.89	7.4	625	9/1/2020	Comp	999580010
604	**2,4-Dimethyl- phenol (105-67-9)**	<1.4	ug/L	☐	1.4	7.4	625	9/1/2020	Comp	999580010
605	**2,4-Dinitrophenol (51-28-5)**	<0.78	ug/L	☐	0.78	15	625	9/1/2020	Comp	999580010
349	**P-Chloro-m-Cresol (3-methyl-4-chlorophenol) (59-50-7)**	<1.0	ug/L	☐	1.0	7.4	625	9/1/2020	Comp	999580010
593	**2-Methyl-4,6- dinitrophenol (534521)**	<1.3	ug/L	☐	1.3	15	625	9/1/2020	Comp	999580010
596	**2-Nitrophenol (88-75-5)**	<1.1	ug/L	☐	1.1	7.4	625	9/1/2020	Comp	999580010
624	**4-Nitrophenol (100-02-7)**	<1.7	ug/L	☐	1.7	15	625	9/1/2020	Comp	999580010

Code	Name	Sample Result	Units	QC Flag	LOD	LOQ	Analytical Method	Sample Collection Date	Sample Type	Lab ID
368	**Pentachloro- phenol (87-86-5)**	<1.3	ug/L	☐	1.3	15	625	9/1/2020	Comp	999580010
633	**Phenol (108-95-2)**	<0.47	ug/L	☐	0.47	3.7	625	9/1/2020	Comp	999580010
608	**2,4,6-Trichloro- phenol (88-06-2)**	<0.50	ug/L	☐	0.50	3.7	625	9/1/2020	Comp	999580010

Explanation of QC Flags

Form 3400-178, rev. 12/13

Industrial Surface Water Outfall Information for Outfall 002: Condenser Cooling Water

1. Receiving Water: **LAKE MICHIGAN**

2. Outfall Location
Describe the outfall location (for example, east bank of Wisconsin River one-quarter mile down stream of Second Street bridge)

-Outfall 001 at Lake Michigan shoreline: 44 deg. 16 min. 50 sec. latitude 87 deg. 32 min. 00 sec. longitude
-Outfall 002 at Lake Michigan shoreline: 44 deg. 16 min. 50 sec. latitude 87 deg. 32 min. 10 sec. longitude

3. Wetlands - Does this outfall discharge to a wetland?
- ● No.
- ○ Yes. If yes, are you requesting increased (less restrictive) effluent limitations for this outfall or will the discharge from this outfall increase over the next 5 years?
  - ○ No.
  - ○ Yes. If yes, you may be required to submit a wetland evaluation with this application. For a description of information that needs to be submitted, see the Guidance for Requesting an Increased Discharge to Wetlands.You may attach information (paper copy) to the Certification Statement.

4. Seasonal or Intermittent Discharges (select one of following options and provide information requested)
- ● Discharge is year round.
- ○ Discharge is intermittent (describe the frequency, duration and flow rate of each discharge occurrence, except for storm water runoff and spillage or leaks).
- ○ Discharge is seasonal (specify dates)

Date From **Through Date**

5. Type of Wastewater Discharged (check all that apply to this outfall and specify the average flow in gallons per day (gpd) or million gallons per day (MGD) of each.)

		Average Flow (specify units)
☒	Noncontact Cooling Water	913.6 MGD 2019 avg
☐	Contact Cooling Water	
☒	Sanitary Wastes	0.0053 MGD 2019 avg
☒	Process Wastewater	0.1178 MGD 2019 avg
☐	Storm Water	
☒	Boiler Blowdown	0.1973 MGD 2019 avg
☐	Cooling Tower Blowdown	
☒	WT RO Reject	0.0914 MGD 2019 avg
☒	Microfiltration Unit Backwash	No flow in 2019 or 2020

Industrial Surface Water Outfall Information for Outfall 002: Condenser Cooling Water

6. Discharge Flow Rates - Specify in gallons per day (gpd) or million gallons per day (MGD) the maximum discharge flow rates that have occurred during the term of the current permit.

	Flow (specify units)	Time Period when flow occurred
Maximum Day	586.8 MGD	10/9/2017
Maximum 7-day Average	586.8 MGD	10/9-10/15/2017
Maximum 30-day Average	567.3 MGD	10/6-11/4/2017
Maximum Annual Average	485.7 MGD	2016

7. Process Streams Contributing to the Outfall Discharge - Identify and provide the Standard Industrial Classification (SIC) code for each production process that contributes wastewaters to this outfall discharge. If a technology-based effluent standard is applicable to the process wastewater, provide the production rate for the process.

Process Name	Process SIC Code	Description and production rates
Steam Electric	4911	Condenser Cooling, Water Screen Backwash, Fire Protection, Misc. Equipment Cooling, Steam Generator Blowdown, Primary Coolant Letdown, Reverse Osmosis, Neutralizing Tank

8. Treatment System Description - Describe any treatment given to wastewaters prior to discharge from this outfall.

Recirculating water is dechlorinated using sodium bisulfite to treat the backwash water identified in Figure 4 in order to neutralize any chlorine in the backwash water sources.

9. Schematic Diagram of Treatment System - Provide a schematic diagram of your wastewater treatement system for this outfall. Show all bypasses, sample locations and treatment units and processes. Attach a paper copy of the diagram to the Certification Statement. If there is no treatment facility associated with this outfall, the flow diagram in question 8 of the Industrial Activity may suffice for this question as well

☒ The schematic diagram is attached to the Certification Statement.

10. Effluent Flow Monitoring and Sampling Devices

Flow Monitoring Type & Age:	No flow meter; use pump capacities, number of pumps, and pump run times to calculate flow
Flow Monitoring Location:	NA
Effluent Sampling Type:	Composite and grab
Effluent Composite Sample Location:	Outfall 001 or Outfall 002
Effluent Grab Sample Location:	Outfall 001 or Outfall 002

Industrial Surface Water Outfall Information for Outfall 002: Condenser Cooling Water

11. Sludge Disposal - If you have a wastewater treatment system for this outfall, does it produce a sludge?

● No.

○ Yes. If yes, where do you dispose your wastewater treatment system sludge?

☐ Land Application
☐ Landfill
☐ Haul to or by Other Permitted Facility
Facility Name
WPDES Permit No. WI-
☐ Other(specify)

12. Additives - Provide the number of biocides, water quality conditioners and process additives that you add to the waters discharged from this outfall. If zero, enter 0

2	Biocides (chlorine and other halogens, fungicides, algicides, herbicides, bacterial control chemicals, etc.)
0	How many of the biocides are used less frequently than once in any four day period?
16	Water Quality Conditioners (water and wastewater treatment chemicals including scale and corrosion inhibitors, chemical conditioning agents, pH adjustment chemicals, dechlorination chemicals, alum, ferric chloride, ferrous sulfate or chloride (pickle liquor) polymers, ammonia, phosphorus, defoamers, etc.)
2	Process Additives (limited to dyes and surfactant-based detergents)
7	How many of the water quality conditioners and process additives are used less frequently than once in any four day period?

13. Biological Toxicity Data - In the last five years, have any biological tests for acute or chronic toxicity been made on the discharge from this outfall or on the receiving water for this outfall?

● No.

○ Yes. If yes, provide all test dates and types below. Also, submit to the Department test results for those tests not previously submitted.

Dates **Type (acute or chronic)**

14. Phosphorus
Alternative Technology Based Effluent Limit OR Adaptive Management/Trading OR Variance -
As of December 2010, Wisconsin's phosphorus rules, NR 217 Wis. Adm. Code, were updated to include procedures for calculating water quality based effluent limits (WQBELs) for phosphorus in addition to the existing technology based limits of 1.0 mg/L and existing provisions for requesting an alternative technology-based phosphorus limit. Options available for phosphorus compliance (based on eligibility) are listed below.

a. Alternative Technology Based Effluent Limit - If you wish to request an alternative technology-based phosphorus limit, please contact your DNR representative to determine if your facility is eligible. Should you decide to pursue an alternative technology-based phosphorus limit, please use the Alternative Phosphorus Effluent Limitation Request Checklist and attach a copy to the Certification Statement.

Are you applying for an alternative technology-based phosphorus limitation?

○ Yes ● No

Industrial Surface Water Outfall Information for Outfall 002: Condenser Cooling Water	
b.	Adaptive Management/Water Quality Trading - If you wish to request either the Adaptive Management option to achieve the phosphorus water quality criteria per s. NR 217.18, Wis. Adm.Code or the Water Quality Trading option per s. 283.84, Wis. Stats., please use the applicable form (see links below) and attach a copy to the Certification Statement. Watershed Adaptive Management Request form 3200-139 Notice to Conduct Water Quality Trading form 3400-206 Are you requesting the Adaptive Management option or Water Quality Trading option to achieve phosphorus water quality compliance? ○ Yes ● No
c.	Variance PERMITEES WITH A PHOSPHORUS WATER QUALITY BASED EFFLUENT LIMIT FOR AN EXISTING SOURCE: You may apply for a variance to the phosphorus water quality standard used to calculate the water quality based effluent limits per s. 283.15, Wis. Stats. (Variance, Form 3200-144) or per s. 283.16, Wis. Stats. (Multi-Discharger Variance, Form 3200-149). PERMITEES WITH A PERMITTED STABILIZATION POND/LAGOON SYSTEM: You may apply for a variance to the phosphorus water quality based effluent limitations if your wastewater treatment system consists primarily of a stabilization pond or lagoon system per s. NR 217.19, Wis. Adm. Code. To apply for the phosphorus variance, please use the applicable form (see links below) and attach a copy to the Certification Statement. Phosphorus Variance Application for Industrial Facilities form 3200-144 Phosphorus Multi-Discharge Variance Application form 3200-149 Phosphorus Variance Application form 3200-137 for Stabilization Ponds/Lagoon Systems Are you applying for a Phosphorus variance? ○ ●
15.	Chloride Variance - If your current permit contains a chloride variance and you wish the variance to continue, you must re-apply. If your effluent chloride concentration approaches or exceeds 1500 mg/L as a daily maximum (or 395 as a weekly average, if you discharge to a very low-flow stream) you may have trouble meeting effluent chloride limits. You may apply for a chloride variance under section NR 106, subchapter IV, Wisconsin Administrative Code. To apply, use the Chloride Variance Application Form 3400-193 and attach a copy to the Certification Statement. Are you applying for a chloride variance? ○ Yes ● No
16.	Mercury Variance - If your effluent mercury concentration approaches or exceeds 1.3 ng/L as a monthly average, and you discharge net quantities of mercury, you may have trouble meeting water quality based effluent limits for mercury. You may apply for a mercury variance (alternative mercury effluent limitation) under section NR 106.145, Wisconsin Administrative Code. To apply for a variance, use the Mercury Variance Application Form 3400-192 and attach a paper copy to the Certification Statement. Are you applying for a mercury variance? ○ Yes ● No
17.	Temperature Alternative Effluent Limit (AEL) - An application for an alternative effluent limitation may be submitted by the permitee if the facility is subject to effluent temperature limitations per s. NR 106.72, Wis. Adm. Code. The application for an AEL shall include a demonstration that the effluent temperature limitations are more stringent than necessary to assure protection of aquatic life. If you wish to apply for an alternative effluent temperature limit per s. NR 106.72, please use the Notice of Application for an Alternative Effluent Limit for Temperature and attach a copy to the Certification Statement. Are you applying for an alternative effluent limitation for temperature? ○ Yes ● No

Industrial Surface Water Outfall Information for Outfall 002: Condenser Cooling Water	
18.	Variance to a Water Quality Standard and/or Water Quality Trading a. Request for a Variance to a Water Quality Standard - If it is your intent to apply for a variance to any water quality standard not referenced above please refer to the DNR web page for variances at http://dnr.wi.gov/topic/wastewater/variances.html b. Request for Water Quality Trading - If it is your intent to use Water Quality Trading to demonstrate compliance with a water quality based effluent limitation, please refer to the DNR web page for trading at http://dnr.wi.gov/topic/surfacewater/waterqualitytrading.html
19.	Discharge Monitoring Report (DMR) Information Select one and give details, if appropriate. ○ This is a first-time permit application for a facility that does not yet have a discharge. ● I believe that data previously reported on DMRs for this outfall for the last 36 months are representative of the effluent quality. ○ Certain of the data previously reported on DMRs for this outfall for the last 36 months are not representative of the effluent quality. The data (give specific dates or date ranges) and the reasons for them not being representative are as follows.
20.	Hazardous Substances If you know or have reason to believe that any substance listed in Table 3 of the instructions is present in the discharge from this outfall, you must list the substance below, provide any monitoring data that you may have, select 'Intake' if you expect the parameter is present in the discharge solely as a result of its presence in your intake water, select 'DMR' if you have provided a sample result for the substance in a recent Discharge Monitoring Report and explain why you believe the substance is present in the discharge. (NOTE: No analytical testing is required for Table 3 substances.) ● I believe all substances in Table 3 of the instructions are absent from the discharge. ○ I believe all substances in Table 3 of the instructions are absent from the discharge with the exception of those that I have listed below.

21.	**Required Effluent Monitoring for Outfall 002 - Primary Industry Outfall**
a.	Primary industry outfalls include discharges of process wastewater, other than noncontact cooling water, from primary industries. Primary industries are categorized by EPA and listed in Table 4 of the instructions.
b.	Permittees are required to monitor and record results in the attached set of Monitoring Grids for each substance listed. You must sample the discharge and test for the parameters listed in the 'Common Pollutants' grid and the 'Metals, Cyanide, Hardness & Total Phenols' grid. You are also required to test for the parameters under each of the remaining grids as specified for your industrial category in Table 4 of the instructions. If you test any parameter more frequently than indicated by the number of rows in the Grid(s), use the Additional Values Grid to report the results. See Table 1 of the instructions for appropriate sample types, recommended analytical methods and proper sample preservation and holding times. All samples should be representative of normal operating conditions.
c.	From Table 4 of the instructions, list below the industrial category or categories that contribute process wastewaters to the discharge from this outfall and place a check mark in the box of each pollutant group that you must test. Industrial Category: Steam Electric Power Plants ☒ Volatile Organics ☒ Acid Extractable Compounds ☐ Base/Neutral Compounds ☐ Pesticides
d.	You may not be required to provide monitoring results of this outfall discharge. Indicate if one of the following conditions apply, please show which one applies and leave all or parts of the monitoring table blank. ○ I am required to provide monitoring results. ● I am NOT required to provide monitoring results because one of the following conditions apply. ● I have two or more outfalls that discharge substantially identical wastewaters and I have received permission by contacting the responsible DNR staff person to only sample one of them. I am providing results for another substantially identical outfall. ○ This is a first-time permit application for a facility that does not yet have a discharge. ○ This outfall is no longer in use. ○ This outfall has a seasonal discharge that I was unable to sample prior to submitting the application. I will take the required samples once discharge resumes and send in the results as soon as possible. ○ I have received instructions in the application notification letter that I am exempt from certain standard monitoring requirements. ○ I have received instructions in the application notification letter that I may submit hard copies of the test results. I have attached them to the Certification Statement.

21.	**Required Effluent Monitoring for Outfall 002 - Primary Industry Outfall**
e.	If you know or have reason to believe that any parameter listed in Tables 1 and 2 of the instructions is present in the discharge from this outfall at a concentration greater than 10 microgram/L AND you have not already provided a sample result in the Monitoring Grid or a recent Discharge Monitoring Report, you must list the parameter in the Additional Values Grid and either provide at least one sample result for the parameter or indicate if you believe the parameter to be present in the discharge solely as a result of its presence in your intake water. Check the following box to indicate that you have evaluated the potential for these parameters being present in the discharge. ☒ Excluding those parameters that I have reported in either the Monitoring Grid, the Additional Values Grid or a recent Discharge Monitoring Report, I believe the parameters listed in Tables 1 and 2 of the instructions are either absent from this outfall's discharge or are present at concentrations less than 10 microgram/L. Note that the Additional Values Grid may also be used to report test results for any parameter that is tested more frequently than indicated by the number of rows in the Monitoring Grid.

Form 3400-178, rev. 12/13

Industrial Surface Water Outfall Information for Outfall 004: Intake De-icing

1. Receiving Water: **LAKE MICHIGAN**

2. Outfall Location
Describe the outfall location (for example, east bank of Wisconsin River one-quarter mile down stream of Second Street bridge)

Discharge is routed to the intake 1,750 ft offshore

3. Wetlands - Does this outfall discharge to a wetland?
- ● No.
- ○ Yes. If yes, are you requesting increased (less restrictive) effluent limitations for this outfall or will the discharge from this outfall increase over the next 5 years?
  - ○ No.
  - ○ Yes. If yes, you may be required to submit a wetland evaluation with this application. For a description of information that needs to be submitted, see the Guidance for Requesting an Increased Discharge to Wetlands.You may attach information (paper copy) to the Certification Statement.

4. Seasonal or Intermittent Discharges (select one of following options and provide information requested)
- ○ Discharge is year round.
- ○ Discharge is intermittent (describe the frequency, duration and flow rate of each discharge occurrence, except for storm water runoff and spillage or leaks).
- ● Discharge is seasonal (specify dates)

Date From	Through Date
12/01	04/01

5. Type of Wastewater Discharged (check all that apply to this outfall and specify the average flow in gallons per day (gpd) or million gallons per day (MGD) of each.)

		Average Flow (specify units)
☐	Noncontact Cooling Water	
☐	Contact Cooling Water	
☐	Sanitary Wastes	
☐	Process Wastewater	
☐	Storm Water	
☐	Boiler Blowdown	
☐	Cooling Tower Blowdown	
☒	Deicing of Intake	95.6 MGD 2019 avg Jan-Mar+Dec
☐		

Industrial Surface Water Outfall Information for Outfall 004: Intake De-icing

6. Discharge Flow Rates - Specify in gallons per day (gpd) or million gallons per day (MGD) the maximum discharge flow rates that have occurred during the term of the current permit.

	Flow (specify units)	Time Period when flow occurred
Maximum Day	145 MGD	February 15, 2020
Maximum 7-day Average	146.1 MGD	January 18 - 24, 2019
Maximum 30-day Average	141.4 MGD	January 18 - February 26, 2020
Maximum Annual Average	31.9 MGD	2019 Average

7. Process Streams Contributing to the Outfall Discharge - Identify and provide the Standard Industrial Classification (SIC) code for each production process that contributes wastewaters to this outfall discharge. If a technology-based effluent standard is applicable to the process wastewater, provide the production rate for the process.

Process Name	Process SIC Code	Description and production rates
Steam electric	4911	Condenser Cooling, Water Screen Backwash, Fire Protection, Misc. Equipment Cooling, Steam Generator Blowdown, Primary Coolant Letdown, Reverse Osmosis, Neutralizing Tank

8. Treatment System Description - Describe any treatment given to wastewaters prior to discharge from this outfall.

NA

9. Schematic Diagram of Treatment System - Provide a schematic diagram of your wastewater treatement system for this outfall. Show all bypasses, sample locations and treatment units and processes. Attach a paper copy of the diagram to the Certification Statement. If there is no treatment facility associated with this outfall, the flow diagram in question 8 of the Industrial Activity may suffice for this question as well

☒ The schematic diagram is attached to the Certification Statement.

10. Effluent Flow Monitoring and Sampling Devices

Flow Monitoring Type & Age:	No flow meter; Flow is based on pumps operating and valve position.
Flow Monitoring Location:	NA
Effluent Sampling Type:	NA
Effluent Composite Sample Location:	NA
Effluent Grab Sample Location:	NA

Industrial Surface Water Outfall Information for Outfall 004: Intake De-icing

11. Sludge Disposal - If you have a wastewater treatment system for this outfall, does it produce a sludge?

● No.

○ Yes. If yes, where do you dispose your wastewater treatment system sludge?

☐ Land Application

☐ Landfill

☐ Haul to or by Other Permitted Facility

Facility Name

WPDES Permit No. WI-

☐ Other(specify)

12. Additives - Provide the number of biocides, water quality conditioners and process additives that you add to the waters discharged from this outfall. If zero, enter 0

0	Biocides (chlorine and other halogens, fungicides, algicides, herbicides, bacterial control chemicals, etc.)
0	How many of the biocides are used less frequently than once in any four day period?
0	Water Quality Conditioners (water and wastewater treatment chemicals including scale and corrosion inhibitors, chemical conditioning agents, pH adjustment chemicals, dechlorination chemicals, alum, ferric chloride, ferrous sulfate or chloride (pickle liquor) polymers, ammonia, phosphorus, defoamers, etc.)
0	Process Additives (limited to dyes and surfactant-based detergents)
0	How many of the water quality conditioners and process additives are used less frequently than once in any four day period?

13. Biological Toxicity Data - In the last five years, have any biological tests for acute or chronic toxicity been made on the discharge from this outfall or on the receiving water for this outfall?

● No.

○ Yes. If yes, provide all test dates and types below. Also, submit to the Department test results for those tests not previously submitted.

Dates **Type (acute or chronic)**

14. Phosphorus

Alternative Technology Based Effluent Limit OR Adaptive Management/Trading OR Variance -

As of December 2010, Wisconsin's phosphorus rules, NR 217 Wis. Adm. Code, were updated to include procedures for calculating water quality based effluent limits (WQBELs) for phosphorus in addition to the existing technology based limits of 1.0 mg/L and existing provisions for requesting an alternative technology-based phosphorus limit. Options available for phosphorus compliance (based on eligibility) are listed below.

a. Alternative Technology Based Effluent Limit - If you wish to request an alternative technology-based phosphorus limit, please contact your DNR representative to determine if your facility is eligible. Should you decide to pursue an alternative technology-based phosphorus limit, please use the Alternative Phosphorus Effluent Limitation Request Checklist and attach a copy to the Certification Statement.

Are you applying for an alternative technology-based phosphorus limitation?

○ Yes ● No

Industrial Surface Water Outfall Information for Outfall 004: Intake De-icing	
b.	Adaptive Management/Water Quality Trading - If you wish to request either the Adaptive Management option to achieve the phosphorus water quality criteria per s. NR 217.18, Wis. Adm.Code or the Water Quality Trading option per s. 283.84, Wis. Stats., please use the applicable form (see links below) and attach a copy to the Certification Statement. Watershed Adaptive Management Request form 3200-139 Notice to Conduct Water Quality Trading form 3400-206 Are you requesting the Adaptive Management option or Water Quality Trading option to achieve phosphorus water quality compliance? ○ Yes ● No
c.	Variance PERMITEES WITH A PHOSPHORUS WATER QUALITY BASED EFFLUENT LIMIT FOR AN EXISTING SOURCE: You may apply for a variance to the phosphorus water quality standard used to calculate the water quality based effluent limits per s. 283.15, Wis. Stats. (Variance, Form 3200-144) or per s. 283.16, Wis. Stats. (Multi-Discharger Variance, Form 3200-149). PERMITEES WITH A PERMITTED STABILIZATION POND/LAGOON SYSTEM: You may apply for a variance to the phosphorus water quality based effluent limitations if your wastewater treatment system consists primarily of a stabilization pond or lagoon system per s. NR 217.19, Wis. Adm. Code. To apply for the phosphorus variance, please use the applicable form (see links below) and attach a copy to the Certification Statement. Phosphorus Variance Application for Industrial Facilities form 3200-144 Phosphorus Multi-Discharge Variance Application form 3200-149 Phosphorus Variance Application form 3200-137 for Stabilization Ponds/Lagoon Systems Are you applying for a Phosphorus variance? ○ ●
15.	Chloride Variance - If your current permit contains a chloride variance and you wish the variance to continue, you must re-apply. If your effluent chloride concentration approaches or exceeds 1500 mg/L as a daily maximum (or 395 as a weekly average, if you discharge to a very low-flow stream) you may have trouble meeting effluent chloride limits. You may apply for a chloride variance under section NR 106, subchapter IV, Wisconsin Administrative Code. To apply, use the Chloride Variance Application Form 3400-193 and attach a copy to the Certification Statement. Are you applying for a chloride variance? ○ Yes ● No
16.	Mercury Variance - If your effluent mercury concentration approaches or exceeds 1.3 ng/L as a monthly average, and you discharge net quantities of mercury, you may have trouble meeting water quality based effluent limits for mercury. You may apply for a mercury variance (alternative mercury effluent limitation) under section NR 106.145, Wisconsin Administrative Code. To apply for a variance, use the Mercury Variance Application Form 3400-192 and attach a paper copy to the Certification Statement. Are you applying for a mercury variance? ○ Yes ● No
17.	Temperature Alternative Effluent Limit (AEL) - An application for an alternative effluent limitation may be submitted by the permitee if the facility is subject to effluent temperature limitations per s. NR 106.72, Wis. Adm. Code. The application for an AEL shall include a demonstration that the effluent temperature limitations are more stringent than necessary to assure protection of aquatic life. If you wish to apply for an alternative effluent temperature limit per s. NR 106.72, please use the Notice of Application for an Alternative Effluent Limit for Temperature and attach a copy to the Certification Statement. Are you applying for an alternative effluent limitation for temperature? ○ Yes ● No

Industrial Surface Water Outfall Information for Outfall 004: Intake De-icing	
18.	Variance to a Water Quality Standard and/or Water Quality Trading a. Request for a Variance to a Water Quality Standard - If it is your intent to apply for a variance to any water quality standard not referenced above please refer to the DNR web page for variances at http://dnr.wi.gov/topic/wastewater/variances.html b. Request for Water Quality Trading - If it is your intent to use Water Quality Trading to demonstrate compliance with a water quality based effluent limitation, please refer to the DNR web page for trading at http://dnr.wi.gov/topic/surfacewater/waterqualitytrading.html
19.	Discharge Monitoring Report (DMR) Information Select one and give details, if appropriate. ○ This is a first-time permit application for a facility that does not yet have a discharge. ● I believe that data previously reported on DMRs for this outfall for the last 36 months are representative of the effluent quality. ○ Certain of the data previously reported on DMRs for this outfall for the last 36 months are not representative of the effluent quality. The data (give specific dates or date ranges) and the reasons for them not being representative are as follows.
20.	Hazardous Substances If you know or have reason to believe that any substance listed in Table 3 of the instructions is present in the discharge from this outfall, you must list the substance below, provide any monitoring data that you may have, select 'Intake' if you expect the parameter is present in the discharge solely as a result of its presence in your intake water, select 'DMR' if you have provided a sample result for the substance in a recent Discharge Monitoring Report and explain why you believe the substance is present in the discharge. (NOTE: No analytical testing is required for Table 3 substances.) ● I believe all substances in Table 3 of the instructions are absent from the discharge. ○ I believe all substances in Table 3 of the instructions are absent from the discharge with the exception of those that I have listed below.

21.	**Required Effluent Monitoring for Outfall 004 - Primary Industry Outfall**
a.	Primary industry outfalls include discharges of process wastewater, other than noncontact cooling water, from primary industries. Primary industries are categorized by EPA and listed in Table 4 of the instructions.
b.	Permittees are required to monitor and record results in the attached set of Monitoring Grids for each substance listed. You must sample the discharge and test for the parameters listed in the 'Common Pollutants' grid and the 'Metals, Cyanide, Hardness & Total Phenols' grid. You are also required to test for the parameters under each of the remaining grids as specified for your industrial category in Table 4 of the instructions. If you test any parameter more frequently than indicated by the number of rows in the Grid(s), use the Additional Values Grid to report the results. See Table 1 of the instructions for appropriate sample types, recommended analytical methods and proper sample preservation and holding times. All samples should be representative of normal operating conditions.
c.	From Table 4 of the instructions, list below the industrial category or categories that contribute process wastewaters to the discharge from this outfall and place a check mark in the box of each pollutant group that you must test. Industrial Category: Steam Electric Power Plants ☐ Volatile Organics ☐ Acid Extractable Compounds ☐ Base/Neutral Compounds ☐ Pesticides
d.	You may not be required to provide monitoring results of this outfall discharge. Indicate if one of the following conditions apply, please show which one applies and leave all or parts of the monitoring table blank. ○ I am required to provide monitoring results. ● I am NOT required to provide monitoring results because one of the following conditions apply. ○ I have two or more outfalls that discharge substantially identical wastewaters and I have received permission by contacting the responsible DNR staff person to only sample one of them. I am providing results for another substantially identical outfall. ○ This is a first-time permit application for a facility that does not yet have a discharge. ○ This outfall is no longer in use. ○ This outfall has a seasonal discharge that I was unable to sample prior to submitting the application. I will take the required samples once discharge resumes and send in the results as soon as possible. ● I have received instructions in the application notification letter that I am exempt from certain standard monitoring requirements. ○ I have received instructions in the application notification letter that I may submit hard copies of the test results. I have attached them to the Certification Statement.

21.	**Required Effluent Monitoring for Outfall 004 - Primary Industry Outfall**
e.	If you know or have reason to believe that any parameter listed in Tables 1 and 2 of the instructions is present in the discharge from this outfall at a concentration greater than 10 microgram/L AND you have not already provided a sample result in the Monitoring Grid or a recent Discharge Monitoring Report, you must list the parameter in the Additional Values Grid and either provide at least one sample result for the parameter or indicate if you believe the parameter to be present in the discharge solely as a result of its presence in your intake water. Check the following box to indicate that you have evaluated the potential for these parameters being present in the discharge. ☒ Excluding those parameters that I have reported in either the Monitoring Grid, the Additional Values Grid or a recent Discharge Monitoring Report, I believe the parameters listed in Tables 1 and 2 of the instructions are either absent from this outfall's discharge or are present at concentrations less than 10 microgram/L. Note that the Additional Values Grid may also be used to report test results for any parameter that is tested more frequently than indicated by the number of rows in the Monitoring Grid.

Code	Name	Sample Result	Units	QC Flag	LOD	LOQ	Analytical Method	Sample Collection Date	Sample Type	Lab ID
Common Pollutants										
66	**BOD5, Total**		mg/L	☐						
140	**COD**		mg/L	☐						
105	**Chloride (16887-00-6)**		mg/L	☐						
112	**Chlorine, Total Residual**		ug/L	☐						
789	**Nitrogen, Ammonia (NH3-N) Total (7664-41-7) (Submit a minimum of 4 sample results collected at least 3 days apart.)**		mg/L	☐						
			mg/L	☐						
			mg/L	☐						
			mg/L	☐						
330	**Nitrogen, Nitrite + Nitrate Total**		mg/L	☐						
335	**Nitrogen, Total Kjeldahl**		mg/L	☐						
338	**Nitrogen, Total**		mg/L	☐						
651	**Oil & Grease (Hexane)**		mg/L	☐						
377	**pH Field**		su	☐						

Code	Name	Sample Result	Units	QC Flag	LOD	LOQ	Analytical Method	Sample Collection Date	Sample Type	Lab ID
388	**Phosphorus, Total (7723-14-0) (Submit 12 sample results collected weekly for 3 months.)**		mg/L	☐						
			mg/L	☐						
			mg/L	☐						
			mg/L	☐						
			mg/L	☐						
			mg/L	☐						
			mg/L	☐						
			mg/L	☐						
			mg/L	☐						
			mg/L	☐						
			mg/L	☐						
			mg/L	☐						
			mg/L	☐						
457	**Suspended Solids, Total**		mg/L	☐						
487	**Temperature**		deg F	☐						
147	**Copper, Total Recoverable (7440-50-8) (Submit a minimum of 4 sample results collected at least 3 days apart)**		ug/L	☐						
			ug/L	☐						
			ug/L	☐						
			ug/L	☐						
Explanation of QC Flags										
Metals, Cyanide, Hardness and Phenols										
31	**Antimony, Total Recoverable (7440360)**		ug/L	☐						
35	**Arsenic, Total Recoverable (7440-38-2)**		ug/L	☐						
50	**Beryllium, Total Recoverable (7440417)**		ug/L	☐						

Code	Name	Sample Result	Units	QC Flag	LOD	LOQ	Analytical Method	Sample Collection Date	Sample Type	Lab ID
87	**Cadmium, Total Recoverable (7440-43-9)**		ug/L	☐						
127	**Chromium +6 (18540-29-9)**		ug/L	☐						
133	**Chromium, Total Recoverable (7440-47-3)**		ug/L	☐						
155	**Cyanide, Total (57-12-5)**		ug/L	☐						
152	**Cyanide, Amenable (57-12-5)**		ug/L	☐						
264	**Lead, Total Recoverable (7439-92-1)**		ug/L	☐						
280	**Mercury, Total Recoverable (7439976)**		ng/L	☐						
315	**Nickel, Total Recoverable (7440-02-0)**		ug/L	☐						
423	**Selenium, Total Recoverable (7782-49-2)**		ug/L	☐						
430	**Silver, Total Recoverable (7440-22-4)**		ug/L	☐						
494	**Thallium, Total Recoverable (7440-28-0)**		ug/L	☐						
553	**Zinc, Total Recoverable (7440-66-6)**		ug/L	☐						
231	**Hardness, Total as CaCO3 (Submit a minimum of 4 sample results collected at 3 days apart.)**		mg/L	☐						
			mg/L	☐						
			mg/L	☐						
			mg/L	☐						
382	**Phenols, Total**		ug/L	☐						

Explanation of QC Flags

Form 3400-178, rev. 12/13

Additional Comments (if none write none)

1. The discharge at outfalls 001 and 002 originates from the same sources; therefore, only one of these outfalls was required to be sampled. Sample results were reported under the tab for Outfall 001, but samples were actually collected at Outfall 002.

   The WDNR required sampling at Outfall 105 for the permit renewal application but did not include forms for Outfall 105 in the application. Information regarding Outfall 105, including sampling results, is included with the Certification Statement submittal.

WPDES Permit Application Certification Statement

Facility Name:	**NEXTERA ENERGY POINT BEACH LLC**				
Permit Number:	**0000957-09-0**	Facility Contact:	**Andrew Watry**		
Contact Address:	**6610 Nuclear Road**	E-Mail:	**andrew.watry@nee.com**		
	Two Rivers, WI 54241	Phone Number:	[redacted]	Application ID:	**6868**

Submittal of your permit application, including this certification document, is required by sections 283.37 and 283.53, Wis. Stats., and chapter NR 200, Wis. Admin. Code.

Personally identifiable information collected on this document or submitted in your electronic permit application will be used for administering the the WPDES permit and related programs and is unlikely to be used for other purposes. This does not include passwords or User IDs. DNR is required to provide non-confidential information to any person who requests it under the Open Records law. Such information may be provided to the public in its original form or in an electronic report.

I certify under penalty of law that this permit application submitted to DNR on 12/18/2020 and identified by the APPLICATION ID listed above, and authenticated by the document key number listed below, and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

If you have any questions, please call **Jason Knutson** at [redacted].

Return Certification to:
WI Dept of Natural Resources
Jason Knutson
PO Box 7921
Madison, WI 53707-7921

Authorized Representative Signature _____ Date _____

Submitter Signature, if different than Authorized Representative _____ Date _____

Andrew Watry electronically submitted this data on **12/18/2020**.

For DNR Use Only:

00006868

Date Received:	_____	FIN:	**7336**	FID:	**436034500**
Date Certified:	_____	Region:	**Northeast Region**		

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NEXTera ENERGY POINT BEACH

December 18, 2020 NPL 2020-0067

Mr. Jason Knutson
Wisconsin Department of Natural Resources
Environmental Engineer Supervisor
101 S Webster St WY/3
Madison, WI 53703

NextEra Energy Point Beach, LLC
Point Beach Nuclear Plant, Units 1 and 2

Re: Application for Reissuance of WPDES Permit Number: WI-0000957-08

Dear Mr. Knutson:

Attached please find a signed certification statement and attachments that go along with the submitted application for the reissuance of the above referenced WPDES Permit for NextEra Energy Point Beach, LLC located at 6610 Nuclear Rd, Two Rivers, WI 54241.

In accordance with the February 28, 2020 WDNR permit renewal letter, monitoring has been completed at Outfall 002 and Outfall 105. Monitoring results for Outfall 002 are believed to be representative of the water quality of water discharged via Outfall 001. Also included are the application requirements for CFR 122.21 (r)(2) – (13).

Should you have any questions or require additional information, please contact Jason Wiesner at 920-755-6781.

Sincerely,

NextEra Energy Point Beach, LLC

Michael Strope
Site Vice President

Nextera Energy Point Beach LLC

WPDES Permit Application Certification Statement – 2020

WPDES Permit Application Certification Statement

Facility Name:	**NEXTERA ENERGY POINT BEACH LLC**				
Permit Number:	**0000957-09-0**	Facility Contact:	**Andrew Watry**		
Contact Address:	**6610 Nuclear Road**	E-Mail:	**andrew.watry@nee.com**		
	Two Rivers, WI 54241	Phone Number:	[redacted]	Application ID:	**6868**

Submittal of your permit application, including this certification document, is required by sections 283.37 and 283.53, Wis. Stats., and chapter NR 200, Wis. Admin. Code.

Personally identifiable information collected on this document or submitted in your electronic permit application will be used for administering the the WPDES permit and related programs and is unlikely to be used for other purposes. This does not include passwords or User IDs. DNR is required to provide non-confidential information to any person who requests it under the Open Records law. Such information may be provided to the public in its original form or in an electronic report.

I certify under penalty of law that this permit application submitted to DNR on 12/18/2020 and identified by the APPLICATION ID listed above, and authenticated by the document key number listed below, and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

If you have any questions, please call **Jason Knutson** at [redacted].

Return Certification to:
WI Dept of Natural Resources
Jason Knutson
PO Box 7921
Madison, WI 53707-7921

Andrew D Watry
Authorized Representative Signature

18 Dec 2020
Date

Submitter Signature, if different than Authorized Representative

Date

Andrew Watry electronically submitted this data on **12/18/2020.**

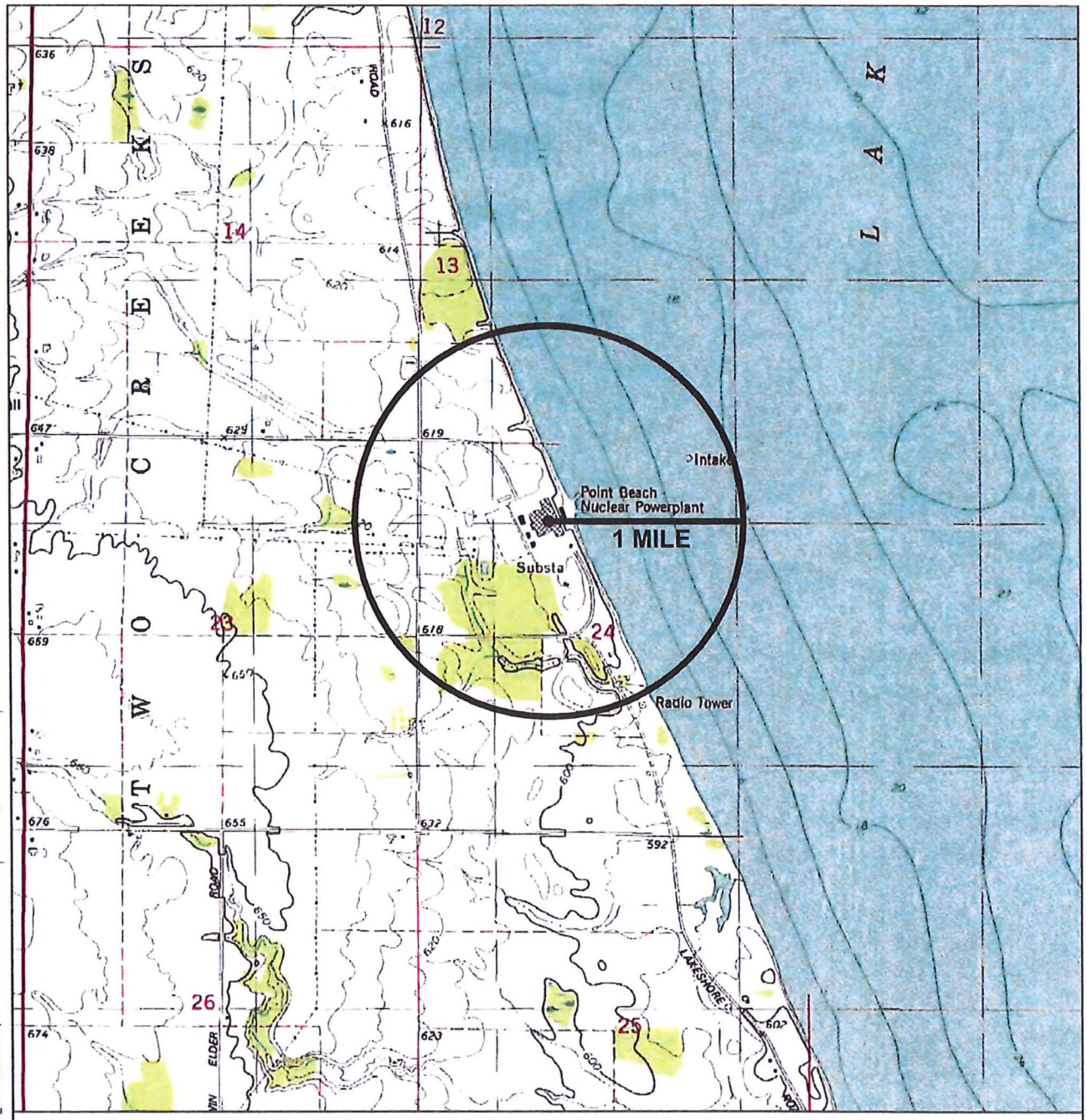
For DNR Use Only:

00006868

Date Received		FIN:	**7336**	FID:	**436034500**
Date Certified:		Region:	**Northeast Region**		

Nextera Energy Point Beach LLC

Figures 1 – 5



N

Scale 1 : 24,000
1 inch = 2,000 feet

Located in the NW 1/4 of Section 24, T21N, R24E
USGS Two Creeks Quadrangle (1978)
7.5 minute, 1 : 24,000 Topographic Map Collection

THE SIGMA GROUP
Single Source. Sound Solutions.

SITE LOCATION MAP

POINT BEACH NUCLEAR POWER PLANT
6610 NUCLEAR ROAD
TWO RIVERS, WISCONSIN

FIGURE

1

Project : 11196 | Directory: GRAPHICS | Filename: F1_Site Location Map.ai | Created By: ERO | Date: 12/08/2008

Date: 12/09/2008 | Created By: ERO | Filename: F2_Site Location Map_Aerial.ai | Directory: GRAPHICS | Project : 11196

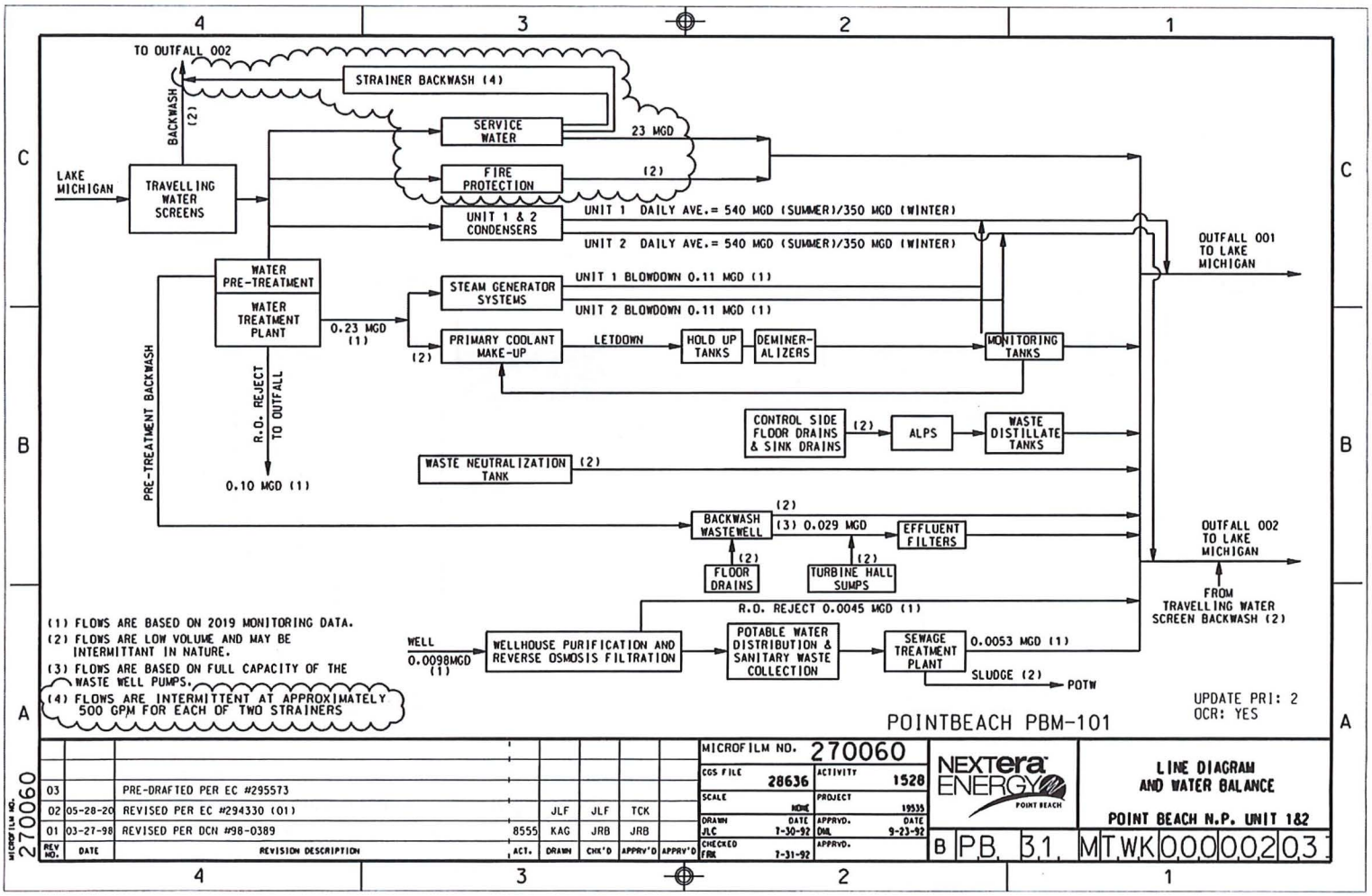
THE SIGMA GROUP
Single Source. Sound Solutions.

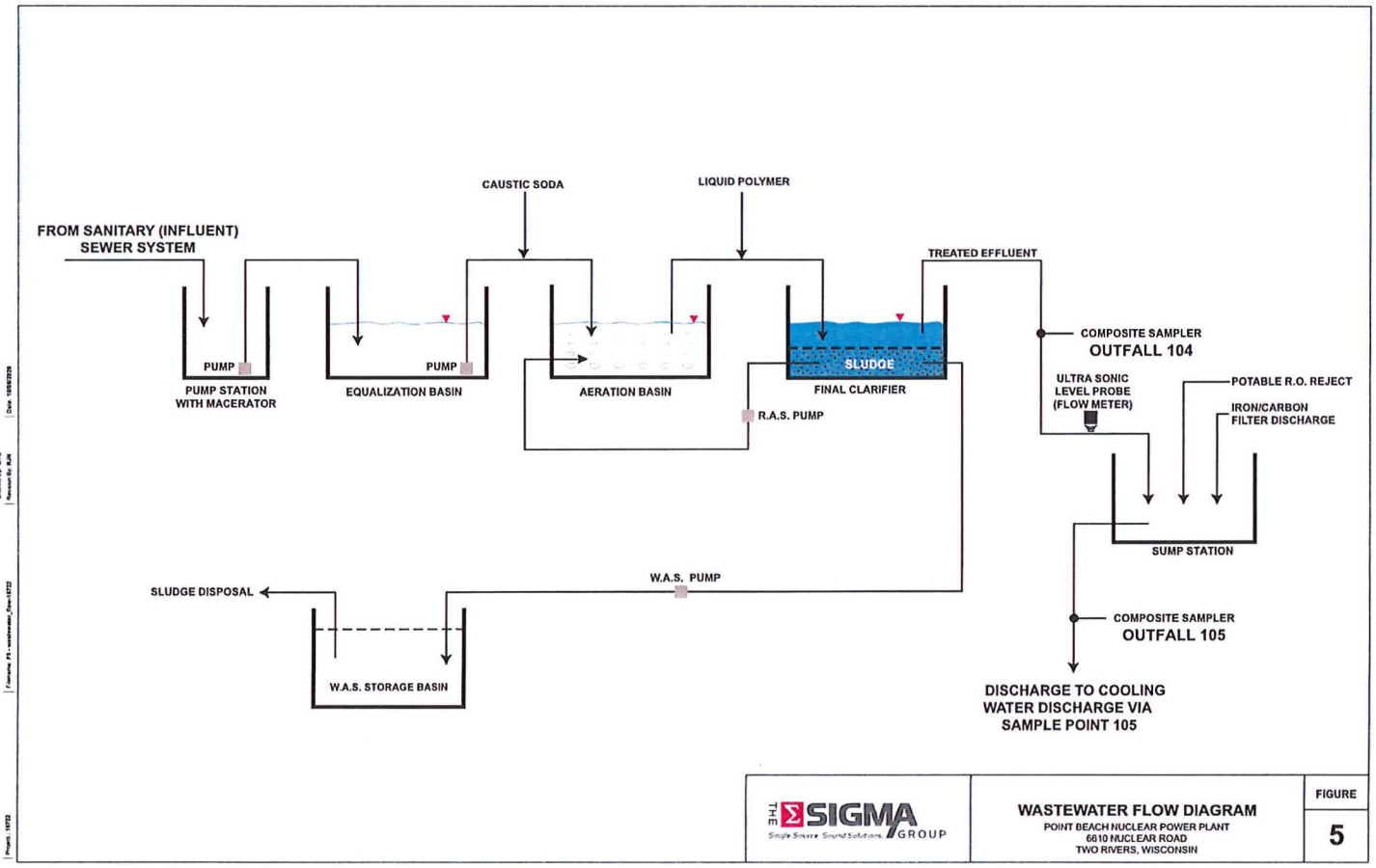
SITE LOCATION MAP - AERIAL

POINT BEACH NUCLEAR POWER PLANT
6610 NUCLEAR ROAD
TWO RIVERS, WISCONSIN

FIGURE
2

WH 6
FY404
WH 7
YG332
Intake
Discharges
Main Well
FB703
Sewage
treatment plant
Holding tank
PW Well
EIC
MY344
SBCC
BE655
Lakeshore Rd
Lake Shore Rd
Nuclear Rd
Google


TO OUTFALL 002
STRAINER BACKWASH (4)
BACKWASH (2)
SERVICE WATER
23 MGD
FIRE PROTECTION
(2)
LAKE MICHIGAN
TRAVELLING WATER SCREENS
UNIT 1 & 2 CONDENSERS
UNIT 1 DAILY AVE.= 540 MGD (SUMMER)/350 MGD (WINTER)
UNIT 2 DAILY AVE.= 540 MGD (SUMMER)/350 MGD (WINTER)
OUTFALL 001 TO LAKE MICHIGAN
WATER PRE-TREATMENT
WATER TREATMENT PLANT
STEAM GENERATOR SYSTEMS
UNIT 1 BLOWDOWN 0.11 MGD (1)
UNIT 2 BLOWDOWN 0.11 MGD (1)
0.23 MGD (1)
PRIMARY COOLANT MAKE-UP
(2)
LETDOWN
HOLD UP TANKS
DEMINER-ALIZERS
MONITORING TANKS
PRE-TREATMENT BACKWASH
R.O. REJECT TO OUTFALL
0.10 MGD (1)
CONTROL SIDE FLOOR DRAINS & SINK DRAINS
(2)
ALPS
WASTE DISTILLATE TANKS
WASTE NEUTRALIZATION TANK
(2)
BACKWASH WASTEWELL
(2)
(3) 0.029 MGD
EFFLUENT FILTERS
FLOOR DRAINS
(2)
TURBINE HALL SUMPS
(2)
OUTFALL 002 TO LAKE MICHIGAN
FROM TRAVELLING WATER SCREEN BACKWASH (2)
R.O. REJECT 0.0045 MGD (1)
WELL
0.0098MGD (1)
WELLHOUSE PURIFICATION AND REVERSE OSMOSIS FILTRATION
POTABLE WATER DISTRIBUTION & SANITARY WASTE COLLECTION
SEWAGE TREATMENT PLANT
0.0053 MGD (1)
SLUDGE (2)
POTW
(1) FLOWS ARE BASED ON 2019 MONITORING DATA.
(2) FLOWS ARE LOW VOLUME AND MAY BE INTERMITTANT IN NATURE.
(3) FLOWS ARE BASED ON FULL CAPACITY OF THE WASTE WELL PUMPS.
(4) FLOWS ARE INTERMITTENT AT APPROXIMATELY 500 GPM FOR EACH OF TWO STRAINERS
POINTBEACH PBM-101
UPDATE PRI: 2
OCR: YES
MICROFILM NO. 270060
CGS FILE 28636
ACTIVITY 1528
SCALE NONE
PROJECT 19535
DRAWN JLC DATE 7-30-92
APPRVD. DAL DATE 9-23-92
CHECKED FRK 7-31-92
APPRVD.
NEXTera ENERGY POINT BEACH
LINE DIAGRAM AND WATER BALANCE
POINT BEACH N.P. UNIT 1&2
B P.B. 3.1. MTWK0000203
03 PRE-DRAFTED PER EC #295573
02 05-28-20 REVISED PER EC #294330 (01) JLF JLF TCK
01 03-27-98 REVISED PER DCN #98-0389 8555 KAG JRB JRB
REV NO. DATE REVISION DESCRIPTION ACT. DRAWN CHK'D APPRV'D APPRV'D
MICROFILM NO. 270060


CAUSTIC SODA
LIQUID POLYMER
FROM SANITARY (INFLUENT) SEWER SYSTEM
TREATED EFFLUENT
PUMP
PUMP STATION WITH MACERATOR
PUMP
EQUALIZATION BASIN
AERATION BASIN
SLUDGE
FINAL CLARIFIER
R.A.S. PUMP
COMPOSITE SAMPLER
OUTFALL 104
ULTRA SONIC LEVEL PROBE (FLOW METER)
POTABLE R.O. REJECT
IRON/CARBON FILTER DISCHARGE
SUMP STATION
W.A.S. PUMP
SLUDGE DISPOSAL
W.A.S. STORAGE BASIN
COMPOSITE SAMPLER
OUTFALL 105
DISCHARGE TO COOLING WATER DISCHARGE VIA SAMPLE POINT 105
THE SIGMA GROUP
Single Source. Sound Solutions.
WASTEWATER FLOW DIAGRAM
POINT BEACH NUCLEAR POWER PLANT
6610 NUCLEAR ROAD
TWO RIVERS, WISCONSIN
FIGURE
5

Nextera Energy Point Beach LLC

Intake Screen Flow-Through Velocity Calculations

Through-Screen Velocity Calculations

For the design and configuration of the CWIS and four pump operation (1,108 MGD DIF), the calculated through-screen velocity (v) is:

$$v = (total\ pump\ rate\ MGD) \times (1{,}000{,}000) \times \left(\frac{1\ day}{24\ hours}\right) \times \left(\frac{1\ hour}{60\ min}\right) \times \left(\frac{1\ min}{60\ sec}\right) \times \left(\frac{0.1337 ft^3}{gal}\right) \times \left(\frac{1}{total\ open\ area\ of\ intake}\right)$$

$$v = (1{,}108) \times (1{,}000{,}000) \times \left(\frac{1}{24}\right) \times \left(\frac{1}{60}\right) \times \left(\frac{1}{60}\right) \times (0.1337) \times \left(\frac{1}{864.6}\right)$$

$$v = 2.0\ {}^{ft}/_{sec}$$

Where:

$$\begin{aligned} total\ open\ area\ of\ intake &= 8\ screens \times open\ area\ of\ individual\ screen \\ &= 8 \times overall\ screen\ area\ \times screen\ open\ area \\ &= 8 \times 10\ ft\ (width) \times 19.3\ ft\ (low\ water\ depth) \times 0.56 \\ &= 864.6\ ft^2 \end{aligned}$$

Screen open area based on screen mesh openings of $0.375\ in \times 0.375\ in$

Nextera Energy Point Beach LLC

Wastewater Treatment Description

Point Beach Nuclear Plant
Additional Treatment Information

Condenser Cooling Water (Outfalls 001 and 002)
As stated in the previous permit application, the Intake Crib was redesigned in 2002 such that cooling water for both condenser units is withdrawn through a submerged intake crib located 1,750 feet offshore in about 22 feet of water.

Water flows from the intake structure to the pumphouse forebay through two 14 foot diameter, corrugated, galvanized, structural plate pipes buried to a minimum depth of three feet below the lake bed. Water depth in the forebay is approximately 28 feet. The intake water passes through vertical bar racks consisting of 3/8-inch by 4-inch bars, spaced with 2¼- inch gaps. One 59-foot wide rack is provided for each unit. Water then flows through the eight traveling water screens (3/8-inch square mesh) in the pumphouse, each of which is approximately 11 feet wide. The screen wash (80 psi) is filtered through a collection basket with 3-inch square openings, and returned to the lake via a 24-inch diameter steel pipe with an outlet in the Unit 2 discharge flume, approximately 80 feet from the collection basket. The eight traveling water screens are operated intermittently with occasional backwashes which are based on screen DP. The duration of each rinse is 30 minutes.

Deicing is performed by reversing flow in one of the intake pipes to return warm discharge water to the intake crib. Part or all of the cooling water discharge of one unit can be redirected to the crib. The other intake pipe then supplies the water to both units. Deicing is performed during the winter months. From March or April until November, the plant usually operates on four circulating water pumps, with a maximum design flow of about 750,000 gpm. During the remainder of the year, two pumps are used for a design flow rate of about 470,000 gpm. Maximum recirculation flow to the intake crib is approximately 200,000 gpm. It should be noted that recirculated water does not discharge directly to the lake, but only to the intake crib.

Zebra Mussel Control Program
Sodium hypochlorite is applied to the circulating water system for one hour per day to prevent biofouling of the heat exchangers. The number of times per week depends on lake temperature and is as follows:

- 3 days per week when below 45 °F,
- 5 days when between 45 °F and 55 °F, and
- 7 days per week when above 55 °F.

Sodium hypochlorite and sodium bromide are injected into the service water system continuously at a low dose.

Total residual halogens are neutralized with sodium bisulfite in the circulating water and service water systems.

Sewage Treatment Plant

Sanitary wastes from the plant and administration building are treated in a package extended aeration, activated sludge plant. The raw sewage pump station contains a macerator to grind large solids in the waste into small particles. The raw sewage is pumped to an equalization basin located at the influent end of the package extended aeration activated sludge unit in the sewage treatment building. The equalization basin uses variable speed feed pumps to reduce surges in flow to the activated sludge plant.

The aeration basin has an approximate capacity of 20,000 gallons and an approximate sludge age of 20 days. Aeration is provided through 12 diffusers. Air to the diffusers is provided by three rotary positive displacement blowers. Effluent from the aeration basin flows by gravity to a final clarifier in the sewage treatment building. An air ejector pump transports the sludge collected in the clarifier to the influent end of the aeration basin as Returned Activated Sludge (RAS). Waste Activated Sludge (WAS) from the clarifier is pumped to the waste sludge storage basin using timed operation wasting pumps. Waste sludge is continuously aerated. A local licensed septage hauler periodically removes the sludge off site for ultimate disposal.

Effluent from the final clarifier flows by gravity into a channel beneath the floor of the sewage treatment building. Water level in the channel is maintained with a 11½-degree V-notch weir. An ultrasonic level probe is installed in the channel to continuously measure the flow over the weir. An automatic flow proportional sampler is provided for the clarifier effluent. Positive displacement chemical feed pumps are provided for feeding the following:

1. Liquid polymer to the final clarifier influent for improved solids settling.
2. Caustic soda to the aeration basin for pH control.

The treated effluent flows by gravity to the effluent sump pump station immediately north of the lift stations. This sump also collects water from the power plant's potable RO reject and Iron/Carbon filter with final discharge to the cooling water discharge via wastewater effluent point 105.

Microfiltration System

The PBN makeup water system starts with Lake Michigan water from the service water system and processes it into high quality demineralized water for use in plant systems. Pretreatment uses a microfiltration system which consists of three independent units that can each supply 250 gpm of product water for a total capacity of 750 gpm. The accumulated solids are routinely removed (approximately every 20 to 30 minutes) through a backwash system. The microfilter membranes are chemically cleaned (approximately monthly) to remove hardened filtered solids that normal backwashing cannot remove. Sulfuric acid, citric acid, sodium hypochlorite, and sodium bisulfite are used for the chemical cleaning process. Both the backwash and chemical cleaning processes discharge to the waste well which eventually enters the circulating water system for discharge to Lake Michigan. The microfiltration effluent is processed further by a modular water treatment plant capable of producing 400 gpm of quality de-ionized water. RO reject is sent overboard to Lake Michigan through outfall 106.

Nextera Energy Point Beach LLC

Supplemental Information for Additives

Chemical Name	Manufacturer	Purpose	Intermittent or Continuous feed	Frequency (months per year)	Frequency (days/week)	Max Quantity used	Average quantity used	Toxicity (48 hour LC50)	Toxicity (96 hour LC50)
Sodium Hypochlorite 12.5%	Hydrite	biocide	continuous	12	7	800 gallons	345 gallons	not needed	not needed
Sodium Bisulfite 38%	Hydrite	Dechlorination	continuous	12	7	750 gallons	310 gallons	* Daphnia magna 119 mg/L	* Fathead minnow: 240 mg/L
sodium bromide	Nalco	chlorine enhancer, biodispersant	continuous	12	7	35 gallons	10 gallons	not needed	not needed
Sodium Hydroxide 50%	Olin	pH control, sewage treatment plant	continuous	12	7	3 gallons	2.5 gallons	not needed	not needed
Cat-Floc 8108 Plus	Nalco	flocculent, sewage treatment plant	continuous	12	7	0.75 gallon	0.2 gallon	Daphnia magna: 1.8 mg/L	Bluegill sunfish: 1.07 mg/L
Scav-ox 35% Hydrazine Solution	Arch Chemicals	oxygen scavenger	continuous	12	7	13 gallons	10 gallons	* Daphnia magna: EC 50 0.81 mg/L	* Bluegill sunfish: 1.08 mg/L
Pre-tect PT7000 Ethanolamine	Nalco	pH control, secondary water	continuous	12	7	12 gallons	3.8 gallons	Daphnia magna: EC 50 65 mg/L	Rainbow trout: 150 mg/L
Carbohydrazide	Sigma-Aldrich	Refueling outage use - corrosion inhibitor	Intermittent	1	2	10 gallons	0.1 gallon	* Daphnia magna: 96 mg/L	* Bluegill sunfish: 190 mg/L
Optisperse PWR6600 Polyacrylic Acid	Suez WTS	Refueling outage use - iron transport	Intermittent	1	2	0.6 gallons	0.2 gallon	Daphnia magna: 1,250 mg/L	Fathead minnow: 2,000 mg/L
Boric Acid	EMD Millipore	Control reactivity in the reactor coolant system	continuous	12	7	1,100 lbs	72 lbs	Daphnia magna: 133 mg/L	Rainbow trout: 79 mg/L
Lithium Hydroxide	Ceradyne Inc	pH control, reactor coolant system	continuous	3	1	6.5 pounds	0.1 pound	Daphnia magna: EC 50 33.5 mg/L	Rainbow trout: 30.3 mg/L
Ammonium hydroxide	Avantor performance Materials	Refueling outage use - pH control	Intermittent	1	1	0.75 gallon	0.25 gallon	Daphnia magna: 0.66 mg/L	* Fathead minnow: 15 mg/L
Hypersperse MDC775	GE Betz	Anti-scalant	continuous	12	7	0.9 gallon	0.8 gallon	Daphnia magna: 2462 mg/L	Fathead minnow: 6817 mg/L
CAIROX Potassium permanganate (1.57% solution strength)	Carus	Iron Removal	Intermittent	12	7	2 gallons/day if continuous	240 ml/hr when RO in operation	* Daphnia magna: 0.235 mg/L	Bluegill sunfish: 2.7 mg/L
CL-50 sodium phosphate (2.9% solution strength)	Nalco	Corrosion Inhibitor	Intermittent	12	7	3 gallons/day if continuous	424 ml/hr when RO in operation	Daphnia magna: >1,000 mg/L	Fathead minnow: 1,162 mg/L
PermaTreat PC-1611T (1/10th dilution)	Nalco	Anti-scalant	Intermittent	12	7	2 gallon/day if continuous	150 ml/hr when RO in operation	* Daphnia magna: 3,634 mg/L	* Fathead minnow: 7,500 mg/L
PermaCare PC-7410 Sodium Hypochlorite (1.8-3.6% solution strength)	Nalco	Potable Water biocide	Intermittent	12	7	2 gallon/day if continuous	200 ml/hr when RO in operation	not needed	not needed
Citric Acid 50%	Avantor performance Materials	Prevent scale	Intermittent	12	0.4	2 gallons	1 gallon	Daphnia magna: 1,534 mg/L	Fish: 440 mg/L
Sulfuric acid	Norfalco Inc	Prevent scale	Intermittent	12	0.4	1.5 gallons	1 gallon	not needed	not needed
3D Trasar 3DT121	Nalco	Silt dispersant (service water system)	continuous	12	7	45 gallons	32 gallons	Daphnia magna: 2,800 mg/L	Fathead minnow: 5,166 mg/L
Nalsperse 73551	Nalco	Biodetergent	Intermittent	12	1	20 gallons	8 gallons	Daphnia magna: >1,000 mg/L	Rainbow trout: >1,000 mg/L
	* SDS from different supplier or similar product used								

Nextera Energy Point Beach LLC

Outfall 105 Monitoring Results

Nextera Energy Point Beach LLC

Outfall 105 - Monitoring Results

Code	Name	Sample Result	Units	QC Flag	LOD	LOQ	Analytical Method	Sample Collection Date	Sample Type	Lab ID
Common Pollutants										
66	BOD5, Total	3.0	mg/L				SM 5210B	9/1/2020	Comp	999580010
140	COD	12.7	mg/L				SM 5220	9/17/2020	Comp	999580010
105	Chloride	43.0	mg/L				SM 4500 Cl- E	9/1/2020	Comp	999580010
112	Chlorine, Total Residual	<200	ug/L		200.0	200.0	Field	9/1/2020	Grab	
789	Nitrogen, Ammonia (NH3-N) Total (7664-41-7)	0.69	mg/L		0.10	0.20	SM 4500 NH3 G	9/1/2020	Comp	999580010
	(Submit a minimum of 4 sample results collected at least 3 days apart.)	0.45	mg/L		0.10	0.20	SM 4500 NH3 G	9/4/2020	Comp	999580010
		0.12	mg/L		0.10	0.20	SM 4500 NH3 G	9/9/2020	Comp	999580010
		0.52	mg/L		0.20	0.40	SM 4500 NH3 G	9/17/2020	Comp	999580010
330	Nitrogen, Nitrite + Nitrate Total	5.10	mg/L		0.210	0.50	MCAWW-353.	9/1/2020	Comp	999580010
335	Nitrogen, Total Kjeldahl	1.20	mg/L		0.4	0.24	4500 NH3 H	9/1/2020	Comp	999580010
338	Nitrogen, Total	6.30	mg/L		0.4	0.4	EPA	9/1/2020	Comp	999580010
651	Oil & Grease (Hexane)	<1.4	mg/L		1.4	5.4	1664B	9/1/2020	Grab	999580010
457	Suspended Solids, Total	5.0	mg/L				SM 2540D	9/1/2020	Comp	999580010
487	Temperature	77	deg F				Field	9/4/2020	Grab	
147	Copper, Total Recoverable (7440-50-8)	11	ug/L		3.5	10	200.7 Rev 4.4	9/1/2020	Comp	999580010
	(Submit a minimum of 4 sample results collected at least 3 days apart)	11	ug/L		3.5	10	200.7 Rev 4.4	9/4/2020	Comp	999580010
		7.2	ug/L	J	3.5	10	200.7 Rev 4.4	9/9/2020	Comp	999580010
		7.8	ug/L	J	3.5	10	200.7 Rev 4.4	9/17/2020	Comp	999580010
Metals, Cyanide, Hardness and Phenols										
31	Antimony, Total Recoverable (7440360)	<7.8	ug/L		7.8	20	200.7 Rev 4.4	9/1/2020	Comp	999580010
35	Arsenic, Total Recoverable (7440-38-2)	<4.2	ug/L		4.2	10	200.7 Rev 4.4	9/1/2020	Comp	999580010
50	Beryllium, Total Recoverable (7440-43-9)	<1.4	ug/L		1.4	4.0	200.7 Rev 4.4	9/1/2020	Comp	999580010
87	Cadmium, Total Recoverable (7440-43-9)	<0.97	ug/L		0.97	2.0	200.7 Rev 4.4	9/1/2020	Comp	999580010
127	Chromium +6 (18540-29-9)	3.6	ug/L	J	3.2	10	SM 3500 CR B	9/1/2020	Comp	999580010
133	Chromium, Total Recoverable (7440-47-3)	<4.4	ug/L		4.4	10	200.7 Rev 4.4	9/1/2020	Comp	999580010
155	Cyanide, Total (57-12-5)	<3.0	ug/L		3.0	10	SM 4500 CN E	9/1/2020	Grab	999580010
152	Cyanide, Amenable (57-12-5)	<5.0	ug/L		5.0	10	SM 4500 CN G	9/1/2020	Grab	999580010
264	Lead, Total Recoverable (7439-92-1)	<2.6	ug/L		2.6	5.0	200.7 Rev 4.4	9/1/2020	Comp	999580010
280	Mercury, Total Recoverable (7439976)	1.73	ng/L		0.16	0.50	Subcontract	9/1/2020	Grab	999580010
315	Nickel, Total Recoverable (7440-02-0)	<3.0	ug/L		3.0	10	200.7 Rev 4.4	9/1/2020	Comp	999580010
423	Selenium, Total Recoverable (7782-49-2)	<6.5	ug/L		6.5	10	200.7 Rev 4.4	9/1/2020	Comp	999580010
430	Silver, Total Recoverable (7440-22-4)	<2.1	ug/L		2.1	5.0	200.7 Rev 4.4	9/1/2020	Comp	999580010
494	Thallium, Total Recoverable (7440-28-0)	<4.6	ug/L		4.6	10	200.7 Rev 4.4	9/1/2020	Comp	999580010
553	Zinc, Total Recoverable (7440-66-6)	16.0	ug/L	J	7.3	20	200.7 Rev 4.4	9/1/2020	Comp	999580010
231	Hardness, Total as CaCO3 (Submit a minimum of 4 sample results collected at	154	mg/L				SM 2340B	9/1/2020	Comp	999580010
	3 days apart.)	204	mg/L				SM 2340B	9/4/2020	Comp	999580010
		198	mg/L				SM 2340B	9/9/2020	Comp	999580010
		242	mg/L				SM 2340B	9/17/2020	Comp	999580010
Volatile Organics										
6	Arcrolein (107-02-8)	<23	ug/L		23	100	624	9/1/2020	Grab	999580010
8	Arcrylonitrile (107-13-1)	<4.5	ug/L		4.5	20	624	9/1/2020	Grab	999580010
40	Benzene (71-43-2)	<0.15	ug/L		0.15	0.5	624	9/1/2020	Grab	999580010
174	Dichlorobromo- methane (bromo- dichloromethane) (75-27-4)	0.43	ug/L	J	0.37	1.0	624	9/1/2020	Grab	999580010
80	Bromoform (75-25-2)	0.49	ug/L	J	0.45	1.0	624	9/1/2020	Grab	999580010
93	Carbon tetrachloride (56-23-5)	<0.38	ug/L		0.38	1.0	624	9/1/2020	Grab	999580010
113	Chlorobenzene (108-90-7)	<0.39	ug/L		0.39	1.0	624	9/1/2020	Grab	999580010
115	Chlorodibromo-methane (124-48-1)	<0.49	ug/L		0.49	1.0	624	9/1/2020	Grab	999580010
117	Chloroethane (75003)	<0.51	ug/L		0.51	1.0	624	9/1/2020	Grab	999580010
118	Chloroform (67-66-3)	5.6	ug/L		0.37	2.0	624	9/1/2020	Grab	999580010
584	1,3-Dichloropropylene (542-75-6)	<0.42	ug/L		0.42	1.0	624	9/1/2020	Grab	999580010
568	1,2-Dichloro- benzene	<0.33	ug/L		0.33	1.0	624	9/1/2020	Grab	999580010
581	1,3-Dichloro- benzene (541731)	<0.40	ug/L		0.40	1.0	624	9/1/2020	Grab	999580010
587	1,4-Dichloro- benzene (106-46-7)	<0.36	ug/L		0.36	1.0	624	9/1/2020	Grab	999580010
556	1,1-Dichloro- ethane (75-34-3)	<0.41	ug/L		0.41	1.0	624	9/1/2020	Grab	999580010
570	1,2-Dichloro- ethane (107-06-2)	<0.39	ug/L		0.39	1.0	624	9/1/2020	Grab	999580010
558	1,1-Dichloro- ethylene (75-35-4)	<0.39	ug/L		0.39	1.0	624	9/1/2020	Grab	999580010
576	1,2-trans Dichloroethylene (156-60-5)	<0.35	ug/L		0.35	1.0	624	9/1/2020	Grab	999580010
573	1,2-Dichloropropane (78-87-5)	<0.43	ug/L		0.43	1.0	624	9/1/2020	Grab	999580010
589	2-Chloroethyl vinyl ether (110-75-8)	<0.77	ug/L		0.77	2.0	624	9/1/2020	Grab	999580010
200	Ethylbenzene (100414)	<0.18	ug/L		0.18	0.50	624	9/1/2020	Grab	999580010
82	Methyl bromide (74839)	<0.65	ug/L		0.65	3.00	624	9/1/2020	Grab	999580010
120	Chloromethane (74873)	<0.32	ug/L		0.32	1.0	624	9/1/2020	Grab	999580010
285	Methylene chloride (75092)	<1.6	ug/L		1.6	5.0	624	9/1/2020	Grab	999580010
565	1,1,2,2-Tetrachloro- ethane (79-34-5)	<0.40	ug/L		0.37	1.0	624	9/1/2020	Grab	999580010
490	Tetrachloroethylene (127-18-4)	<0.37	ug/L		0.37	1.0	624	9/1/2020	Grab	999580010
500	Toluene (108-88-3)	<0.15	ug/L		0.15	0.50	624	9/1/2020	Grab	999580010
561	1,1,1-Trichloro- ethane (71-55-6)	<0.38	ug/L		0.38	1.0	624	9/1/2020	Grab	999580010
563	1,1,2-Trichloro- ethane (79-00-5)	<0.35	ug/L		0.35	1.0	624	9/1/2020	Grab	999580010
508	Trichloro- ethylene (79-01-6)	<0.16	ug/L		0.16	0.50	624	9/1/2020	Grab	999580010
517	Vinyl chloride (75-01-4)	<0.20	ug/L		0.20	1.0	624	9/1/2020	Grab	999580010
Acid Extractable Compounds (Phenols)										
592	2-Chlorophenol (95-57-8)	<0.46	ug/L		0.46	3.7	625	9/1/2020	Comp	999580010
603	2,4-Dichlorophenol (120-83-2)	<0.87	ug/L		0.87	7.3	625	9/1/2020	Comp	999580010
604	2,4-Dimethyl- phenol (105-67-9)	<1.4	ug/L		1.4	7.3	625	9/1/2020	Comp	999580010
605	2,4-Dinitrophenol (51-28-5)	<0.77	ug/L		0.77	15	625	9/1/2020	Comp	999580010
349	P-Chloro-m-Cresol (3-methyl-4-chlorophenol) (59-50-7)	<1.0	ug/L		1.0	7.4	625	9/1/2020	Comp	999580010
593	2-Methyl-4,6- dinitrophenol (534521)	<1.3	ug/L		1.3	15	625	9/1/2020	Comp	999580010
596	2-Nitrophenol (88-75-5)	<1.1	ug/L		1.1	7.3	625	9/1/2020	Comp	999580010
624	4-Nitrophenol (100-02-7)	<1.7	ug/L		1.7	15	625	9/1/2020	Comp	999580010
368	Pentachloro- phenol (87-86-5)	<1.3	ug/L		1.3	15	625	9/1/2020	Comp	999580010
633	Phenol (108-95-2)	<0.46	ug/L		0.46	3.7	625	9/1/2020	Comp	999580010
608	2,4,6-Trichloro- phenol (88-06-2)	<0.49	ug/L		0.49	3.7	625	9/1/2020	Comp	999580010

J' Flag - Reported value was between the limit of detection and the limit of quantitation.

Incoming Water

Mercury	0.77	ng/L		0.16	0.5	Subcontract	44075	Grab	999580010

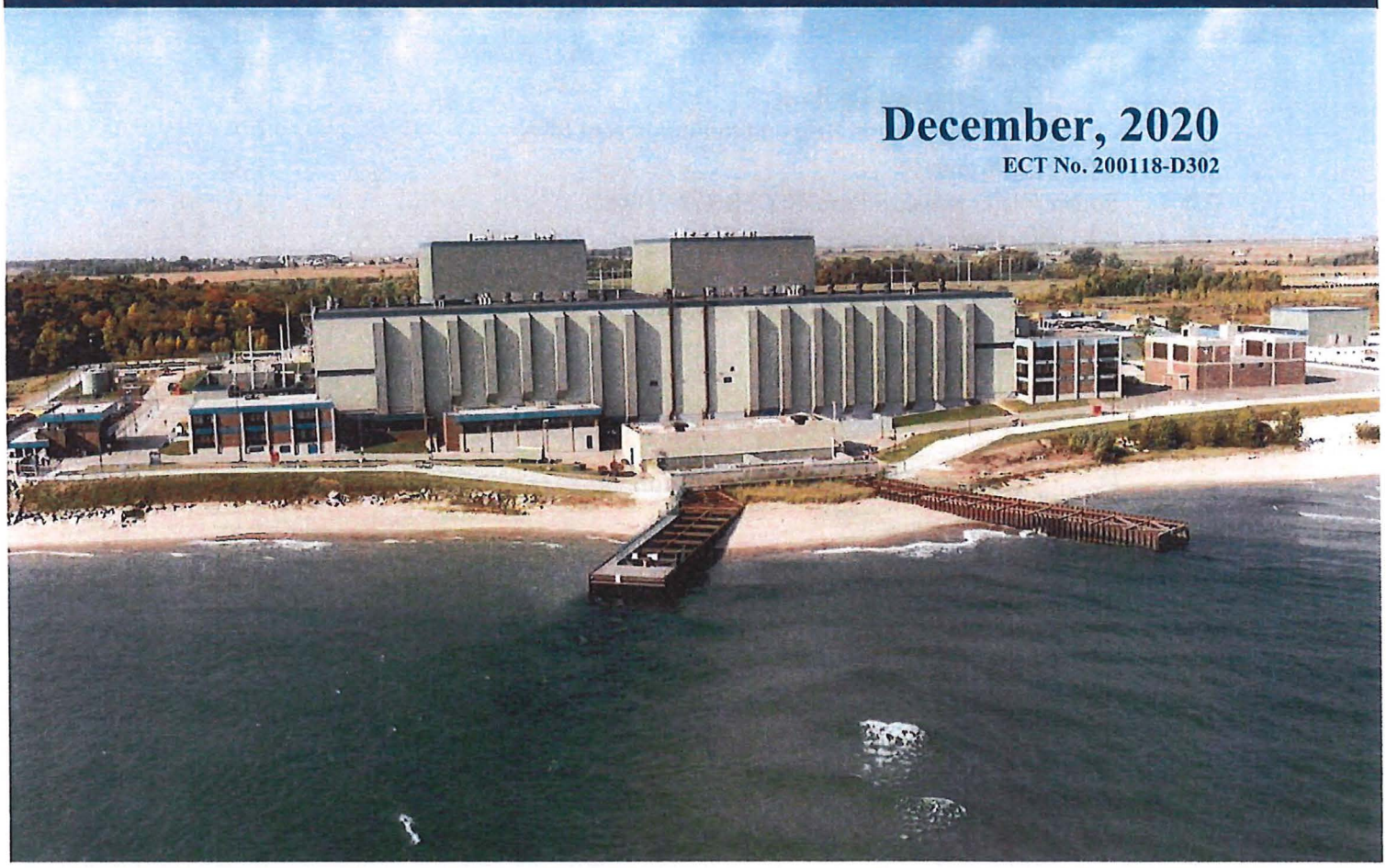
Nextera Energy Point Beach LLC

Intake Impact Study

Clean Water Act §316(b) Compliance Submittal 40 CFR 122.21(r)(2) through (13)

Point Beach Nuclear Plant
NextEra Energy Point Beach, LLC
6610 Nuclear Road
Two Rivers, Wisconsin 54241

WI-0000957



December, 2020
ECT No. 200118-D302

VERITAS ALDEN ECT Environmental Consulting & Technology, Inc. EA Engineering, Science, and Technology, Inc., PBC ASA Solutions through Science

Complex Challenges … **Practical Solutions**

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List of Acronyms and Abbreviations

ΔT	change in temperature
°C	degrees Celsius
°F	degrees Fahrenheit
µg/L	microgram per liter
µmhos/cm	micromhos/cm
AACE	Association for the Advancement of Cost Engineering
ACC	air-cooled condensers
AFB	Aquatic filter barrier
AIF	actual intake flow
AOI	area of influence
bhp	brake horsepower
BPJ	best professional judgment
BTA	best technology available
Btu	British thermal units
Btu/hr	British thermal units
C/R	Commercial and recreational
CCRS	closed-cycle recirculating system
cf	cubic feet
CFR	Code of Federal Regulations
cfs	cubic feet per second
Clean Water Act	Federal Water Pollution Control Act of 1972
cm/s	centimeters per second
CO_2	carbon dioxide
COC	cycles of concentration
CPUE	catch per unit effort
CUR	Capacity utilization rate
CWA	Clean Water Act
CWIS	cooling water intake structure
dB	decibels

dBA	decibels through air
DE	drift eliminator efficiency
DIF	design intake flow
DOE	U.S. Department of Energy
EAC	equivalent annual costs
ECT	Environmental Consulting & Technology, Inc.
EIA	U.S. Energy Information Administration
EPA	U.S. Environmental Protection Agency
EPRI	Electric Power Research Institute
ESA	Endangered Species Act of 1973
Final Rule	National Pollutant Discharge Elimination System, Final Regulations to Establish Requirements for Cooling Water Intake Structures at Existing Facilities and Amend Requirements at Phase I Facilities, 40 CFR Parts 122 and 125
FM MTWS	fine-mesh modified traveling water screens
FMS	fine-mesh screens
FPL	Florida Power & Light
fps	feet per second
FR	Federal Register
ft	foot or feet
ft	feet
ft/s	feet per second
ft^3	cubic feet
gpm	gallons per minute
ha	hectare
hp	horsepower
HRSG	heat recovery steam generators
IM	impingement mortality
IPaC	Information Planning and Conservation
kg/yr	kilogram per year
kHz	kilohertz
lb/hr	pounds per hour
lbm	pound-mass
m	meter
MDCT	mechanical draft cooling tower

mg/L	milligram per liter
MGD	million gallons per day
mi^2	square miles
mm	millimeter
mph	miles per hour
MTWS	modified traveling water screens
MW	megawatt
MWe	megawatt electric
MWhr	megawatt-hours
MWhr/yr	megawatt hours per year
MWt	megawatt thermal
NAAQS	National Ambient Air Quality Standards
NDCT	Natural draft cooling towers
NextEra	NextEra Energy Point Beach, LLC
NNE	north-northeast
NOAA	National Oceanic and Atmospheric Administration
NOAA Fisheries	NOAA National Marine Fisheries Service
NO_x	Nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NPV	Net present value
NRC	Nuclear Regulatory Commission
NSR	New Source Review (air emissions)
O&M	Operational and Maintenance
ONAC	Office of Noise Abatement and Control
PBNP	Point Beach Nuclear Plant
PBNP or Plant	Point Beach Nuclear Plant
Plant	Point Beach Nuclear Plant
PM	particulate matter
PM_{10}	particulate matter less than 10 microns in diameter
$PM_{2.5}$	particulate matter less than 2.5 microns in diameter
POTW	publicly owned treatment works
ppm	parts per million
ppt	parts per thousand
PSC	Public Service Commission of Wisconsin

PSD	Prevention of Significant Deterioration
psi	pounds per square inch
psia	pounds per square inch, absolute pressure
psig	pounds per square inch gauge
PV	Present value
QCT	cooling water circulation rate per unit
RTO	Regional Transmission Organization
SO_2	Sulfur dioxide
sq. ft	square feet
SSW	south-southwest
T&E	threatened and endangered
TDD	Technical Development Document for the Final Section 316(b) Existing Facilities Rule
TDH	total dynamic head
TDS	total dissolved solids
TMDL	total maximum daily load
TS	total dissolved solids and total suspended solids
TS_{CT}	total solids in the circulating water
TSS	total suspended solids
TSV	through-screen/slot velocity
TWS	traveling water screens
UHS	Ultimate Heat Sink
USACE	U.S. Army Corps of Engineers
USDOE	U.S. Department of Energy
USEPA	United States Environmental Protection Agency
USFWS	U.S. Fish & Wildlife Service
USGS	United States Geological Survey
VSD	variable speed drive
VSP	variable speed pump(s)
WDNR	Wisconsin Department of Natural Resources
WMO	World Meteorological Organization
WMO	World Meteorological Organization
WPDES	Wisconsin Pollution Discharge Elimination System
WSW	West-Southwest

WWTP	wastewater treatment plant
YOY	young-of-year

1.0 Introduction and Executive Summary

NextEra Energy Point Beach, LLC (NextEra) owns and operates the Point Beach Nuclear Plant (PBNP or Plant). This report has been prepared to address the final Clean Water Act (CWA) Section 316(b) rule for existing facilities (Federal Register [FR], Volume 79, No. 158, Pages 48300-48439), known as the Final Rule, which was published August 15, 2014, by the U.S. Environmental Protection Agency (EPA). Specifically, this report addresses the Final Rule's requirements for the renewal of PBNP's Wisconsin Pollutant Discharge Elimination System (WPDES) permit as described at Title 40, Parts 122.21(r)(2) through (13), of the Code of Federal Regulations (CFR).

NextEra acknowledges that the State of Wisconsin has developed its own rule for the evaluation of cooling water intake structures (Wisconsin Administrative Code, Chapter NR 111, May 2020[1]). While NextEra understands that the Wisconsin Rule was intended to be generally consistent with EPA's Final Rule[2], it also finds some differences between the two rules that have relevance to PBNP (e.g., the requirement to assess variable speed pumps as a potential entrainment mitigation measure, a more definitive statement of the impingement mortality best technology available performance standard for the "system of measures"). NextEra has considered the requirements of both the Wisconsin Rule and the Final Rule in the preparation of this document and, when their differences affect the analyses and their conclusions, will discuss those differences and attempt to reconcile them. This submittal is organized according to the twelve requirements of the Final Rule as defined at 40 CFR 122.21(r)(2)-(13) and will favor citations to the Final Rule. The Wisconsin NR 111 Rule will be considered as necessary to reconcile differences in analyses and their conclusions.

[1] https://docs.legis.wisconsin.gov/code/admin_code/nr/100/111
[2] WDNR has published a mapping of the sections of the Final Rule to NR 111. That document is provided as Appendix 1-A to this report. Note that the mapping occurs first for the Final Rule citations to the Wisconsin Rule and then from the Wisconsin citations to the Final Rule. Because this report relies on the federal citations, searching for them in the first half of the appendix may be most useful for finding the analogous Wisconsin language.

NextEra also notes that Wisconsin Department of Natural Resources (WDNR) proposed a guidance document for 316(b) implementation[3]. While comments on the guidance were received, it was not finalized and NextEra understands that WDNR has no plans to finalize it. NextEra and its contractors have reviewed the draft guidance carefully and have considered its contents in preparation of this document.

1.1 Facility Description

PBNP is located on the western shore of Lake Michigan near Two Rivers, in Manitowoc County, Wisconsin (Figure 1-1). The plant began commercial operation in 1970 with two steam generating reactor units and a combined rated capacity of 1,246 megawatts (MW) that has since been uprated to 1,263.5 MW. PBNP Units 1 and 2 operate on a continuous basis as base-load electrical generating units and are currently licensed by the Nuclear Regulatory Commission (NRC) to operate through 2030 and 2033, respectively.

Once-through cooling water is withdrawn from Lake Michigan through an intake crib located approximately 1,750 feet offshore and discharged into Lake Michigan via a pair of outfalls consisting of flumes that discharge approximately 60 feet offshore both north and south of the intake (Figure 1-2). The intake crib is at a depth of about 22 feet and consists of two rings (110-foot diameter and 60-foot diameter) of steel piles driven into the lakebed and filled with limestone blocks. Water is drawn through the limestone blocks and through plastic mesh grating on top of the crib into 30-inch galvanized steel, concrete encased pipes. The pipes are buried beneath the lakebed and lead to the pumphouse.

The intake structure is equipped with vertical bar racks (3/8-inch by 4-inch, with 2¼-inch spacing on center) in the forebay and eight traveling water screens (3/8-inch mesh, 11-foot wide panels) at the pumphouse. The screens are washed with an 80-pounds per square inch (psi) screen wash that discharges to the lake via a return trough. Debris is captured by a basket and disposed of offsite. The total design intake flow (DIF) of the facility is 1,108 million gallons per day (MGD).

[3] WDNR, 2016. Draft Guidance for the Implementation of Section 316(b) of the Clean Water Act: Regulating Cooling Water Intake Structures. Guidance Number: 3400-2016-0X. November 10, 2016.

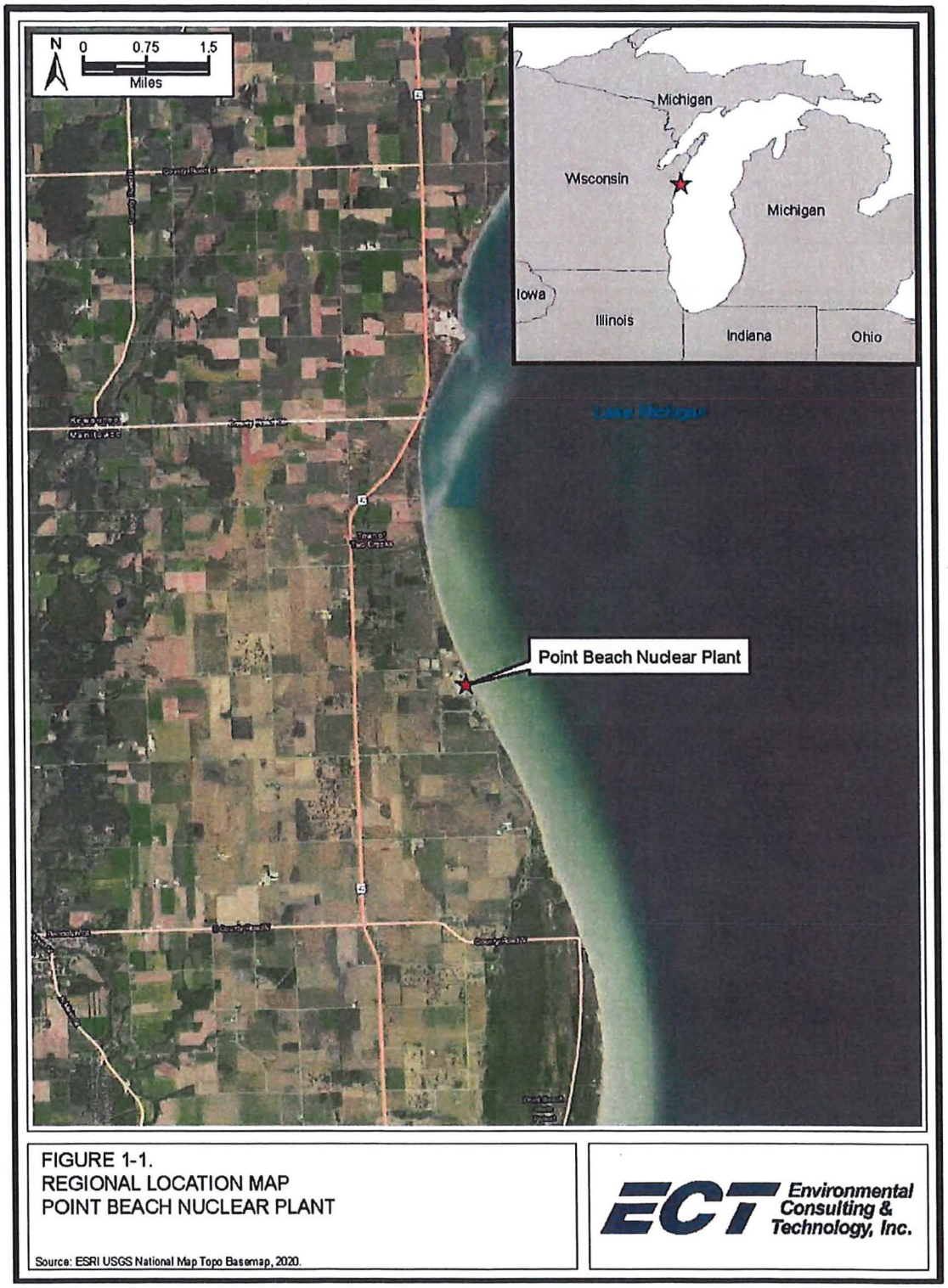

Figure 1-1. Regional Location of Point Beach Nuclear Plant

Figure 1-2. Point Beach Nuclear Plant Intake and Discharge Locations

1.2 Regulatory Background

PBNP is subject to the Final Rule, which regulates the location, design, construction, and operation of cooling water intake structures (CWIS) at existing facilities that hold a WPDES permit, have a DIF greater than 2 MGD from Waters of the United States, and use at least 25 percent of that water exclusively for cooling purposes. The Final Rule supersedes the Phase II rule, which was remanded in 2007, and the remanded existing facility portion of the previously promulgated Phase III rule. The Final Rule became effective on October 14, 2014.

The Final Rule requires that each affected facility develop and submit to the WPDES Director (i.e., WDNR) specific submittals and supporting information to address compliance with the Final Rule's performance standards. Submittal of the Final Rule-related reports is generally coordinated with the facility's application to renew its WPDES permit. PBNP's WPDES permit (WI-0000957-08-0) expires on June 30, 2021, and the 316(b)-related materials are due with the application to renew the WPDES permit which is due 180 days before that date (i.e., December 30, 2020).

Existing facilities with a DIF greater than 2 MGD are required to submit a set of documents with their WPDES application for renewal to establish compliance with the Final Rule, 40 CFR §§122.21(r)(2) through (8):

- 122.21(r)(2), Source Water Physical Data
- 122.21(r)(3), Cooling Water Intake Structure Data
- 122.21(r)(4), Baseline Biological Characterization
- 122.21(r)(5), Cooling Water System Data
- 122.21(r)(6), Chosen Method of Compliance with Impingement Mortality Standard
- 122.21(r)(7), Entrainment Performance Studies
- 122.21(r)(8), Operational Status

Facilities such as PBNP, with an actual intake flow (AIF) greater than 125 MGD, are required to submit five additional documents to establish compliance with the Final Rule per 40 CFR §§122.21(r)(9) through (13):

- 122.21(r)(9), Entrainment Characterization Study

- 122.21(r)(10), Comprehensive Technical Feasibility and Cost Evaluation Study
- 122.21(r)(11), Benefits Valuation Study
- 122.21(r)(12), Non-water Quality Environmental and Other Impacts Study
- 122.21(r)(13), Peer Review of (r)(10), (r)(11), and (r)(12)

The sections of the document are numbered consistent with the relevant sections of 40 CFR 122.21(r); for example, Section 2 addresses the Final Rule's requirements as specified under 40 CFR 122.21(r)(2).

1.3 Executive Summary

This section serves as the executive summary of the submittals prepared for PBNP under 40 CFR 122.21(r) through (13) of the Final Rule. These submittals constitute the balance of this document, following Section 1. Section 1.3.1 presents the provisional recommendations for impingement mortality (IM) best technology available (BTA) under the Final Rule, recognizing that a final decision on IM BTA must follow the Director's determination of BTA for entrainment.

Section 1.3.2 summarizes the information relevant to assessment of entrainment BTA on a best-professional-judgment (BPJ) basis, as required by the Final Rule. Section 1.3.2.1 provides a summary of the site, and Section 1.3.2.2 includes a brief summary of the entrainment analyses performed. The Final Rule includes site-specific factors available to the WPDES Director in considering entrainment BTA on a BPJ basis. These factors include those WDNR "must"[4] consider per at 40 CFR 125.98(f)(2), as summarized in Section 1.3.2.2, and those WDNR "may" consider per 40 CFR 125.98(f)(3), as summarized in Section 1.3.2.3. Section 1.3.2.4 presents a summary of the entrainment BTA findings and recommendations.

1.3.1 Proposed IM BTA

Section 6.0 presents the information required under 40 CFR 122.21(r)(6) of the Final Rule and documents NextEra's finding that its existing system of technologies, management practices, and operational measures constitute compliance with IM BTA consistent with 40 CFR 125.94(c)(6).

[4] WDNR may weigh these factors under both 40 CFR 125.98(f)(2) and (3) according to its discretion.

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This system of measures includes PBNP's offshore intake location, seasonal flow reduction during winter, and seasonal use of a high frequency acoustic deterrent system (ADS). Calculations presented in Section 6 indicate that rates of impingement are reduced by approximately 96.1 percent relative to the potential rates for an uncontrolled, shoreline intake. An important feature of this system is its protection of Alewife and other species designated by the Final Rule as "fragile". The Final Rule, and it's supporting documents, are clear that the alternative IM BTA measure for PBNP, modified traveling water screens (MTWS) with a fish return, would afford little additional protection to these forage species that dominate impingement at the Plant.

The system of measures compliance approach requires an impingement technology performance optimization study, as described at 40 CFR 122.21(r)(6)(ii), to demonstrate rates of impingement mortality achieved by the system. This Section of the Final Rule suggests a study plan be submitted to WDNR as part of the 316(b) submittals. As discussed in Section 6.0, NextEra's final selection of IM BTA and development of a study plan will occur after WDNR's determination of entrainment BTA. Such an approach to an optimization study plan has regulatory precedent and is consistent with the provisional nature of NextEra's recommendation for IM BTA pending determination of entrainment BTA.

1.3.2 Information Relevant to Entrainment BTA

This section summarizes the analyses intended by the Final Rule to support WDNR in its assessment of entrainment BTA under a site-specific BPJ review. This summary focuses on those reports prepared under 40 CFR 122.21(r)(9) through (13):

- The rule at 40 CFR 122.21(r)(9) requires the collection and presentation of data sufficient to characterize facility entrainment; this is referred to as an entrainment characterization study. Section 9.0 of this document and its appendices characterize entrainment at PBNP using site-specific entrainment data, and Section 11 expresses entrainment rates consistent with the configuration and operation of the plant following its extended uprate in 2011.
- The rule at 40 CFR 122.21(r)(10) requires that facilities with actual intake flow rates greater than 125 MGD evaluate the feasibility of cooling towers, fine-mesh screens with a mesh size of 2-mm or smaller, and alternate water sources. The Wisconsin Rule also

requires assessment of VSPs as a potential entrainment mitigation measure. For those technologies found feasible, the cost of installing and operating those technologies is calculated; this is done from the perspective of the facility and the perspective of society (i.e., the costs to the facility are translated based on if and how those costs affect the broader society). Section 10 of this document provides that evaluation for PBNP.

- The rule at 40 CFR 122.21(r)(11) requires that "Each category of [social] benefits must be described narratively, and when possible, benefits should be quantified in physical or biological units and monetized using appropriate economic valuation methods." Section 11 evaluates the social benefits of implementing potentially feasible entrainment reduction technologies at PBNP.
- The rule at 40 CFR 122.21(r)(12) requires a discussion of the non-water quality environmental (and other) impacts for each technological alternative considered in the (r)(10) report. These include changes in facility efficiency, air emissions, noise, safety, reliability, and water consumption along with a discussion of efforts to mitigate any adverse changes. Section 12 discusses these changes, all of which represent social costs.
- Per rule requirements at 40 CFR 122.21(r)(13), Sections 10 through 12 were peer reviewed by third-party professionals approved by WDNR. The documentation of this process and its results are reported in Section 13. Sections 10 through 12 reflect NextEra's changes made in response to comments provided by the peer reviewers.

The information required in 40 CFR 122.21(r)(9) through (12), together with comments and resolutions in 40 CFR 122.21(r)(13), are meant to provide all relevant information the Director needs to determine entrainment BTA for the facility. The explicit purpose of calculating the social costs and social benefits associated with each alternative cooling water technology is to determine if the adoption of a specific technology is likely to leave society better off (i.e., social benefits are likely to exceed social costs) or worse off (i.e., social costs are likely to exceed social benefits).

As part of its entrainment BTA decision, the rule specifically identifies in 40 CFR 125.98(f)(2) and (f)(3) eleven factors that the Director must or may consider when determining entrainment BTA. Review of these factors is provided in this Executive Summary based upon information provided as part of Sections 9 through 12.

The rule at 40 CFR 125.98(f)(4) gives the Director latitude on determining the site-specific entrainment BTA using BPJ as to whether existing design and operational measures[5] are BTA or if benefits, impacts and costs justify the installation of closed-cycle cooling towers, fine-mesh screens, or use of an alternate cooling water source.

1.3.2.1 Summary of the Setting

PBNP is a nuclear-powered electrical generation plant located on the western shore of Lake Michigan near Two Rivers, in Manitowoc County, Wisconsin. It has two steam generating reactor units that operate on a continuous basis. Once-through condenser cooling water is withdrawn from Lake Michigan through an intake crib located approximately 1,750 feet offshore. Water flows from the crib through two 14-foot diameter steel pipes under the lakebed to the plant. The DIF of the cooling water circulating pumps is 1,108 MGD. Cooling water leaving the plant is discharged back into Lake Michigan via outfall flumes located close to the shore to the north and south of the intake.

Lake Michigan is the third largest of the Great Lakes and the fifth largest freshwater lake in the world by surface area. The Great Lakes are the world's largest surface freshwater system and combined contain approximately 84 percent of North America's surface freshwater.

1.3.2.2 Summary of Analyses

This section summarizes the approach used in each of the entrainment BTA-related reports. In the subsequent sections of the executive summary, the findings are summarized in the context of the entrainment BTA decision factors the Final Rule provides to WDNR. Figure 1-3 presents the sequence of analyses used in assessing entrainment BTA under the Final Rule. The work flow includes integration of information on the configuration and operation of the facility, as well as measured rates of entrainment. The steps involved in assessing social costs, social benefits, and

[5] Existing measures that reduce entrainment and impingement include the offshore intake location, seasonal flow reduction during winter, and seasonal use of a high frequency ADS.

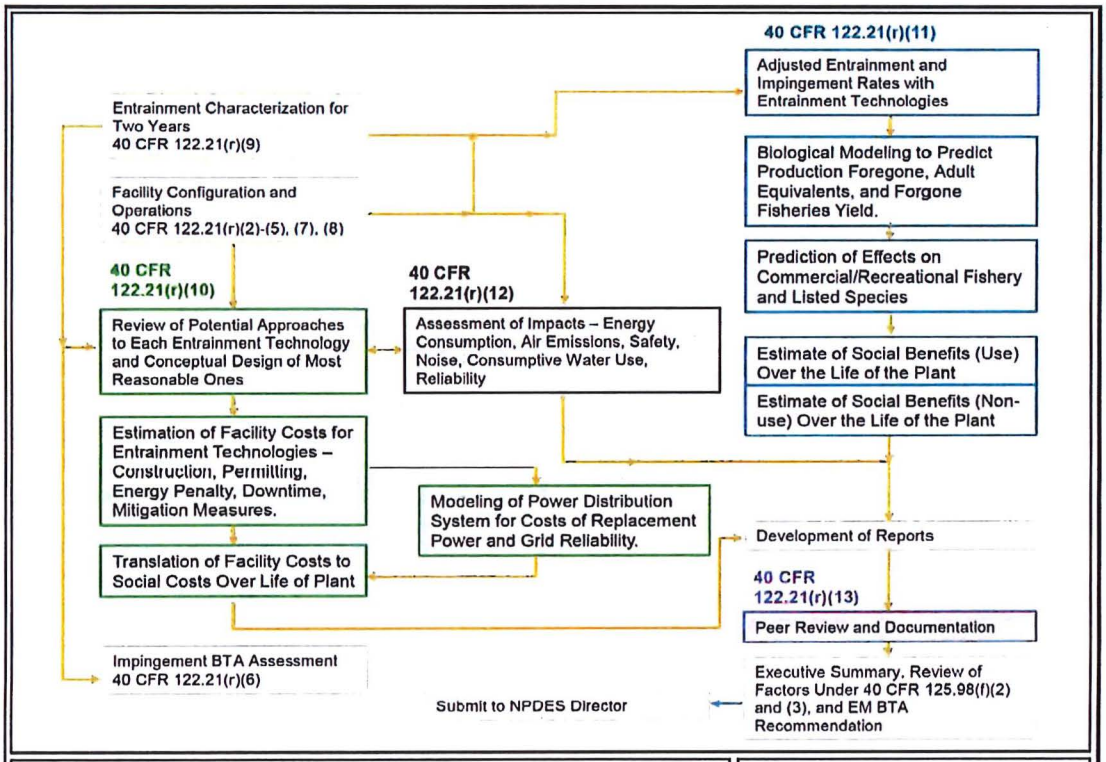

FIGURE 1-3.

ENTRAINMENT BTA WORK FLOW

Source. ECT, 2019.

ECT Environmental Consulting & Technology, Inc.

Figure 1-3. Entrainment BTA Work Flow

other environmental impacts are outlined along with the peer review process. These steps are summarized in the following subsections.

Entrainment Characterization Study—40 CFR 122.21(r)(9)

A one-year entrainment characterization study was conducted in the intake forebay weekly from mid-April through September 2006 under the Phase II rule, along with concurrent ambient sampling in the lake adjacent to PBNP. WDNR approved of use of the Phase II data to fulfill part of the two-year data requirement under the Final Rule. A second year of entrainment sampling was conducted during 2017. Section 9.0 and its appendices summarize the entrainment characterization study. The rates of entrainment observed in the two years are used to support estimation of monetized social benefits in Section 11.

Comprehensive Technical Feasibility and Cost Evaluation Study—40 CFR 122.21(r)(10)

The Final Rule requires the feasibility and costs of alternative entrainment measures be considered. This includes the potential quantification of the social costs of alternative entrainment control measures be estimated and compared to potential social benefits. This estimation proceeded in three steps:

- The set of potential entrainment mitigation measures was identified, and the most cost-effective[6] configuration of each measure was selected from the available options.
- Based on a conceptual design that considers site-specific constraints, the costs to the facility for retrofitting each feasible technology were estimated. These costs include those associated with construction, permitting, and increased operation and maintenance associated with the measure. Loss of generation output was also calculated based on, as appropriate for the technology, increased parasitic load, loss of generation efficiency, outage of the unit with construction, and potential for deratings.
- Social costs were estimated based on how increased facility costs are likely to be distributed to society over the life of the technology. Estimated social costs include those associated with increased price of power when lost generation must be replaced with a

[6] In the context of the 316(b) rule and this document, most cost-effective means the lowest cost option technically feasible that yields a reliable and significant rate of entrainment reduction. The approach to this assessment (e.g., capturing relevant benefits while neglecting some costs) is discussed further in Section 10.0.

higher-priced source(s). Such social costs were estimated using NextEra's power system model.

As required by the Final Rule, NextEra considered the feasibility and costs of three potential technologies that could reduce rates of entrainment: (a) retrofit to closed-cycle cooling, (b) use of fine-mesh screens (FMS) at the intake, and (c) use of alternative water supplies to replace some or all of the water used in the once-through cooling system. NextEra also considered entrainment protection provided by use of VSPs to reduce the rate of water withdrawal and, therefore, entrainment. WDNR's draft guidance for implementing the 316(b) rule suggested Ranney Collectors as a potential technology for examination for entrainment BTA; as such, NextEra examined available information on the use of Ranney wells along Lake Michigan. In discussions with NextEra, WDNR did not identify other entrainment measures that should be considered. Section 10.0 also provides a more general review of the available approaches to reduction of entrainment and, for each of the technologies, summarizes available alternatives.

As discussed in Section 10, installation and operation of closed cycle cooling and FMS would be associated with substantial technical challenges. For both technologies, NextEra has developed conceptual approaches that attempt to address those challenges in as cost-effective manner as possible. While these conceptual approaches are used to develop monetized estimates of both facility and social costs, NextEra has important concerns, as explained in Section 10, that substantial technical uncertainties remain and that the actual costs could be considerably higher. Therefore, NextEra believes that the monetized facility and social costs should be considered a lower bound estimate.

No alternative water supply was found to provide a reasonable alternative, including Ranney-type wells, to replace even a small fraction of intake flow. There is no additional appreciable opportunity to reduce flow using VSPs at a nuclear power plant operating at full capacity, such as PBNP, while retaining plant reliability and maintaining an appropriate margin of safety. For the other potential measures, a conceptual design, including location of the facility, facility costs, and schedule for design, permitting, and construction, was developed. The present value (PV) of the social costs of each technology was also developed based on the estimated start of the technologies' operation and retirement date for the facility. Section 10.0 addresses each of the

requirements of the Final Rule at 40 CFR 122.21(r)(10). For potential retrofit with closed-cycle cooling and VSPs, the rate of water use reduction was estimated as a means of estimating reductions in entrainment in Section 11.0. The conceptual design for each measure was used to estimate any other environmental effects as described in Section 12.0.

Benefits Valuation Study—40 CFR 122.21(r)(11)

The goal of this section is the estimation of social benefits that would derive from additional controls on entrainment at PBNP. As with the estimation of social costs, this effort proceeds by way of a number of steps:

- The total rate of entrainment was estimated for the current cooling water system and its operation at PBNP. To illustrate the interannual variation in entrainment rates, results from each year of the two-year entrainment dataset (2006 and 2017) were considered separately. The rates were adjusted to reflect the recent five-year AIF for the facility.
- Estimated decreases in the rates of entrainment for each technology were calculated. For potential retrofit with closed-cycle cooling, reduction in entrainment was assumed to be equal to the reduction in cooling water flow. For FMS, the separate rates of organism exclusion and post-exclusion survival were estimated based on empirical data available from historical studies at Prairie Island Nuclear Station's FMS installation and other sources.
- Various rates of entrainment, including baseline and mitigated, were used to model the effects on commercial and recreational (C/R) fisheries harvest. This estimation was based on commonly applied population models to estimate the effects of direct reductions in entrainment and impingement of C/R species, as well as the effects of loss of forage associated with the entrainment of other finfish and shellfish[7]. Changes in harvest were considered on a numerical and mass basis. Parameters used in population modeling were derived from the literature and reflected the fishery of Lake Michigan. Uncertainty in selection of model parameters was considered and discussed.

[7] NextEra has collected and enumerated invertebrates that were entrained in both sampling years. As described in Section 11, while NextEra believes that inclusion of these invertebrates is very unusual and their numbers are biased high relative to the lake at large, the impacts of the loss of these organisms as forage to C/R species was calculated. In fact, these organisms are estimated to contribute a very substantial fraction of the monetized social, a finding that NextEra believes strongly over-estimates that social benefit.

- Uncertainties in the biological assessments (i.e., technology effectiveness and biological modeling) were considered including alternative approaches and their potential effect on the social benefit. Generally, uncertainty was addressed in a fashion that resulted in a likely over-estimate of social benefits, such as inclusion of invertebrates as forage.
- For each of the entrainment scenarios (baseline and the potential reductions with additional technologies), change in social benefit associated with changes in C/R harvest were estimated using a random utility model calibrated to the use of the local fishery. This change is termed a "use" benefit and was calculated over the life of the technology and beyond until any effects of the technology have dissipated. The total benefit over that period of time was expressed as an PV.
- There are no federally or state-listed threatened or endangered species in Lake Michigan, thus there is no potential for interaction of listed species with the CWIS.
- Nonuse benefits were also estimated based on EPA survey data on perception of the value of protected but unused fish and shellfish. Nonuse benefits were calculated for all households in Manitowoc County, Wisconsin, the county where PBNP is located; all households in the states included in the inland region of EPA's stated preference survey; and all households in the United States. Nonuse benefits were also expressed as an PV to facilitate combining with use benefits and comparing with social costs.

Non-water Quality Environmental and Other Impacts Study—40 CFR 122.21(r)(12)

The report under 40 CFR 122.21(r)(12) calls for assessment of other environmental impacts, including estimates of the level of impact. It also calls for discussion of reasonable efforts to mitigate the impacts. Section 12.0 describes the following changes associated with the potential entrainment mitigation measures in the order they are presented in the Final Rule:

- Estimates of changes to energy consumption associated with parasitic load, loss of generation efficiency, and downtime associated with construction
- Estimates of increases in air emissions
- Estimates of changes in noise generation
- Discussion of potential impacts to safety
- Discussion of potential impacts to facility reliability
- Estimation of changes in water consumption
- Discussion of efforts to mitigate these adverse effects

Sections 10.0 and 12.0 were developed with a high degree of coordination. Such coordination is necessary because the conceptual approach to each technology is defined in Section 10.0, and that approach (e.g., nature of the cooling towers, their position, etc.) has an important effect on the level of impacts. As importantly, the quantitative engineering and costing analyses performed in Section 10.0 have been developed to provide estimates of the level of impacts as well as incorporate reasonable estimates for their mitigation. For example, changes in energy consumption and production were estimated in Section 10.0 as part of the conceptual design and were used to estimate both facility and social costs. Similarly, reasonable measures to ensure facility reliability with the potential installation of FMS (e.g., expansion of screen area; two sets of MTWS in series) and potential retrofit to closed-cycle cooling (e.g., selection of critical wet bulb temperature for cooling tower design) were incorporated into the costing exercise in Section 10.0.

Therefore, in many cases, Section 12.0 summarizes analyses performed in Section 10.0, while in other cases (e.g., changes in water consumption and noise), analyses independent of those in Section 10.0 are presented.

Peer Review—40 CFR 122.21(r)(13)

The reports prepared under 40 CFR 122.21(r)(10) through (12) were peer-reviewed by external experts as required by 40 CFR 122.21(r)(13). Three peer reviewers were retained, consisting of qualified experts in power plant engineering, aquatic biology, and resource economics. The qualifications of the peer reviewers were submitted to WDNR for review and approval and were subsequently approved by WDNR. Consistent with the Final Rule's requirements, Section 13.0 provides the peer reviewers' qualifications.

Peer review of NextEra's approach to the BTA analyses under 40 CFR 122.21(r)(10) through (12) was sought on the draft final documents as required by the Final Rule. The Final Rule requires NextEra to "provide an explanation for any significant reviewer comments not accepted." NextEra addressed all comments by the reviewers with changes in the analyses and/or summary text. Section 13.0 provides the full set of peer reviewers' comments along with NextEra's responses. The peer reviewers each concurred that NextEra's responses addressed their

comments as documented in Section 13. Therefore, this final document reflects input from the peer reviewer expert in those three disciplines.

1.3.2.3 Entrainment BTA Factors that Must Be Considered

In this section, factors the rule defines as required for WDNR to assess entrainment BTA on a site-specific BPJ basis, per 40 CFR 125.98(f)(2), are considered. While each factor is considered separately for both potential mitigation measures, in the interest of brevity, references to the relevant section(s) of the report are provided along with a summary of findings relative to that factor. Factors that the Final Rule indicates "may" be considered by WDNR are presented in Section 1.3.2.4.

Based on the review of the findings presented in Sections 10.0 through 12.0, NextEra believes the net social benefits (i.e., social benefits minus social costs) is the best and most complete factor for assessing potential retrofits to mitigate entrainment. This conclusion is based on a number of considerations:

- Some factors (e.g., thermal discharge effects[8], impacts on water consumption, and availability of alternative water supplies) are not significant at PBNP.
- Estimation of both social costs and social benefits integrate several other decision factors available to WDNR. For example, the social costs of potential retrofits directly incorporate:
  - Land availability
  - Remaining useful plant life
  - Mitigation of potential impacts to facility reliability
- Similarly, social benefits directly incorporate:
  - Numbers and types of organisms entrained
  - Remaining useful plant life
  - Entrainment impacts on the waterbody
- The rule considers the social costs and social benefits, ensuring that the assessment focuses on the parties affected by the technology social costs (e.g., the rate-payers) and social benefits (e.g., those that fish in the vicinity of PBNP).

[8] The thermal discharge complies with WPDES permit limits.

- Monetizing social costs and social benefits facilitates their comparison on a common basis. Consistent with this policy objective, NextEra has carefully estimated all social benefits (e.g., all entrained organisms are considered as affecting C/R fisheries either directly or indirectly; nonuse benefits are quantified) while omitting monetization of some social costs that are uncertain and/or difficult to estimate (e.g., monetization of the health effects of increased air emissions, noise, and potential safety effects). Therefore, estimates of net social benefits should be viewed as a likely overestimation.

Numbers and Types of Entrained Organisms—40 CFR 125.98(f)(2)(i)

Key Document Section(s)*—Section 11.2.1 for anticipated rates of entrainment; Section 9.0 and appendices for methods and background on entrained species.*

Section 9 and its appendices present the number and type of entrained organisms based on annualized, AIF-flow-adjusted counts of entrained organisms during the two years of sampling. This presentation is based on the actual plant flows and observed rates of entrainment during each year and included enumeration of entrained finfish and shellfish.

A total of 32,477 "shellfish" (under WDNR's definition that includes amphipods) were collected, in 2017 primarily non-native (*Echinogammarus ischnus*; 71.7 percent of total) and native amphipods (*Gammarus* sp.; 27.8 percent), collectively comprising more than 99% of the entrained shellfish. Dominance of entrainment samples by these amphipod species is likely a result of their colonization of substrate formed by the rock crib and co-occurrence with other invertebrates (e.g., quagga and zebra mussels). A single native opossum shrimp (*Mysis diluviana*) was collected and the non-native mysid shrimp (*Hemimysis anomala*) accounted for <1.0% of the entrained shellfish. A total of 15 ichthyoplankton taxa/life stage groups were encountered in the 2017 entrainment samples, with the most abundant being Rainbow Smelt (41.7% of the total), followed by Burbot (26.4%), Alewife (11.1%), and Round Goby (8.3%). About 3% were unidentified fish eggs and 7% were unidentified larvae.

A total of 19 taxa/life stage groups were reported from the 2006 Phase II study. Rainbow Smelt was also the most abundant (60%), followed by Alewife type eggs (18%). Four taxa/life stage groups accounted for 11% of the remaining collection in 2006. Only a single Burbot was collected in 2006 compared to 19 in 2017. Most taxa that occurred only in 2006 were represented

by single specimens. Round Goby were not entrained in 2006, but were entrained in low numbers in 2017. Juvenile and adult Round Goby were also impinged in low numbers during the Phase II study.

Entrained taxa represented fish common in Lake Michigan based on historical data collected at Point Beach from April-October 1975 and from April-September 2006. A total of 91 larval fish occurred in the entrainment samples collected in the 1975 study with the same collection system. The 1975 entrainment samples contained 57 Rainbow Smelt (62.6% of the larvae), 17 Alewife larvae (18.7%), 15 Sculpin (16.5%), and two Longnose Sucker (2.2%). Alewife eggs (203) were the only fish eggs collected during the 1975 study. The relative abundance of early life stages of Rainbow Smelt and Alewife were similar between studies, although Alewife eggs were more abundant in 2006 than in 1975 and were not collected in 2017.

While the annualized entrainment numbers seem large, the direct and indirect effects of the loss of these organisms is found, through modeling designed to overestimate effects, to result in a minor impact to the C/R fishery (see Section 11.0). This is attributable to: (1) the high rate of baseline mortality among the entrainable life stages of fish and shellfish; and (2) entrainment losses affect only a minor portion of the resource in Lake Michigan. These factors have been integrated into the assessment of social benefits in Section 11.0.

The average total annual foregone fishery yield is estimated as 7,406 kg. This number represents the annual total loss of biomass from the C/R fisheries due to entrainment losses, both direct and production foregone from forage, from the operation of PBNP. This estimate is designed to be an overestimation of these losses by employing a number of modeling assumptions (i.e., entrainment results in 100-percent lethality, all entrainment losses affect C/R taxa and no others, and selection of various parameters to maximize the estimated effects on stocks). For perspective, the annual commercial finfish landings for the Wisconsin Great Lakes from 2015 through 2018 range from 1,107,000 to 1,369,000 kg, or an average of 1,227,000 kg. Thus, the foregone fishery yield because of the estimated entrainment rates at PBNP represents approximately 0.60 percent of the average (2015 to 2018) annual commercial yield of the Wisconsin Great Lakes.

In addition to the estimated annual commercial harvest, the recreational landings in the Great Lakes in Wisconsin, although not specifically quantified at this level, are substantially higher than the commercial landings for many species including Chinook and Coho Salmon, Steelhead, Lake Trout, Brown Trout, Brook Trout, Yellow Perch, Bullheads, Largemouth Bass, Northern Pike, and Lake Sturgeon. Therefore, the estimated losses from PBNP are a very small fraction of the combined harvest from commercial and recreational fishing.

The potential for reduction in entrainment with the potential installation of entrainment mitigation measures has been quantified for the two potential technologies. Potential retrofit to closed-cycle cooling was estimated to reduce entrainment by 95.5 percent. Reduction of entrainment by seasonal deployment of FMS (i.e., the product of the rate of exclusion and post-exclusion survival) was estimated to be approximately 30 percent for finfish and 100 percent for shellfish (the latter assumes 100 percent exclusion and survival). These rates were used in the quantitative estimation of the social benefits of potential entrainment measures. The social costs and benefits of these options are compared below but neither technology results in a positive social benefit. In fact, for both technologies the net social benefits (i.e., social benefits – social costs) are very strongly negative.

In conclusion, NextEra does not believe the number and type of organisms entrained provide a compelling basis under the Final Rule to consider additional entrainment measures. Importantly, no federally or state-listed species have been subject to entrainment. In addition, the rates of entrainment are not believed to substantially affect the fishery of Lake Michigan. As noted previously, NextEra believes quantification of the social benefits is the best means to evaluate the number and nature of entrained organisms in the context of the Final Rule's goals, see below.

Impacts of Changes in Emissions of Particulates and Other Pollutants—
40 CFR 125.98(f)(2)(ii)

Key Document Section(s)*—Cooling Towers: Section 12.3.2; FMS: Section 12.4.2*

The entrainment BTA assessment considers changes in pollutant emissions to the atmosphere in Section 12.0. The increase in emissions is associated with two separate factors: (1) particulate emissions from the cooling towers used in the hypothetical conversion to closed-cycle recirculating cooling system (CCRS) at PBNP, and (2) loss of generation capacity associated

with parasitic loads and loss of efficiency and the resulting need to replace that power with other generator(s). Table 1-1 provides estimates of increased emissions for CCRS and FMS operations using an average 93.9 percent capacity factor for Unit 1 and 95.5 percent for Unit 2 (based on average generation capacities from January 2015 to December 2019). Table 1-2 provides emissions data for replacement power from fossil-fueled non-baseload plants during the outage required for retrofit of each technology.

Table 1-1. Increased Air Emissions Associated with Operation of Potential Retrofits

Technology	CCRS (tons per year)		FMS (tons per year)
	Unit 1	Unit 2	Total for Units 1 & 2
Total PM	3.5	3.6	*
PM_{10}	2.9 to 3.2	3.0 to 3.3	*
$PM_{2.5}$	1.3	1.4	None
Estimated Increase in CO_2	196,636	201,862	1,189
Estimated Increase in SO_2	154.6	158.7	0.93
Estimated Increase in NO_x	146.8	150.7	0.89

*Too small to be quantified meaningfully

Table 1-2. Estimated Air Emissions During Retrofit Downtimes

Technology	CCRS (tons)		FMS (tons)	
	Unit 1	Unit 2	Unit 1	Unit 2
Estimated Increase in CO_2	780,258	798,992	2,909,746	2,928,429
Estimated Increase in SO_2	613	628	2,287	2,302
Estimated Increase in NO_x	583	597	2,173	2,187

Emissions of particulates, dominated by concentrated mineral deposition from the cooling tower drift, would result from the use of mechanical draft cooling towers at PBNP. Particulate emissions are estimated to travel approximately 2,500 feet and have the potential to result in damage to vegetation and infrastructure both onsite (e.g., electrical switchyards) and offsite.

Emissions associated with replacing lost generation would be dominated by carbon dioxide with far lower amounts of sulfur oxides, nitrogen oxides, and particulate matter. These increased emissions could occur on the site or at other fossil fuel-fired generators in the area. The social costs of these increased emissions were not monetized because of various uncertainties; therefore, the social costs are underestimated and the net social benefits are likely overestimated.

Land Availability—40 CFR 125.98(f)(2)(iii)

Key Document Section(s)*—Cooling Towers: Section 10.3.3 for review of candidate technologies, Section 10.4.2 for cooling tower sizing, and Section 10.4.3 for assessment of potential locations; FMS: Section 10.5*

The availability of space for infrastructure was considered in the assessment of entrainment BTA. While some space constraints at the Plant and in the surrounding areas may limit the potential locations for additional equipment, a location was identified for a potential cooling tower retrofit that would have the least impact on the existing operations. While such a retrofit is believed to be feasible, the complexity of existing infrastructure at the site results in higher estimated installation costs, which affect the estimated social costs. Space constraints also exist for FMS due to the complexity of the existing intake and discharge structures. Therefore, an alternate configuration of placing FMS in front of the existing screens and staging their construction was evaluated.

Land availability near the pump house was found to limit the potential for use of variable speed pumps (VSPs), which must be housed in a dust-, humidity- and temperature-controlled environment. A separate building would need to be constructed adjacent to the existing CWIS and as close as possible to the circulating pump motors to house these drives; and the new building would need its own heating, ventilation and air-conditioning system to provide the necessary controlled environment. The PBNP Protected Area is fully built-up and the existing intake structure is surrounded by underground piping and utilities as well as critical transportation corridors; there is no space to construct a new building close enough to the existing pumps to house VSPs.

Remaining Useful Plant Life—40 CFR 125.98(f)(2)(iv)

Key Document Section(s)*—Section 10.1.8*

The remaining life of the generating units and the potential entrainment technologies impacts both social costs and benefits (as affected by O&M costs, duration of changes in plant output, fisheries benefits). Under the current operating license, PBNP Unit 1 is permitted to operate through October of 2030 and Unit 2 to operate through March of 2033. NextEra notes that some nuclear operating licenses are being renewed to allow for longer periods of operation (e.g., 80 years rather than the originally planned 60 years). Given this industry trend, NextEra believes

that it is prudent to anticipate for the purposes of the CWA 316(b) assessment that the operating license of PBNP could similarly be extended by another 20 years. Therefore, in assessing both social costs and social benefits, it was assumed that Unit 1 will remain operational through October of 2050 and Unit 2 will remain operational through March of 2053.

If the original entrainment reduction technology is in good operating order at that time, it is assumed that the technology would be retired then. Any potential salvage value is assumed to be minor and is not evaluated here. If the anticipated life of the entrainment technology is shorter than the anticipated life of the unit, then this evaluation assumes that the technology would be repaired or rebuilt and somehow made available to service the generating unit through 2050 and 2053. The potential social costs and social benefits were both modeled assuming the technology would be installed in a reasonable time frame and would remain in operation through that date of plant closure. Both social costs and social benefits were expressed as PV based on implementation, operation, and retirement time frames.

Such social costs were estimated using a power system simulation model (Environmental Policy Simulation Model [EPSM]) (Veritas Economics, 2011) calibrated to annual average historical prices. The social costs reflect the estimated rate of facility use in the future as well as the plant's lifetime (to the extent presently known; future market conditions could change future utilization rates).

Quantitative and Qualitative Social Benefits and Social Costs—40 CFR 125.98(f)(2)(v)

Key Document Section(s)*—Social Costs: Section 10.1.7 for description of the process, Appendix 10-A for description of the social costing methods, Section 10.8.3 for the summary of results for cooling towers; Social Benefits: Section 11.2 for an overview of the methods employed, Section 11.4.4 for a summary of the monetized social benefits, Appendix 11-C for a review of the economics methods applied and their results.*

NextEra has developed peer-reviewed estimates of both social costs and social benefits consistent with the Final Rule's requirements. The estimation of social benefits included both use benefits (i.e., potential changes in C/R fishing stocks and their attending economic effects), as well as nonuse benefits.

NextEra believes considering the net social benefits of a potential activity is a sound means of deciding whether the activity represents entrainment BTA on a BPJ basis. As noted in Section 1.3.2.5, the Final Rule allows WDNR the discretion to "reject otherwise available entrainment controls if the costs of the controls are not justified by their associated benefits (taking into account monetized, quantified, and qualitative benefits), and the other factors discussed in the Final Rule." In the event the net social benefits of a proposed set of activities are negative (i.e., social costs outweigh social benefits[9]), there is no reasonable justification for that activity to represent entrainment BTA. On the other hand, if the net social benefit is positive, the approach that provides for the greatest net social benefit or the greatest marginal net social benefit could be considered entrainment BTA (subject to confirmation from detailed engineering and potentially through pilot studies).

The monetized social costs and social benefits associated with the candidate entrainment reduction measures estimated in Sections 9.0 through 13.0 has been summarized in Figure 1-4. The figure compares the approaches to BTA to provide context for determining the maximum entrainment reduction warranted under the Final Rule's site-specific entrainment evaluation.

The vertical axis in the top portion of Figure 1-4 presents the total social costs, total social benefits, and net social benefits (total social benefits minus total social costs) of each compliance option, as arrayed on the horizontal axis. The total social costs (in black) are greater than the social benefits (in green) for each of the entrainment compliance options. The net social benefit is represented by a red bar which is negative for both options presented.

[9] It is important to note that the calculation of the social costs and, therefore, the net social benefits, recognizes that the cost of the technologies being considered are borne by the rate-payer in the form of higher electricity costs.

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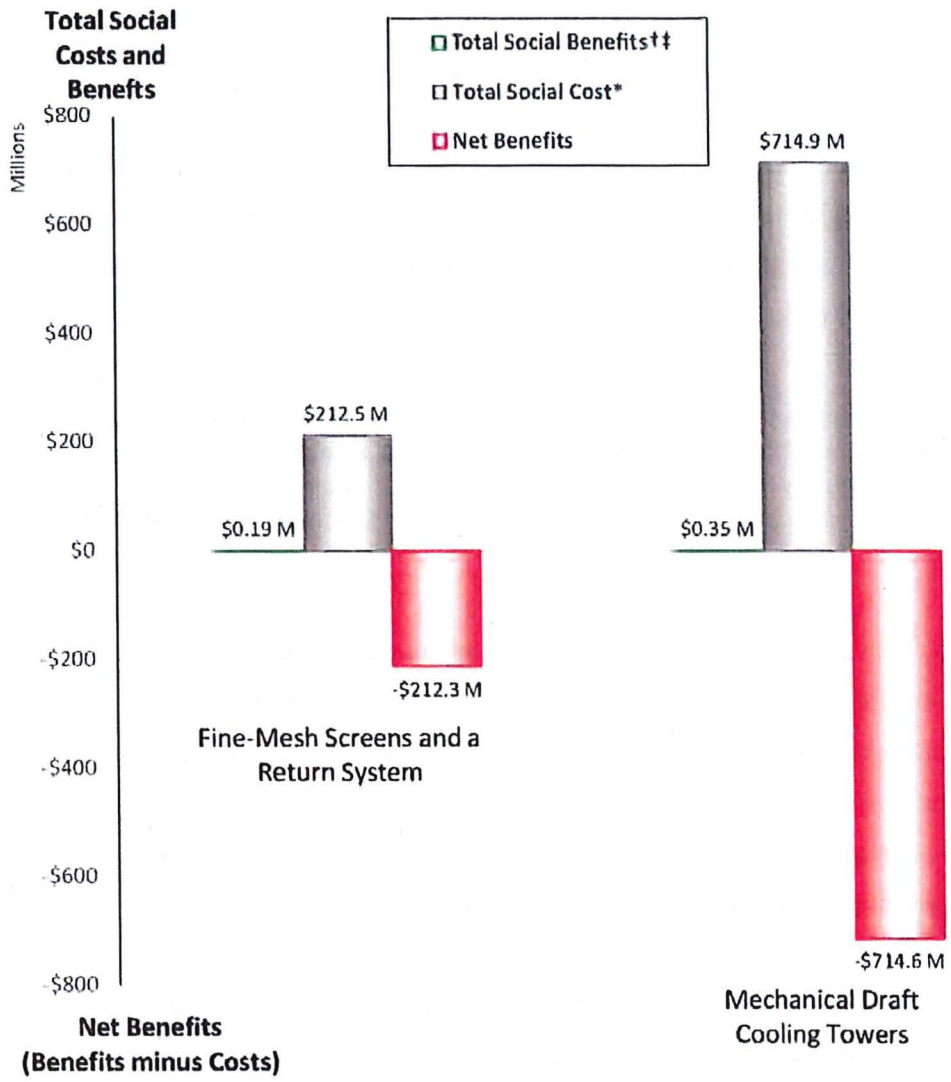
Table 1-3. Net Benefits of Entrainment Reduction Technologies at PBNP

Regulatory Standard Addressed	Compliance Alternative	Total Social Cost*	Total Social Benefits ($)†‡	Net Benefits
Entrainment	Fine mesh screens	$212.5M	$0.19M	-$212.31M
	Closed-cycle cooling retrofit	$714.9M	$0.35M	-$714.55M

*Social costs and social benefits are presented in 2020 dollars using a 3-percent discount rate. Expression of social costs and benefits consider a 7-percent discount rate is presented in Sections 10 and 11.
†Entrainment benefits are based on the higher of the two years' entrainment benefits for each technology.
‡Entrainment benefits include nonuse benefits.
Source: ECT, 2020.



Notes:
*Social costs and social benefits are presented in 2020 dollars using a 3-percent discount rate. Expression of social costs and benefits consider a 7-percent discount rate is presented in Sections 10 and 11.
†Entrainment benefits are based on the higher of the two years' entrainment benefits for each technology.
‡Entrainment benefits include nonuse benefits.

FIGURE 1-4
COMPARISON OF SOCIAL COSTS AND SOCIAL BENEFITS AT PBNP

Source: ECT, 2020, Vertias, 2020

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Figure 1-4. Comparison of Social Costs and Social Benefits at PBNP

Social costs spent on candidate entrainment measures would result in substantially negative net social benefits. Retrofit to closed-cycle cooling has the most negative net social benefits, at ($714.6) million. The FMS option, which has been determined to be tentatively feasible at PBNP but requires additional testing and design and which may be considerably more costly than estimated here, also has a net negative benefit of ($212.3) million. Given that the net social benefits are strongly negative for each of the alternatives[10], neither entrainment compliance option is warranted as BTA under the Final Rule's site-specific entrainment evaluation, for, as the Final Rule notes at 40 CFR 125.98(f)(4):

> *If all technologies considered have social costs not justified by the social benefits...the Director may determine that no additional control requirements are necessary beyond what the facility is already doing. The Director may reject an otherwise available technology as a BTA standard for entrainment if the social costs are not justified by the social benefits.*

Similarly, because both of the candidate entrainment measures result in more negative net social benefits than the existing facility condition, the commonly accepted framework of efficiency for economic decision making (Boardman *et al.*, 2018; Freeman *et al.*, 2014), suggests that the existing configuration at PBNP represents the entrainment BTA for meeting the Final Rule's site-specific entrainment requirement, per 40 CFR 125.98(f). Therefore, NextEra concludes neither candidate entrainment measure is justified as entrainment BTA on a BPJ basis, and the current design and operational measures at PBNP are BTA for entrainment. NextEra believes that such a finding is entirely consistent with the direction provided to the NPDES Director regarding situations in which "social costs [are] not justified by the social benefits" as described at 40 CFR 125.98(f)(4) (see Section 1.3.2.5).

1.3.2.4 Entrainment BTA Factors that May Be Considered

The following are the findings of the entrainment BTA assessment relative to the factors that WDNR may consider under 40 CFR 125.98(f)(3).

[10] The ratio of costs to benefits is also used as a basis of comparison. The estimated ratio [PV social costs/PV social benefits] are 1,120 and 2,043 for FMS and CCRS, respectively.

Entrainment Impacts on the Water Body-40 CFR 125.98(f)(3)(i)

Key Document Section(s)*—Section 11.2.2 for estimation of changes in stock size and harvest levels, Section 11.2.5 for discussion of other potential benefits of a technology*

As discussed in Section 11, effects of entrainment on the fishery of Lake Michigan are believed to be minor based on the size of the ecosystem and the localized effect from the intake, particularly given the artificial substrate represented by the intake crib. This was confirmed by quantitative modeling of the effects of entrainment, including direct losses of C/R species as well as losses of organisms that may serve as forage for C/R species.

Thermal Discharge Impacts-40 CFR 125.98(f)(3)(ii)

Key Document Section(s)*—Section 11.2.6*

The thermal discharge from PBNP to Lake Michigan is regulated by the plant's WPDES permit, which is based upon a recent, site-specific impact study and which requires continuous monitoring of cooling water inlet and outlet temperatures. PBNP calculates and reports its daily heat load based on measured cooling water flow and average daily increase in cooling water temperature. Compliance with the Plant's heat load limit of 8,273 million British thermal units per hour is based on a weekly average of the heat load calculation. Based on its compliance with the permit requirements, NextEra concludes reduction in the thermal loading associated with the potential retrofit to closed-cycle cooling would not have a meaningful beneficial effect to the nearby aquatic community.

Flow Reduction-40 CFR 125.98(f)(3)(iii)

Key Document Section(s)*—10.7 and Appendix 10-B*

Under 40 CFR 125.98(f)(3)(iii), reductions in flow associated with unit closure can be credited if they occurred in the 10 years prior to the effective date of the Final Rule. PBNP has not closed any units at the Plant for which it can take such a credit. NextEra has taken into account the flow reduction (and commensurate reduction in entrainment) achieved by operating a single circulating water pump during winter when water temperatures are low enough to meet the thermal limits with reduced flows. PBNP also recirculates some of its cooling water discharge back to the intake crib to prevent ice formation at the intakes which also reduces entrainment rates.

Impacts on Reliability of Energy Delivery-40 CFR 125.98(f)(3)(iv)

Key Document Section(s)—*Cooling Towers: Sections 12.3.1, 12.3.5; FMS: Section 12.4.1, Section 12.4.5*

PBNP represents a large and important asset in its commitment to supplying electricity to the regional transmission organization. Maintenance of reliable energy delivery is an imperative of NextEra and has been considered in the assessment of entrainment BTA approaches in three ways:

- During the conceptual design of potential measures, configurations were adjusted to improve generation reliability, including the assumption that two sets of MTWS would be necessary in series in the event FMS are pursued and the selection of a cooling tower critical wet bulb temperature that reduces the frequency of unit derating. Such design changes affect the capital and social costs estimated for the retrofit. NextEra notes that it has not concluded that the FMS system considered in Section 10 would, in fact, reliably provide cooling water to PBNP. The likelihood that FMS would be clogged at high frequency with the potential for their failure, interruption of water supply, and/or damage to pumps is of great concern to NextEra. While NextEra believes that the FMS configuration considered supports the goals of the Final Rule of evaluating the technology, there is a strong possibility that the actual costs of a workable system would be far higher than estimated in Section 10. The level of uncertainty and risks to operations must therefore be addressed by additional studies.
- The potential for VSPs to result in flow reduction and, therefore, entrainment reduction was evaluated relative to the need to meet PBNP's thermal limits under each unit's existing capacity factors (94 and 95.5 percent for Units 1 and 2, respectively). VSPs represent a highly variable opportunity to reduce flow depending on environmental and market conditions. It was concluded that very low entrainment reductions would be attainable that would not justify installation of VSPs.
- Power system modeling was performed to evaluate loss of generation capacity associated with retrofit in the context of the available electricity sources, both to ensure electricity was available and to estimate the social costs of securing it.

Potential retrofit of PBNP to include closed-cycle cooling would reduce the available electrical output, particularly during summertime periods when electricity demand and the price of

electricity is highest. Such reductions will have marginal effects on the reliability of energy to the regional transmission organization. Furthermore, both alternative technologies would require extended outages of several months which could substantially impact the grid reliability.

Impacts on Water Consumption-40 CFR 125.98(f)(3)(v)

Key Document Section(s)—*Cooling Towers: Section 12.3.6; FMS: Section 12.4.6*

Section 12.0 considers changes in water consumption for the candidate entrainment technologies. Potential changes in water consumption with FMS and VSPs would be negligible. Water consumption in the form of increased evaporation with use of cooling towers was quantified and compared to the increased evaporation associated with discharge of heated effluent from the once-through cooling system. This analysis is dependent on ambient weather conditions and was performed monthly. Cooling towers were estimated to increase water loss by 76 to 232 percent for each unit, depending on the month.

Availability of Alternative Water Supplies-40 CFR 125.98(f)(3)(vi)

Key Document Section(s)—*Section 10.6*

Based on a review of several potential sources of water in the area, no alternative source of cooling water was found within in a five-mile radius of the Plant. If the use of an alternate water source (whether groundwater, including Ranney-type wells, or reclaimed water) were viable, then energy consumption would increase owing to additional pumping, and emissions would increase correspondingly. Depending on PBNP's dependence on the alternate water source and fraction of water provided by the alternate source, the reliability of PBNP operations could also be compromised.

1.3.2.5 Summary of Entrainment BTA and Recommendations

The Final Rule's summary of the requirements of the NPDES Director includes the following section under 40 CFR 125.98(f), Site-specific entrainment requirements:

> *(4) If all technologies considered have social costs not justified by the social benefits, or have unacceptable adverse impacts that cannot be mitigated, the Director may determine that no additional control requirements are necessary beyond what the facility is already doing. The Director may reject an otherwise available technology as a BTA standard for entrainment if the social costs are not justified by the social benefits.*

NextEra has assessed the social costs and social benefits of potential retrofit to closed-cycle cooling and installation of FMS; VSPs were found to be infeasible and therefore social costs and social benefits were not estimated. While closed-cycle cooling and FMS may be feasible, important uncertainties remain that could adversely affect social costs and each has substantially negative net social benefits. Brief summaries of these potential entrainment BTA measures follow.

Incorporation of Closed-cycle Cooling

The conceptual design of a potential closed-cycle cooling retrofit was developed to estimate capital costs for the potential project as well as ongoing operation and maintenance costs. These costs were converted to social costs that would be borne by the rate payer. The anticipated reduction in cooling water flow was used to estimate changes in entrainment and impingement, which were converted to monetized social benefits.

Net social benefits over the anticipated lifetime of the plant and technology are estimated to be in excess of ($714.6 million) based on construction costs, increased price of power, as well as increased operation and maintenance costs. Therefore, social costs exceed social benefits by a factor of approximately 2,043. Due to loss of generation capacity associated with parasitic loads, decreased efficiency, weather-related de-rates, and construction downtime, air emissions from replacement power sources will increase.

Rates of flow reduction associated with cooling towers would be approximately 95.5 percent. This fact is reflected in the estimation of social benefits, and, while the social costs are roughly 3.5 times higher than FMS, the monetized social benefits are only approximately twice as high as FMS. Therefore, retrofit to closed-cycle cooling should be rejected as entrainment BTA based on its highly negative net social benefits as well as its poor performance relative to other entrainment BTA approaches.

Potential retrofit to closed-cycle cooling is also associated with the highest level of unavoidable adverse effects, including increased noise, air emissions with attending effects, and loss of generation output with attending effects on system reliability. These effects, while real, have not

been monetized as a part of this effort. Therefore, the net social benefits are actually lower (i.e., more negative) than the figures provided previously.

Installation and Use of VSPs

Variable speed pumps (VSPs) could allow the operator to increase or decrease the pumping rate (within the pump's capacity) based on the Unit 1 and Unit 2 condenser cooling water requirements to meet various operating or regulatory goals. The intention is to pump only the amount of water needed to adequately condense steam associated with each unit's thermal load thereby reducing the water withdrawal rate while meeting regulatory thermal criteria.

As presented in this section, PBNP is a nuclear power plant that operates at full capacity and has little opportunity to reduce flow beyond what is already achieved during Plant outages, from warm water recirculation for deicing, or idling circulating water pumps when possible in winter conditions. There is no additional appreciable opportunity to reduce flow using VSPs while retaining plant reliability and maintaining a margin of safety appropriate for a nuclear power plant. NextEra has also considered recent retrofits to use VSPs and found that, due to constraints on operation, rates of reduction in flow and entrainment were less than anticipated in planning exercises.

Installation and Operation of FMS

The net social benefits for installation and operation of FMS is estimated to be approximately ($212.3 million) over the life of the technology. While this is the least adverse net social benefit of the potentially feasible technologies, it is still a situation in which social costs outweigh social benefits by approximately 1,120 to 1. NextEra believes this conforms to the Final Rule's criteria of "social costs not justified by the social benefits."

NextEra also notes that the design basis for FMS systems is not well established and the installed base is small. Critically, the reliability and biological performance of such systems are understood to vary dramatically with site-specific conditions. The system considered in this analysis is patterned after a seasonally-deployed FMS system at Prairie Island, a nuclear plant located on the Mississippi River in Minnesota. Based on the site-specific entrainment data collected at PBNP, NextEra has incorporated seasonally deployed FMS in this analysis.

Most importantly, while NextEra has considered a system and construction approach that attempts to ensure reliable facility operation, important site-specific factors may greatly increase the estimated costs. NextEra also notes that the anticipated construction downtime, while very long, may be subject to extension due to unforeseen factors. The estimated downtime for construction is a key aspect of social costs and may result in facility costs that are inconsistent with the Plant's continued operation. All of these factors force NextEra to conclude that FMS cannot be found to be feasible at PBNP without extensive site-specific pilot testing.

1.4 Conclusion

NextEra believes its existing system of technologies, management practices, and operational measures represent IM BTA consistent with 40 CFR 125.94(c)(6). The final selection of IM BTA will follow WDNR's determination of entrainment BTA. This sequence is anticipated by the rule and is the subject of precedent.

NextEra has concluded none of the candidate entrainment mitigation technologies considered (closed-cycle cooling, VSPs, alternative water supplies, and FMS) are justified based on their relative social costs and social benefits as well as other factors. Alternative water supplies were found to be infeasible and variable speed pumps are found to present no real opportunity for flow reduction. While both the remaining technologies have some unavoidable adverse effects, potential retrofit to closed-cycle cooling would result in more adverse effects than FMS, and although not all of the social costs of these effects are monetized in this effort, even the partial monetization of costs shows they far outweigh the social benefits. Therefore, neither approach to entrainment BTA is justified under the Final Rule at 40 CFR 125.98(f)(4) and commonly-accepted economic decision processes. Neither FMS nor full closed-cycle cooling is practical at PBNP, and both might prove infeasible upon further engineering design. The social costs far outweigh the social benefits afforded by such retrofits.

In summary, NextEra believes neither of the two entrainment mitigation technologies are justified based on their social costs and social benefits, or any of the other must, per 40 CFR 125.98(f)(2), or may, per 40 CFR 125.98(f)(3), factors. Neither approach is practical and both may prove to be infeasible. Therefore, NextEra respectfully requests WDNR reject the potential

technologies as entrainment BTA and conclude the existing design and operational measures for PBNP are entrainment BTA without additional measures.

2.0 Source Water Physical Data 40 CFR 122.21(r)(2)

This section provides information on the physical characteristics of the source waterbody. The following subsections are numbered and titled consistent with the sections of 40 CFR 122.21(r)(2), with information required by the Final Rule quoted in italics.

2.1 Description of Source Waterbody

§122.21(r)(2)(i) *- A narrative description and scaled drawings showing the physical configuration of all source water bodies used by your facility, including areal dimensions, depths, salinity and temperature regimes, and other documentation that supports your determination of the water body type where each cooling water intake structure is located.*

PBNP is located on the shore of Lake Michigan approximately eighty miles north of Milwaukee, Wisconsin in Manitowoc County. Lake Michigan is approximately 307 miles long and 118 miles wide with an average depth of 279 feet and a maximum depth of 923 feet. With a water surface area of 22,300 square miles and a drainage area of 45,600 square miles, it is the third largest of the Great Lakes and the fifth largest freshwater lake in the world by surface area. It is hydrologically connected to Lake Huron through the Straights of Mackinac (USEPA, 2016).

Lake Michigan is a freshwater lake and therefore has no salinity. The Great Lakes are the world's largest surface freshwater system and combined contain approximately 84 percent of North America's surface freshwater and 20 percent of the world's surface water supply (Canada and EPA, 1995).

Daily average surface water temperatures for Lake Michigan for the period of 1995 to 2019 are depicted in Figure 2-1. Average monthly surface water temperatures ranged from a low of 1.7°C (35.0°F) in February to 21.2°C (70.2°F; Coast Watch, 2020). Average annual temperatures using the same data ranged from a low of 7.8°C (46.1°F) in 1996 to a high of 11.3°C (52.3°F) in 2012.

Surface water temperatures from Coast Watch are derived from satellite imagery and represent the average surface water temperature for Lake Michigan.

Water in Lake Michigan circulates in a generally counterclockwise motion, with the prevailing current along the western coastline to the south; several gyres have been noted to occur offshore. Currents are generally stronger in the winter than in the summer (Beletsky *et al.*, 1999). Upwelling events can result in drastic temperature changes along the shoreline. For example, offshore winds can push warmer surface waters into the middle of the lake; colder waters from deeper parts of the lake move in to replace it resulting in as much as a 20°F (11.1°C) drop in temperatures in 24 hours (Torregrossa, 2015). The shape of the lake as well as circulation patterns result in a long residence time of as much as 99 years (USEPA, 2016).

Short-term variations associated with upwelling are evident in the data records for intake temperature in both 2006 and 2017 (Figure 2-2). The temperature records also illustrate seasonal and interannual differences such as the relatively higher winter-time temperature observed in 2017. Daily minimum and maximum intake temperatures ranged from 6.6°C (43.9°F) to 21.3°C (70.3°F).

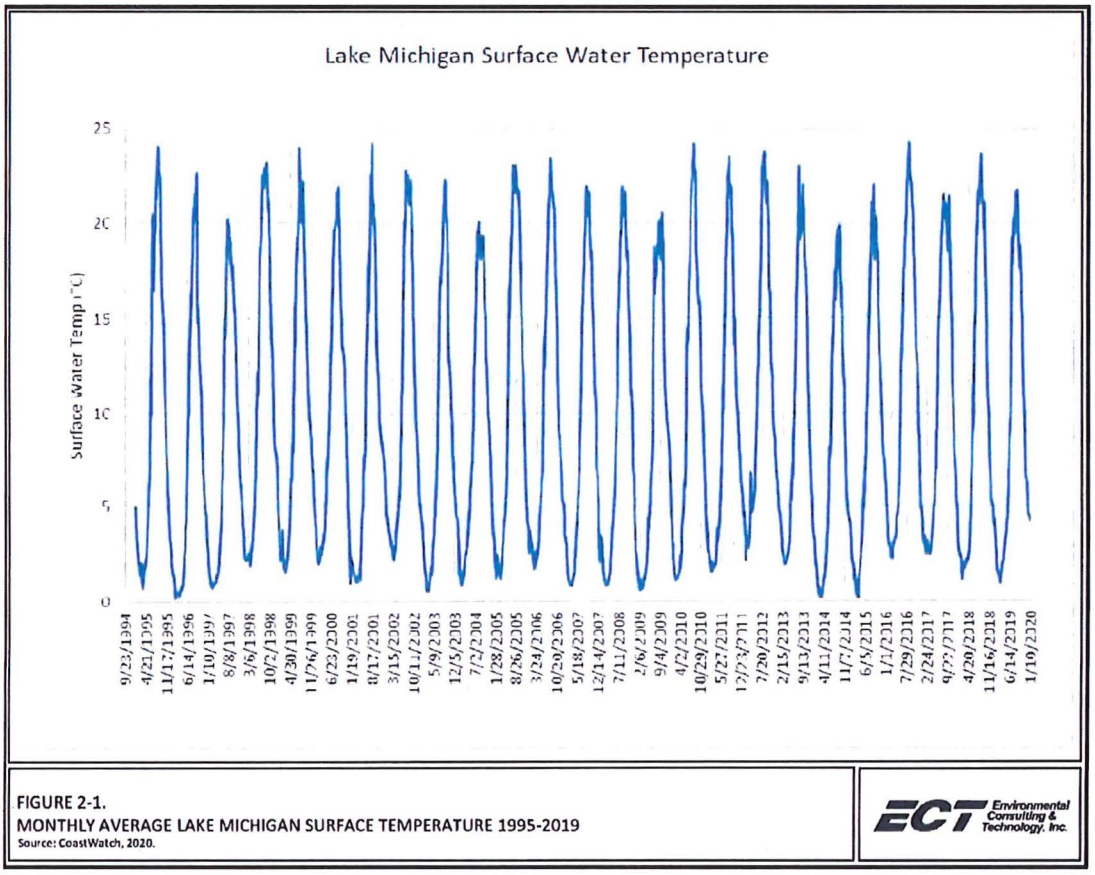


FIGURE 2-1.
MONTHLY AVERAGE LAKE MICHIGAN SURFACE TEMPERATURE 1995-2019
Source: CoastWatch, 2020.

ECT Environmental Consulting & Technology, Inc.

Figure 2-1. Daily Average Lake Michigan Surface Temperature 1995 – 2019

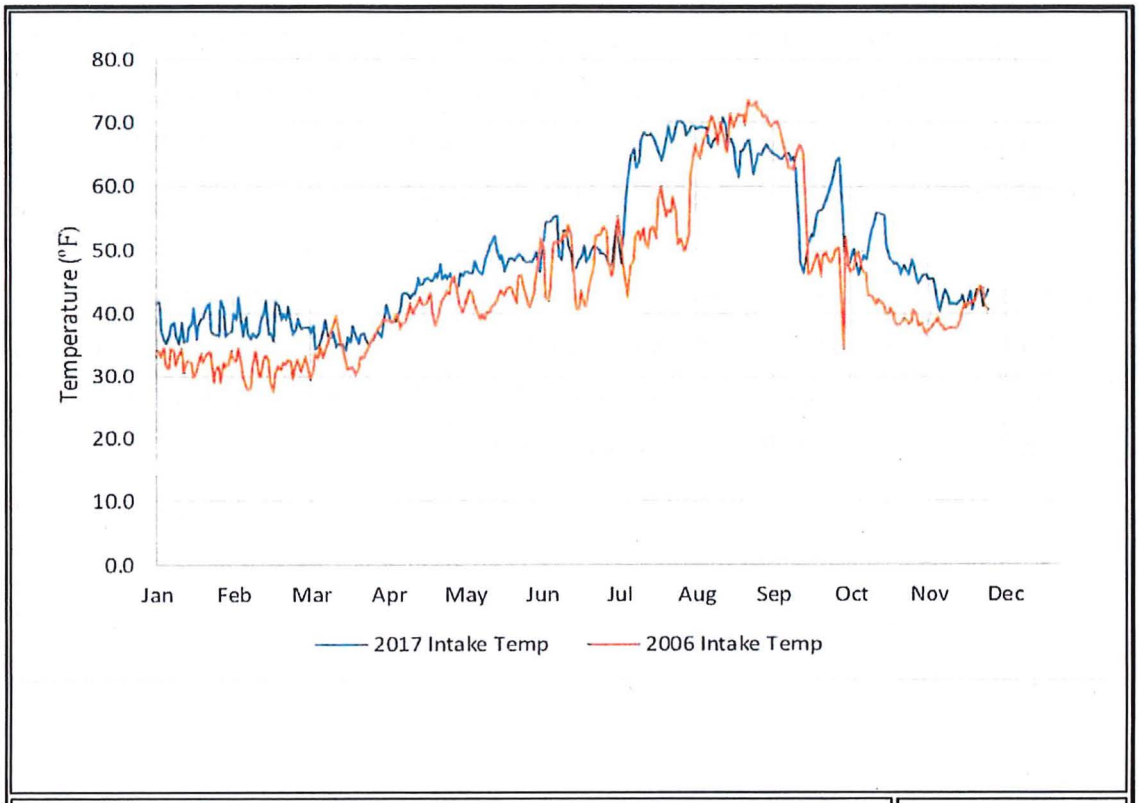


FIGURE 2-2.
POINT BEACH NUCLEAR PLANT INTAKE TEMPERATURES 2006 - 2017
Source: EA, 2020.

ECT Environmental Consulting & Technology, Inc.

Figure 2-2. Point Beach Nuclear Plant Intake Temperatures - 2006 and 2017

2.1.1 Water Levels

Water levels throughout the Great Lakes are recorded at 53 monitoring stations in the U.S. and 33 in Canada. The lake-wide average water level in Lake Michigan for the period 1918 to 2020 was 174.4 feet (International Great Lakes Datum [IGLD85]; Great Lakes Hydro Climate Dashboard, 2020). Water levels have fluctuated below this long-term average until 2014 and fluctuated above the average since 2014 (Smith *et al.*, 2016). Low water levels were attributed to above-average evaporation due to lower than average ice cover (Figure 2-3). A rapid increase in water levels, rising 0.96 meters from January 2013 to December 2014, has been attributed to high precipitation and the high percentage of ice cover during the winter of 2013 to 2014 (Gronewold *et al.*, 2015.) This has continued in 2015 through 2020.

Lake water levels were below the long-term averages for several years before the Phase II Rule study and continued for several years afterward until lake water levels rebounded prior to the 2017 entrainment study. However, these variations in lake level are not likely to have affected the fish populations around PBNP or the rates of entrainment.

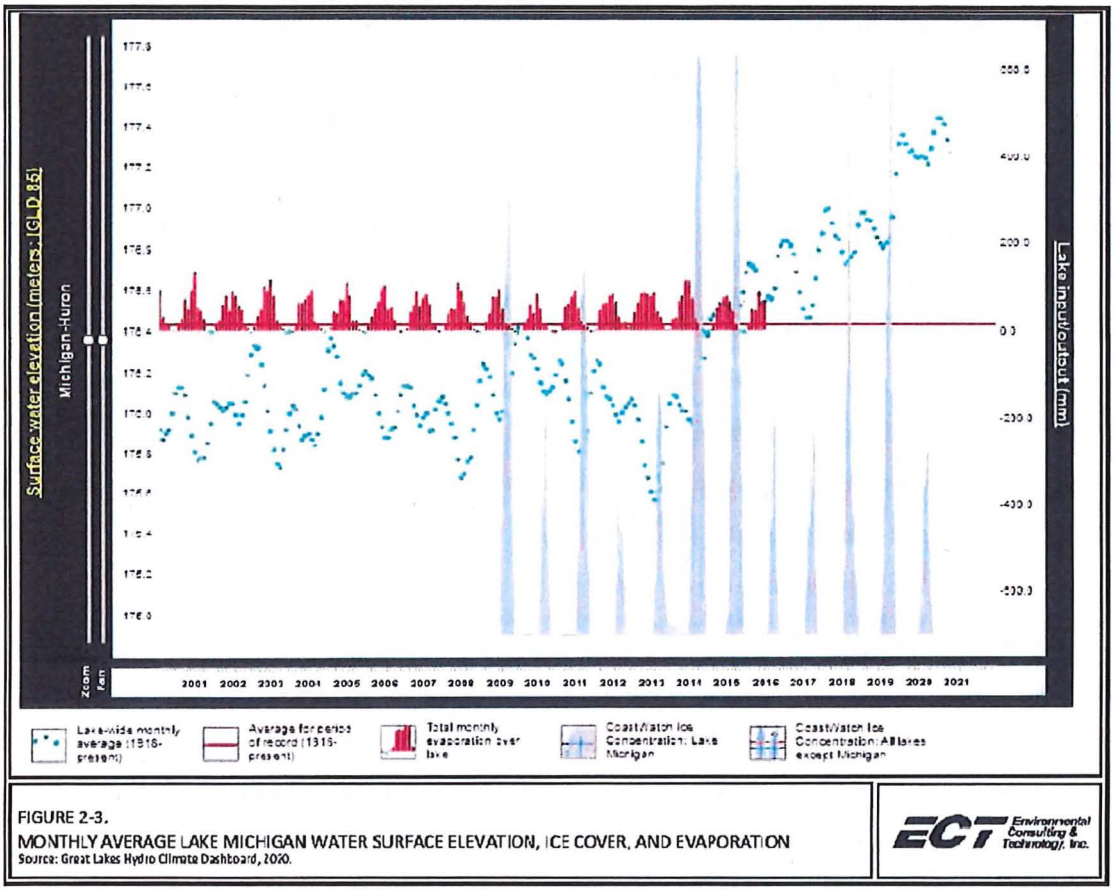


FIGURE 2-3.
MONTHLY AVERAGE LAKE MICHIGAN WATER SURFACE ELEVATION, ICE COVER, AND EVAPORATION
Source: Great Lakes Hydro Climate Dashboard, 2020.

ECT Environmental Consulting & Technology, Inc.

Figure 2-3. Monthly Average Lake Michigan Water Surface Elevation, Ice Cover, and Evaporation

ECT

2.2 Characterization of Source Waterbody

***§122.21(r)(2)(ii)** - Identification and characterization of the source waterbody's hydrological and geomorphological features, as well as the methods you used to conduct any physical studies to determine your intake's area of influence within the waterbody and the results of such studies.*

2.2.1 Hydrology

Lake Michigan is connected to Lake Huron through the 5-mile-wide, 120-foot-deep Straits of Mackinac. The water flow through the straits keeps water levels at an equilibrium and these two lakes are hydrologically considered as one lake. Major tributaries that flow into Lake Michigan include Fox-Wolf, Grand, and Kalamazoo Rivers (Canada and EPA, 1995).

Nearshore currents are highly influenced by wind with the prevailing westerly wind in the winter turning to easterly and southerly winds in the spring and summer (Beletsky *et al.*, 1999). These winds produce cyclonic circulation especially in the winter in Lake Michigan. In southern Lake Michigan, the mean winter current speed is 2.5 centimeters per second (cm/s) with a maximum of 10.3 cm/s. Mean annual current speed is 2.1 cm/s, and maximum speed is 9.1 cm/s (Beletsky and Schwab, 2008). Real-time data are available from websites maintained by the National Oceanic and Atmospheric Administration (NOAA).[11]

2.2.2 Geomorphology

The Great Lakes were formed from glacial scour as glacial ice sheets moved across the landscape. The area was covered by glacial ice at least six times since the Matuyama-Brunhes geomagnetic reversal (0.78 million years ago). The southern lowland region of the Great Lakes including Lake Michigan is underlain by sedimentary rocks of Paleozoic age, and the northern upland region is underlain by granite, gneiss, and metavolcanic and metasedimentary rocks of Precambrian age (Larson and Schaetzl, 2001). The southern region is characterized by generally low relief with broad, low morainal ridges and a few bedrock escarpments and is covered by glacial sediments, often greater than 50 meters (m) in thickness and in places over 350 m thick (Larson and Schaetzl, 2001).

[11] https://www.glerl.noaa.gov/res/glcfs/kml/glcfsmap_small.php?lake=a&param=currents&time=now
https://www.glerl.noaa.gov/res/glcfs/glcfs.php?lake=m&ext=sfcur&type=F&hr=01

2.2.3 Determination of Area of Influence

The area of influence (AOI) of a CWIS appears in three of the 40 CFR 122.21(r) sections of the 316(b) Final Rule for existing facilities:

- (2), Source Water Physical Data, requires information on "the methods used to conduct any physical studies to determine the intake's AOI in the water body and the results of such studies."
- (4), Source Water Baseline Biological Characterization Data, states, for data collection, "The study area should include, at a minimum, the AOI of the cooling water intake structure."
- (11), Benefits Valuation Study (relevant to existing facilities such as RBEC subject to the entrainment studies in the final existing facilities), states, "The study would also include discussion of recent mitigation efforts already completed and how these have affected fish abundance and ecosystem viability in the intake structure's AOI."

The Section 316(b) Phase I rule for new facilities states AOI "means that portion of the source water body hydraulically affected by the cooling water intake structure withdrawal of water."

While this definition does not provide a clear means of estimating AOI (e.g., threshold velocity), it is common understanding the AOI is that area of the source water body directly affected by the CWIS. Relative to impingeable organisms (generally juvenile and adult fish and shellfish), the concept is somewhat more concrete. It could be assumed it is the point at which the organism is no longer capable of overcoming the forces of water withdrawal and impinges upon an intake screen (Electric Power Research Institute [EPRI], 2007). This would be highly dependent on the swimming capabilities of the species and its life stage, size, and general health conditions, a point noted by EPRI in previous research on the relationship between intake approach velocity and the occurrence of impingement (EPRI, 2000).

EPA considers a 0.5 ft/s through-screen velocity to be a *de minimis* value for the probability of impingement, which means a fish can swim freely in a flow at this velocity and avoid impingement (in fact, the studies showed a 1.0 ft/s threshold was protective, but it was halved as

a safety factor). As a compliance option for impingement mortality best technology available (BTA) in the Final Rule, EPA indicates there is no need for any type of impingement protection, including impingement mortality studies, if the maximum design or actual maximum through-screen velocity of the CWIS is 0.5 ft/s or less per 40 CFR 125.94(c)(2) and (3). Under these conditions, it is considered that the facility has met the performance standards for impingement mortality. Therefore, the 0.5-ft/s contour for velocities induced by the CWIS delineates the CWIS's AOI for impingement.

A hydrodynamic study in the vicinity of the cooling water intake was conducted in 2001 by Great Lakes Water Institute (GLWI) following modifications to the intake crib which were intended to reduce impingement of alewife and cormorants (see description of intake structure in Section 3.1). Information from this study can be used to estimate the area of influence of the PBNP CWIS. The study was conducted during low lake levels (actually the lowest measured since 1965). Measurements were made from October 1 through October 4, 2001 using an acoustic current meter which measured currents in two dimensions on a horizontal plane.

Ambient currents were generally low, between 0.2 and 0.3 ft/s with the highest current speeds near the surface and decreasing with depth. This vertical gradient, along with the currents generally matching the wind direction, indicated that the AOI extends approximately 3 meters from the CWIS, with currents within 3 meters (9.8 feet) of the intake controlled by effects of the CWIS and currents beyond 3 meters controlled by local wind conditions. The maximum current speed near the surface above the rock wall of the crib was measured at 2.0 ft/s. Currents near the inner edge of the rock wall were 1.3 ft/s and near the top of the wall on the outside were 0.66 ft/s.

2.3 Locational Maps

§122.21(r)(2)(iii) *- Locational maps.*

Figures 1-1 and 1-2 provide location maps.

3.0 Cooling Water Intake Structure Data 40 CFR 122.21(r)(3)

This section provides information on the cooling water intake structure for the facility, with requirements from the Final Rule provided in italics at the beginning of each section.

3.1 Intake Configuration

§122.21(r)(3)(i) *- A narrative description of the configuration of each of your cooling water intake structures and where it is located in the waterbody and in the water column.*

The PBNP intake draws cooling water from Lake Michigan through a rock intake crib located 1,750 feet offshore at a depth of approximately 22 feet. The offshore intake crib consists of two annular rings of 12-inch steel "H" piles driven into the lakebed, with an outside diameter of 110 feet and an inside chamber diameter of 60 feet. The annulus is filled with 3- to 12-ton limestone blocks.

Water is drawn into the chamber several ways: 1) through a plastic mesh grating located on the top of the crib; 2) through the interstitial spaces between the limestone blocks; 3) through 27, 30-inch diameter, corrugated, galvanized steel pipes that penetrate the blocks in a ring 5 feet above the lakebed; and 4) through three 6.5-foot square concrete pipes near the lake bottom in the south half of the crib. The 30-inch steel pipes are covered with 3/16-inch by 2-inch galvanized bar grating to prevent debris and large fish from entering the intake system. The 6.5-foot concrete pipes are covered with a 1/4-square-inch grating that is hinged for lowering in the winter months (usually December 1 to March 1) to prevent the formation of frazil ice on the grate and the subsequent restriction of water flow. Based on the velocity measurements in the vicinity of the crib (Bootsma, 2001), it has been estimated that approximately one-half of the intake flow occurs through the crib's cap with the other half through the walls of the intake crib.

A high frequency acoustic deterrent system (ADS) surrounds the crib in a radial pattern to reduce alewife impingement. The acoustic array at PBNP consists of 16 Integrated Projector Assemblies

("IPAs") uniformly spaced around the outer circumference of the crib. The deterrent signal consists of high frequency broad band (122 – 128 kilohertz [kHz]) pulses, 0.5 second in duration, at 1-second intervals. A sound frequency of 125 kHz has been shown to be effective at deterring alewife at a cooling water intake structure located on Lake Ontario (Ross *et al.*, 1993).

Water flows from the crib through two 14-foot diameter steel pipes under the lakebed to the plant. The DIF of the cooling water circulating pumps is 1,108 MGD. Vertical bar racks (3/8-inch by 4 inches, with 2 ¼ in. spacing on center) are located in the inshore forebay. Eight standard traveling water screens (3/8-inch mesh, 11 feet wide) are located at the pumphouse. An 80-psi screen wash is used to clean the traveling screens, which discharges to the lake via an 80-foot long 24-inch pipe to the Unit 2 discharge flume.

Prior to 2001, the intake crib extended above the lake surface so that cooling water was drawn into the crib from the entire water column. This resulted in cormorants being impinged. In addition, the PBNP thermal discharge plume that floats on the lake surface would occasionally encounter the intake crib, attracting significant numbers of alewife to the thermal plume. This was deemed to result in substantial impingement numbers. To address both impingement and thermal recirculation concerns, the intake crib was cut down so that it was submerged about 11.5 feet below the lake surface. In addition to changing the configuration of the crib, the intake was outfitted at this time with the acoustic deterrent system to reduce impingement of alewife.

***§122.21(r)(3)(ii)** - Latitude and longitude in degrees, minutes, and seconds for each of your cooling water intake structures.*

The intake crib is located at approximately 44°17'0.42"N, 87°31'44.45"W, and the pumphouse is located at approximately 44°16'53.13"N, 87°32'7.09"W.

***§122.21(r)(3)(iii)** - A narrative description of the operation of each of your cooling water intake structures, including design intake flows, daily hours of operation, number of days of the year in operation and seasonal changes, if applicable.*

PBNP has two units, with each unit equipped with two cooling water circulating water pumps with a capacity of 243,000 gallons per minute (gpm) each. In addition, there are six service water pumps (three in each of the two service water bays), two screen wash pumps, and two fire water

pumps which are not included in the cooling water total. Due to suction head loss on the cooling water intake side and head loss effects on the discharge side of the pumps, the cooling water system has a combined DIF of 1,108 MGD. Daily flow monitoring data from 2015 through 2019 indicate an AIF of 925 MGD (Table 3-1).

Table 3-1. Actual Intake Flows at PBNP (MGD)

2015	2016	2017	2018	2019	Average
954.2	943.6	906.0	906.5	914.9	925.1

The four circulating water pumps are typically operated during normal summertime generation to maintain maximum thermal efficiency, while during the winter (typically mid-December through March) only one pump per unit typically operates. The plant operates 24 hours/day, 365 days a year with no significant seasonal changes in operation.

3.2 Intake Flow and Water Balance

***§122.21(r)(3)(iv)** - A flow distribution and water balance diagram that includes all sources of water to the facility, recirculating flows, and discharges.*

A water use diagram for the PBNP is provided in Figure 3-1.

3.3 Engineering Drawings of Intake

***§122.21(r)(3)(v)** - Engineering drawings of the cooling water intake structure*

Drawings of the CWIS are provided in Figures 3-2 through 3-6.

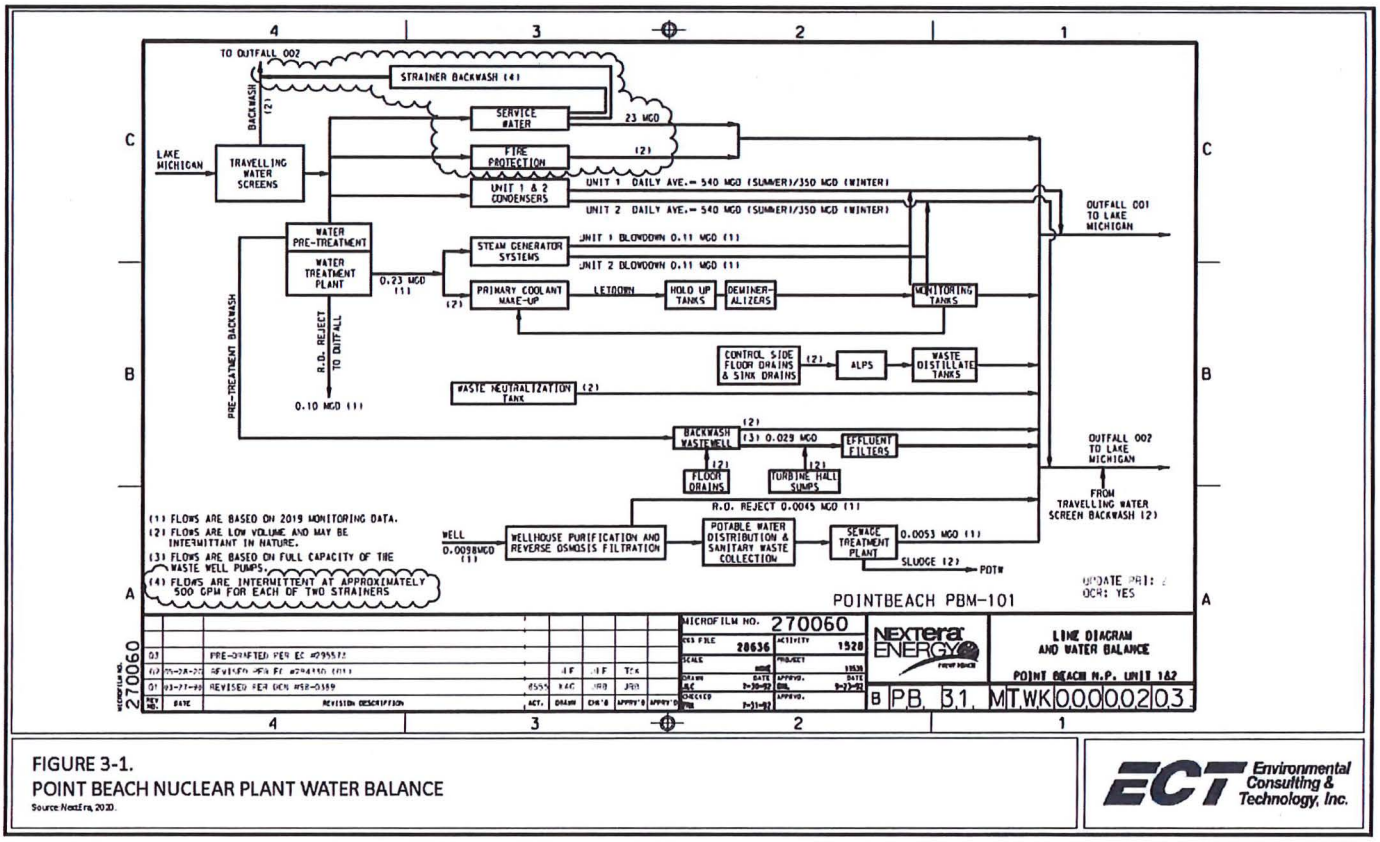


FIGURE 3-1.
POINT BEACH NUCLEAR PLANT WATER BALANCE
Source: NextEra, 2020.

ECT Environmental Consulting & Technology, Inc.

Figure 3-1. Point Beach Nuclear Plant Water Balance

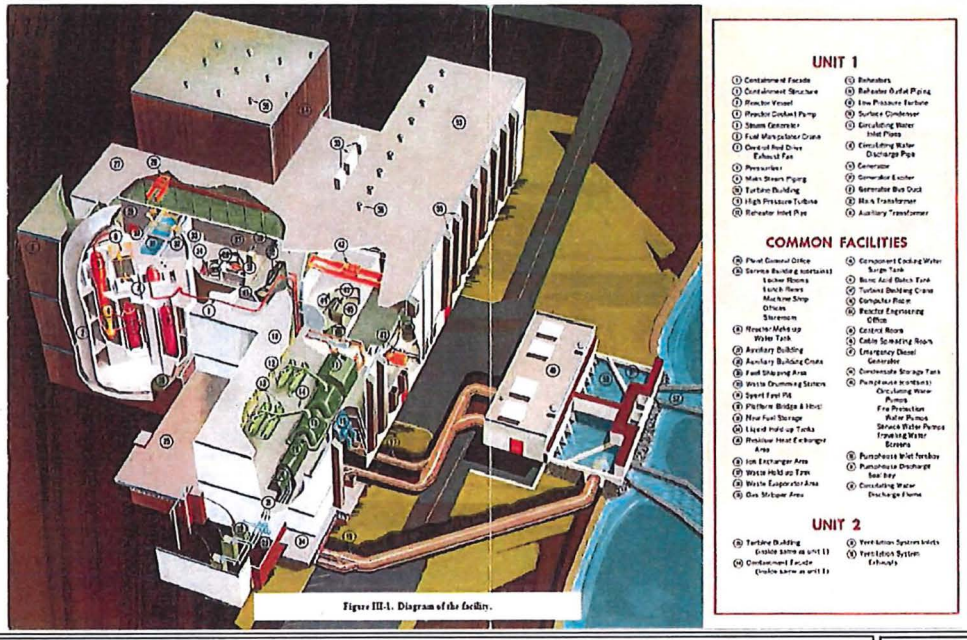


FIGURE 3-2.
POINT BEACH NUCLEAR PLANT LAYOUT
Source: §316(b) REPORT, AKSF 2007.

ECT Environmental Consulting & Technology, Inc.

Figure 3-2. Point Beach Nuclear Plant Layout

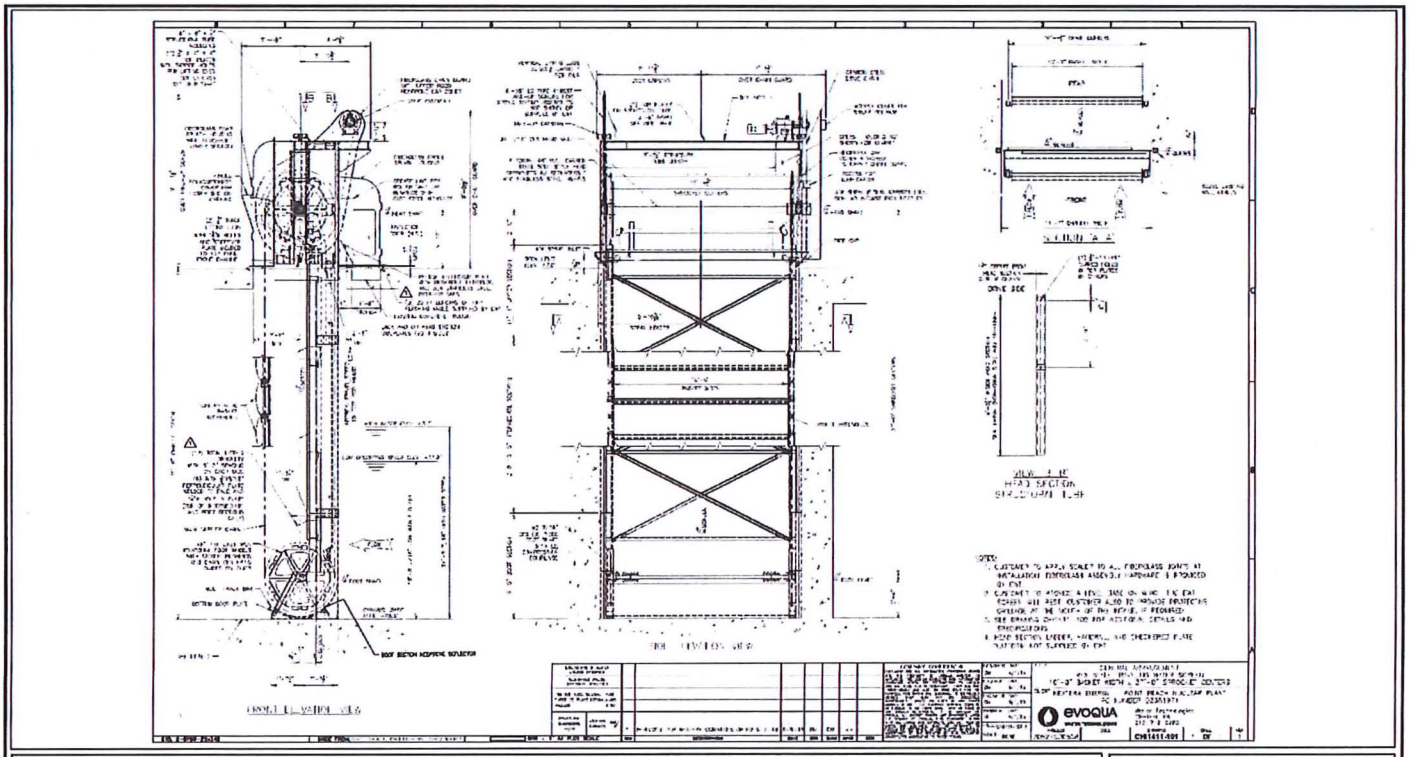


FIGURE 3-3.
POINT BEACH NUCLEAR PLANT TRAVELING SCREEN DETAIL
Source: NextEra, 2018.

ECT Environmental Consulting & Technology, Inc.

Figure 3-3. Point Beach Nuclear Plant Traveling Screen Detail

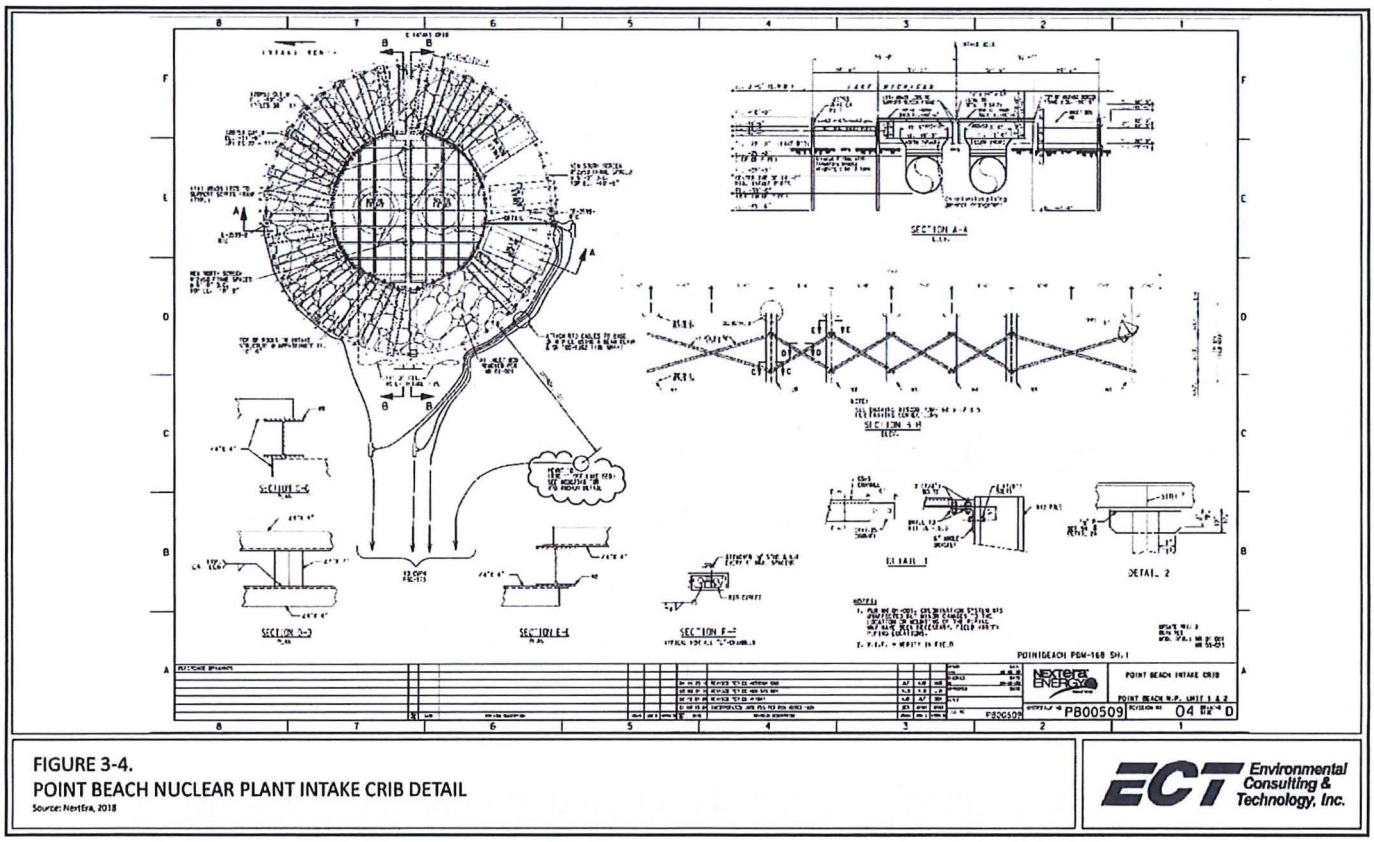


FIGURE 3-4.
POINT BEACH NUCLEAR PLANT INTAKE CRIB DETAIL
Source: NextEra, 2018

ECT Environmental Consulting & Technology, Inc.

Figure 3-4. Point Beach Nuclear Plant Intake Crib Detail

4.0 Source Water Baseline Biological Characterization Data 40 CFR 122.21(r)(4)

This section characterizes the biological community in the vicinity of the CWIS at PBNP and addresses each of the information requirements under 40 CFR 122.21(r)(4). The following subsections are numbered and titled consistent with the subsections of 40 CFR 122.21(r)(4). The discussion of threatened and endangered (T&E) species as required by 40 CFR 122.21(r)(4)(vi) has been modified to also address the requirements to list both state- and federally listed species and designated critical habitat per 40 CFR 125.95(f).

4.1 List of Unavailable Biological Data

§122.21(r)(4)(i) *- A list of the data in paragraphs (r)(4)(ii) through (vi) of this section that are not available and efforts made to identify sources of the data;*

The data needed to prepare the elements of the requirements of 40 CFR 122.21(r)(4) were available from the literature and prior studies performed at the site.

4.2 List of Species and Relative Abundance in the Vicinity of CWIS

§122.21(r)(4)(ii) *- A list of species (or relevant taxa) for all life stages and their relative abundance in the vicinity of the cooling water intake structure;*

Several studies were reviewed when compiling the list of species and relative abundance in the vicinity of the CWIS:

- Peer reviewed literature
- U.S. Geological Survey (USGS) trawl surveys of Lake Michigan
- WDNR Angler Survey Data
- National Marine Fisheries Service (NOAA Fisheries) Commercial Landings data

- Previous impingement and entrainment studies at PBNP.

4.2.1 Review of Lake Michigan Fisheries from the Literature

This section provides a summary of key papers on the fishery of Lake Michigan from the peer-reviewed literature. The Lake Michigan fishery has been affected by both management for game fish (e.g., stocking of both game fish and stocking/protecting their prey species) and the more recent proliferation of non-native fish (e.g., alewife, round goby, sea lamprey) and shellfish (i.e., dreissenid mussels). For this reason, populations of some species have experienced significant increases and/or decreases over the last several years. Some of the key trends documented in recent reports for ongoing surveys are summarized below with a focus on trends in species that have historically dominated impingement and entrainment at PBNP (e.g., alewife).

The following is a set of key excerpts from the 2018 status and trends in forage fish of Lake Michigan which is based on the USGS's annual survey of the fishery (USGS, 2019):

> *In 2018, total prey fish biomass was estimated to be 6.22 kg/ha, which is a 65% increase over 2017 and a five-fold increase over the record-low estimate from 2015. Every species was estimated to attain a higher biomass density in 2018 than in 2017, with round goby providing the largest percentage increase. Relative to the long-term average of 36.9 kg/ha, however, the 2018 estimate indicates relatively low biomass densities of prey fish in Lake Michigan. This low level of prey fish biomass can be attributable to a suite of factors, two of which can be clearly identified: (1) a prolonged period of poor bloater recruitment during 1992- 2015 and (2) intensified predation on alewives by salmonines during the 2000s and 2010s. Adult alewife density has been maintained at a relatively low level over the last 15 years and the age distribution of the adult alewife population has become especially truncated in recent years. As recent as 2007, alewives as old as age 9 were sampled in this survey, whereas the oldest alewife sampled since 2013 has been age 6 or younger, with age 5 being the oldest in 2013, 2014, 2017, and 2018. In addition to the importance of top-down forces, prey fishes also may be negatively influenced by reduced prey resources (i.e., "bottom-up" effects). For example, several data sets are indicating a reduction in the base of the food web, particularly for offshore total phosphorus and phytoplankton, as a consequence of long-term declines in phosphorus*

inputs and the proliferation of dreissenid mussels. Grazing of phytoplankton by dreissenid mussels and reduced availability of phosphorus in offshore waters appeared to be the primary drivers of the 35% decline in primary production in offshore waters between the 1983-1987 and 2007-2011 periods. The quagga mussel expansion into deeper waters may have been partly responsible for this reduced availability of phosphorus in offshore waters. The evidence for declines in "fish food" (e.g., zooplankton and benthic invertebrates) in offshore waters of Lake Michigan is somewhat less clear. Diporeia has undoubtedly declined in abundance, but whether or not crustacean zooplankton and mysids have declined depends on which data set is examined. Crustacean zooplankton biomass density in nearshore waters appeared to decrease during 1998-2010, likely due to a reduction in primary production mainly stemming from grazing of phytoplankton by dreissenid mussels. The above-mentioned decline in Diporeia abundance appeared to have led to reductions in growth, condition, and/or energy density of lake whitefish, alewives, bloaters, and deepwater sculpins during the 1990s and 2000s. Of course, decreases in growth, condition, and energy density do not necessarily cause declines in fish abundance. The challenge remains to quantify bottom-up effects on prey fish abundances and biomasses in Lake Michigan. Given the complexities of the food web, disentangling the effects of the dreissenid mussel invasions and the reduction in nutrient loadings from other factors influencing the Lake Michigan food web will require a substantial amount of ecological detective work.

The following is a set of important excerpts from the Warner *et al.*'s (2015) 2014 status and trends of pelagic prey fish:

Prey fish biomass in Lake Michigan remains at levels much lower than in the 1990s, and the estimate of total lakewide biomass (31.7 kt) from acoustic sampling was the second lowest in the time series. This is in contrast to 2008-2010, when biomass was relatively high (but still lower than in the 1990s). The recent decline resulted primarily from decreased alewife biomass. Because of predation by salmonines and a weak 2014 alewife year-class, it seems likely that biomass of alewife will be lower in 2015 than in 2014. Despite this, alewife were the dominant component of pelagic prey fish biomass in 2014. The large difference between prey fish biomass in the 1990s and the 2000s resulted

primarily from a decrease in large bloater abundance, but alewife and rainbow smelt declined as well. Bloater densities showed an increasing trend 2001-2009, driven primarily by increases in small bloater. It is not clear what led to the drastic decline in bloater abundance from the 1980s to present. Recent stock-recruit modeling for bloater in Lakes Michigan and Huron indicated that bloater sex ratio and alewife abundance were related to recruitment (Collingsworth et al., 2014). It is also possible that predation on small bloater by salmonines could be an important limit to recruitment at times (see Warner et al., 2008) as these small fish are found in the same location as alewife and at times can be important to some predators (Elliott, 1993; Rybicki and Clapp, 1996; Warner et al., 2008).

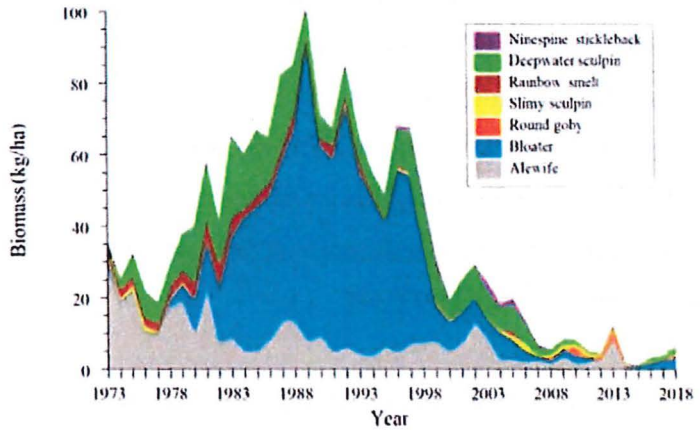
The trends referenced in these excerpts are apparent in Figure 4-1, which has been adopted from USGS, 2020. From the above excerpts and Figure 4-1, some conclusions relevant to assessing impingement and entrainment data at PBNP are apparent:

- Alewife populations have been greatly reduced from historic highs in the lake. Alewife populations were relatively low throughout the 1990's and 2000's, including during the Phase II study (2006) when alewife dominated both entrainment and impingement at PBNP. Biomass densities in 2015 trawl data set a record low. For example, at the Port Washington, WI location, no alewife were captured in 2016 and only low numbers in 2017 through 2019. Alewife were collected at the Sturgeon Bay, WI site, albeit in low numbers compared to historical numbers. Despite these declines, they remain an important component of the forage base in Lake Michigan.
- Round goby populations have increased to a point where they contribute substantially to lake-wide estimates of the forage biomass since 2008.
- Deepwater sculpin have been a dominant component of the forage base and were so during the Phase II study at PBNP. Despite their lake-wide importance, deepwater sculpin were not an important contributor to impingement or entrainment in 2005 to 2006 and were not entrained in 2017. Deepwater sculpin populations have declined in recent years, since 2006.
- Bloater populations have been greatly reduced for many years, since the late 1990s, and remain at low levels. Their numbers have declined substantially from 1992 to the present.

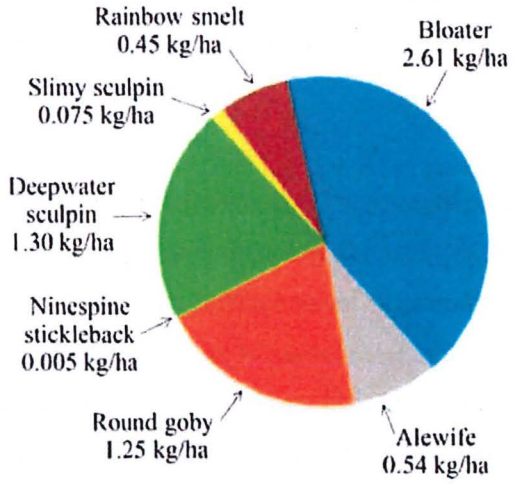
Bloater were not found in impingement in 2005 to 2006, they did not contribute substantially to entrainment in 2006 and were not entrained in 2017.

Figure 4-1. Estimated Lake-Wide Biomass of Prey Fishes in Lake Michigan, 1973-2018 (a) and Species Composition in 2018 (b)

a.) Lake-wide biomass density (in kg/ha) in Lake Michigan estimated from bottom trawl survey, 1973-2018



b.) Lake-wide biomass density (in kg/ha) in Lake Michigan in 2018



USGS, 2020.

- Rainbow smelt numbers have also declined lake-wide since about 1998. Populations were at relatively low levels during the Phase II entrainment study at PBNP and remained so in

2017. During both entrainment sampling events, rainbow smelt were the dominant taxa entrained at PBNP and were the second most impinged in 2005 to 2006.

In summary, key components of the forage base have been in decline since before the 2005 to 2006 Phase II impingement and entrainment study through the 2017 study. These taxa include rainbow smelt and alewife, which have dominated impingement and entrainment at PBNP in 2005 to 2006 and entrainment in 2017. While lake-wide alewife and rainbow smelt population estimates are unlikely to be a perfect predictor for impingement or entrainment, it is reasonable to expect that impingement and entrainment rates will be reduced given the reduced adult populations. It is also reasonable to expect that round goby, which were not present in the 2007 impingement data and comprised 7 percent of the entrainment rates in 2017, may become a common component of impingement and entrainment at intakes located on Lake Michigan. They are listed as a nuisance species in NR 111.03(34).

Finally, this general review focused on literature that attempts to synthesize lakewide fisheries trends. This literature is quite reasonably focused on the forage base as it affects game and commercial fish stocks. While impingement and entrainment at PBNP has included several forage species including rainbow smelt and alewife, it has also included species that are not evaluated by the USGS effort (e.g., common carp, suckers, and Coregoninae [whitefish]). The following sections consider temporal trends in these species based on other available data.

4.2.2 Survey Data

Multiple data sources were used to determine the temporal changes in important species that might be subject to impingement and entrainment, including data from both Lake Michigan as a whole and the subsection of the lake that is located near the facility. These data sources included the USGS long-term benthic trawl data, summaries of the NOAA Fisheries commercial landings, and a WDNR survey report. In general, annual variation is a common occurrence for all datasets. Another apparent hallmark for many of the data is declining forage populations as illustrated by a variety of metrics (abundance, catch per unit effort [CPUE], catch in pounds, etc.). Populations and catch rates of game fish appear to be more stable. The following sections outline the trends observed in each data set and provides inferences for all datasets combined.

When working with multiple datasets from different sources that cover long temporal spans, it is difficult to have fully standardized and consistent methods between those datasets. This makes determining trends a challenging task. Therefore, the following sections take into account that generally each data set is not directly comparable to the others based on each survey's collection methods. However, the datasets are comparable to themselves. Conclusions drawn from each source take into account these discrepancies, but trends can still be deduced. As such, all datasets attempted to use time series analyses based on a standardized parameter (e.g., CPUE, biomass, net catch tonnage) relative to the type of data collected.

4.2.2.1 USGS Trawls of Lake Michigan

Starting in the fall of 1973, the USGS Great Lakes Science Center (GLSC) has conducted yearly trawls of the fish community in Lake Michigan. Transects consist of standard 12-m bottom trawls towed along contours at depths of 9 to 110 m at seven index transects across Lake Michigan. Waters of Lake Michigan that were within Wisconsin jurisdiction had two transects included in the dataset, which were located north and south of PBNP (Figure 4-2). Catch data (#/hectare[ha]) at each index transect from 1973-2019 were obtained from the USGS GLSC and used for analyses. Catch densities and biomass are reported for twelve species, two of which (alewife and rainbow smelt) are among commonly impinged and entrained species. The balance of the species are indicators of the overall status of the Lake Michigan fishery.

For the purposes of this report, only the two Wisconsin transects (Port Washington and Sturgeon Bay) were used in the time-series analysis (Figure 4-2). While the data are reported herein both separately and as a single dataset, comparisons using the combined dataset based on the data between the two sites showing similar trends, despite inter-annual variations. Comparisons to the lake-wide estimates (which include all transects) using the entire data set have also been made and generally follow similar trends.

While time series analyses were used to visualize the long-term trends (#/ha per year; Figure 4-3), a rank order analysis was conducted to show how densities may have changed during each of the impingement and entrainment sampling years (2006 and 2017; see Table 4-1). This was used as a potential estimator of how impingement and entrainment rates might change at the facility, based on catch densities as a surrogate of population size.

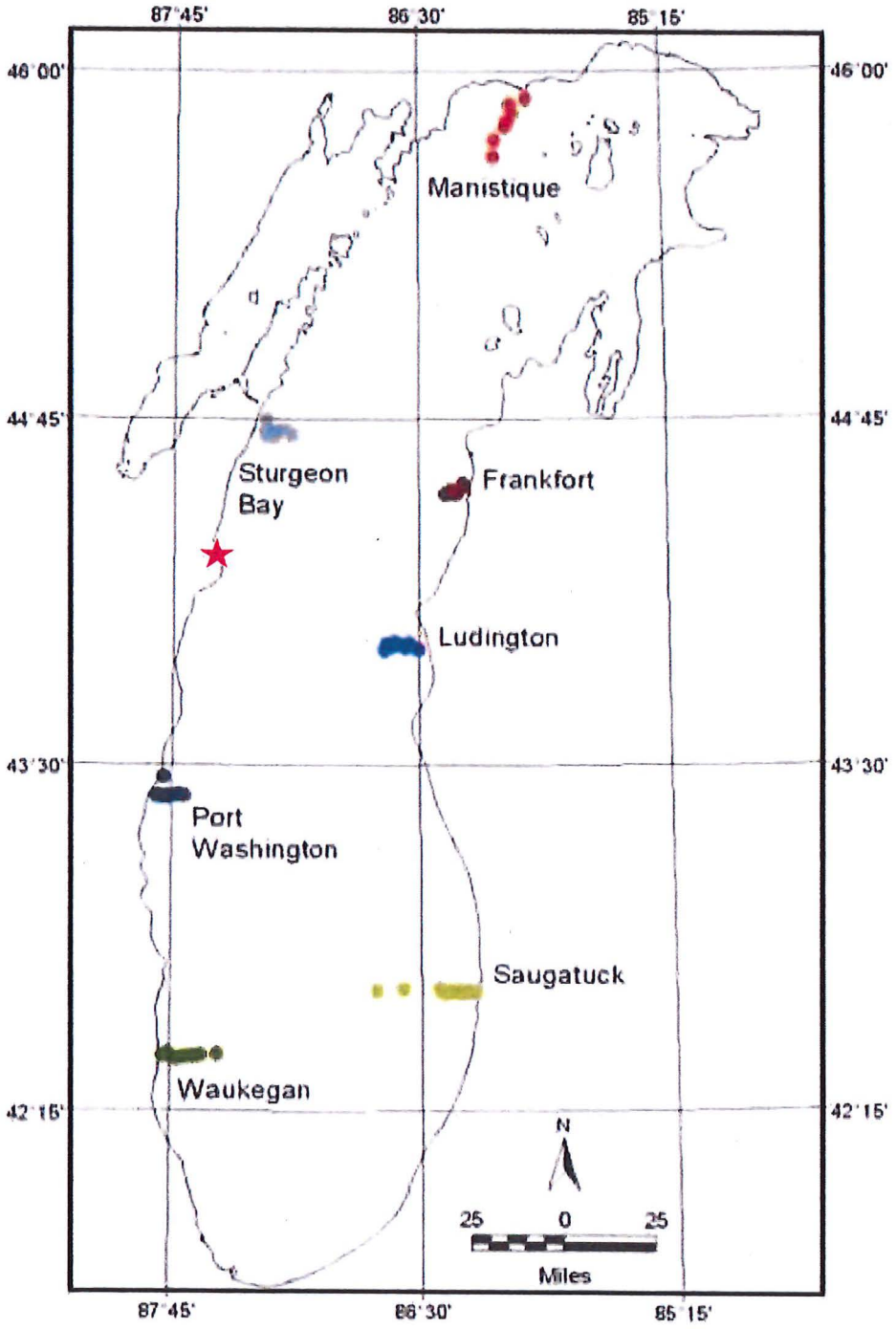


Figure 4-2. Locations of the USGS bottom trawls.

Source: Bunnell *et al.*, 2017

Table 4-1. Ranking of Key Species Surveyed by the USGS near PBNP During 2005 to 2006 and 2017 Entrainment Survey Periods

Port Washington, WI									
Species	2006			2017			Average		
	No./hectare	%	Rank	No./hectare	%	Rank	No./hectare	%	Rank
Deepwater sculpin	5,321.94	47.94%	1	608.14	14.99%	1	2,965.04	33.92%	1
Ninespine stickleback	2,132.85	19.21%	2	1.66	0.02%	6	1,067.26	11.05%	2
Slimy sculpin	1,645.32	14.82%	3	57.28	10.08%	3	851.30	12.80%	3
Rainbow smelt	1,321.98	11.91%	4	3.20	0%	5	662.59	6.84%	4
Alewife	436.14	3.93%	5	1.47	0%	7	218.81	2.26%	5
Bloater	223.40	2.01%	6	164.65	74.83%	2	194.03	33.00%	6
Yellow perch	9.23	0.08%	7	0.00	0%	10	4.62	0.05%	7
Lake trout	4.34	0.04%	8	0.00	0%	10	2.17	0.02%	8
Burbot	3.63	0.03%	9	0.00	0.02%	10	1.82	0.03%	9
Round goby	0.00		11.5	3.32	0.05%	4	1.66	0.02%	10
Lake whitefish	2.55	0.02%	10	0.00	0%	10	1.28	0.01%	11
Threespine stickleback	0.00	0%	11.5	0.00	0%	10	0.00	0.00%	12
Total	11,101.38			8,225.31			5,970.55		
Sturgeon Bay, WI									
Species	2006			2017			Average		
	No./hectare	%	Rank	No./hectare	%	Rank	No./hectare	%	Rank
Ninespine stickleback	30,353.72	82.85%	1	3.11	0.04%	7	15,178.42	72.92%	1
Slimy sculpin	3,340.05	9.12%	2	209.28	21.90%	3	1,774.67	10.65%	2
Rainbow smelt	1,347.37	3.68%	3	816.36	9.85%	2	1,081.87	4.42%	3
Deepwater sculpin	385.88	1.05%	5	1,000.84	18.49%	1	693.36	3.14%	4
Alewife	1,108.14	3.02%	4	23.93	2.61%	6	566.04	2.98%	5
Bloater	40.01	0.11%	6	189.60	12.09%	4	114.81	1.55%	6
Round goby	19.02	0.05%	8	163.51	34.98%	5	91.27	4.24%	7
Yellow perch	26.10	0.07%	7	0.00	0%	11	13.05	0.06%	8
Lake whitefish	9.49	0.03%	9	0.00	0%	11	4.75	0.02%	9
Lake trout	3.45	0.01%	10	1.56	0.04%	8	2.51	0.01%	10
Burbot	1.54	0.00%	11	1.54	0%	9	1.54	0.00%	11
Threespine stickleback	0.00	0%	12	0.00	0%	11	0.00	0.00%	12
Total	36,634.77			4,991.96			19,522.25		
Port Washington and Sturgeon Bay, Averaged									
Species	2006			2017			Total Average		
	No./hectare	%	Rank	No./hectare	%	Rank	No./hectare	%	Rank
Ninespine stickleback	16,243.29	68.05%	1	2.39	0.15%	7	9,071.73	71.17%	1
Deepwater sculpin	2,853.91	11.96%	2	804.49	49.52%	1	1,420.96	11.15%	2
Bloater	131.71	0.55%	6	177.13	10.90%	3	966.58	7.58%	3
Slimy sculpin	2,492.69	10.44%	3	133.28	8.20%	4	677.98	5.32%	4
Rainbow smelt	1,334.68	5.59%	4	409.78	25.22%	2	392.42	3.08%	5
Round goby	9.51	0.04%	8	83.42	5.13%	5	154.42	1.21%	6
Alewife	772.14	3.24%	5	12.70	0.78%	6	47.94	0.38%	7
Yellow perch	17.67	0.07%	7	0.00	0.00%	11	7.61	0.06%	8
Lake whitefish	6.02	0.03%	9	0.00	0.00%	11	3.28	0.03%	9
Lake trout	3.90	0.02%	10	0.78	0.05%	8	2.08	0.02%	10
Burbot	2.59	0.01%	11	0.77	0.05%	9	1.41	0.01%	11
Threespine stickleback	0.00	0.00%	12	0.00	0.00%	11	0.00	0.00%	12
Total	23,868.08			1,624.73			12,746.40		

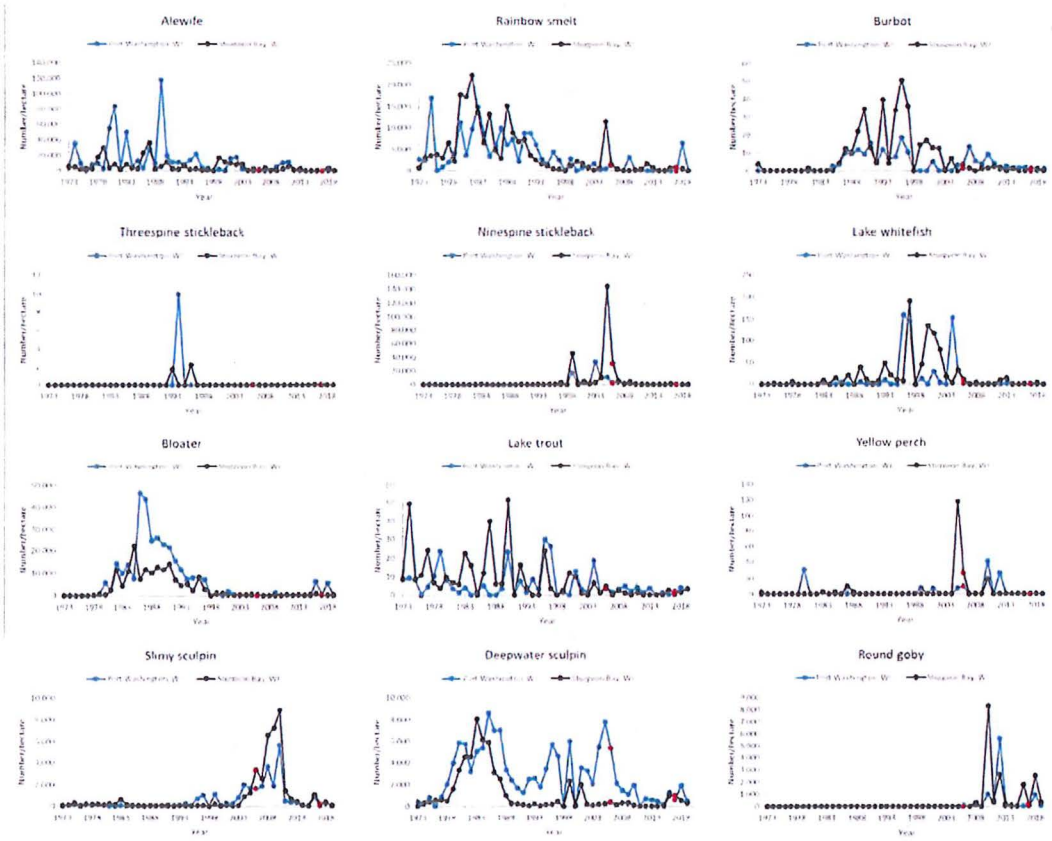


Figure 4-3. Numerical Densities of 12 Fish Species in the Vicinity of PBNP, 1973-2019

Note: Red symbols are those years included in Table 4-1.

4.2.2.2 Summary of Trends

Two species that are dominant components of Phase II and 2017 entrainment at PBNP are included in the USGS trawl data: rainbow smelt and alewife. Both species have shown variable but declining population densities near PBNP over the period of record (see Figure 4-3). In both 2006 and 2017, rainbow smelt and alewife densities were low compared to historical values at both USGS trawl sampling sites. Densities for all fish species captured in the USGS trawls largely unchanged between 2006 and 2017, with the exception of slimy sculpin and deepwater sculpin, both of which were more common in 2006. Bloater were not present in the impingement or entrainment data for either year; round goby were present in the 2017 entrainment data but had only a minor contribution to impingement, consistent with their recent introduction to the lake.

Despite near record low levels of prey fish biomass in USGS trawl data, rainbow smelt and alewife densities at the combined Port Washington and Sturgeon Bay collection sites comprised a similar proportion of the total trawl catch data between 2006 and 2017. For example, in 2006 rainbow smelt had a ranked score of 4 in the combined data set, and a rank score of 2 in 2017. Alewife dropped in rank between the two entrainment study years (5 to 6 in the averaged data sets from the two trawl locations). While rainbow smelt biomass has declined since the mid-1990s, their mean biomass was the highest at the two northern-most trawl sampling sites, which includes Sturgeon Bay (Bunnell *et al.*, 2017). The presence of these two species in the entrainment data despite their relatively low numbers in the trawl data is likely due to their habit of broadcast spawning nearshore and their planktonic larvae.

The three most abundant species in the combined trawl data for Port Washington and Sturgeon Bay were ninespine stickleback, deepwater sculpin, and bloater (Table 4-1). Ninespine stickleback saw an increase in abundances in the late 1990's to mid-2000's but quickly declined thereafter (Figure 4-3), potentially a result of increased predation (Bunnell *et al.*, 2017). Deepwater sculpin are not expected to be impacted by intake operations due to the lack of appropriate habitat for the species near the intake.

Burbot were shown to represent a larger proportion of the entrainment samples in 2017 compared to the Phase II data (i.e., a nearly 10-fold increase – see below). This increase is not

apparent in the USGS trawl data. However, the USGS trawl surveys are mostly selective to adult burbot and exclude juveniles, so it is unlikely the trawl data are indicative of the earlier life stage densities. While the decline in burbot in Lake Michigan since the 1950's has been attributed to predation by sea lamprey, it has been proposed that the reduction in alewife abundance could be a precursor for the recovery of burbot (Eshenroder and Burnham-Curtis, 1999).

While round goby abundance appears to be increasing dramatically beginning in 2011, its abundance has been variable in recent years with a sharp decline from 2013 to 2015, increase to 2018 and decrease to 2019 (Figure 4-3). Despite these recent increases and the ensuing sharp declines, round goby are being consumed in larger numbers by predators (e.g., Coho salmon, yellow perch, walleye), and have even become a larger constituent in lake trout, burbot, lake whitefish, smallmouth bass, and yellow perch diets (Bunnell *et al.*, 2017). This increased predatory pressure may explain the decline between 2013 through 2015, but round goby now represents an important part of the forage base.

The Sturgeon Bay trawl site also had the third highest densities of round goby compared to the rest of the USGS trawl sampling sites. However, round goby are likely underestimated in the trawl surveys due to round goby's preferred habitats (rocky, inshore areas) not being sampled by the trawls.

In summary, based on the USGS survey data, rainbow smelt and alewife are expected to continue to dominate impingement and entrainment at PBNP albeit at rates that are lower than historical ones. Round goby are likely to continue to be present in the impingement and entrainment data. It is unclear as to whether burbot will remain a dominant species in entrainment or will be subject to inter-annual variations in entrainment rates. The absence of other species in the 2017 data that were captured during the Phase II study is not necessarily indicative they are absent from the waterbody. It is more likely they are in low abundances near the intake and are, therefore, entrained episodically and at low rates.

4.2.3 Angler Survey Data by Wisconsin Department of Natural Resources

WDNR provides an annual review of Lake Michigan game fish (e.g., WDNR, 2019) which is focused on fish that are harvested commercially and recreationally. For example, Table 4-2

indicates that the harvest of salmonids has been variable but without a substantial trend since 2003. The commercial harvest of whitefish has also remained relatively stable over the last several years (see Figure 4-4). While the data reported by WDNR suggest that the commercial and recreational fisheries are relatively stable, few of these fish are affected by entrainment at PBNP.

4.2.4 NMFS Commercial Landings

4.2.4.1 Background and Methods

Great Lakes commercial fishery landings data are provided through NOAA Fisheries, courtesy of the USGS GLSC[12] (hereafter referred to as NOAA Fisheries data). These data report the round (live) weight of all landed finfish captured by U.S. commercial anglers (excluding Canadian commercial landings). These Great Lakes data include finfish that were landed but not sold and may differ from data reported in NOAA Fisheries annual, monthly and gear web query programs which usually do not report finfish landings unless they are sold. For the purposes of this report, only landing data reported as caught under Wisconsin jurisdiction are included, not lake-wide catch data.

The dataset consists of, among other species, a number of the most commonly entrained species at PBNP: alewife, burbot, and rainbow smelt. Together these three species represented 84% of the estimated entrainment at PBNP for the Phase II and 2017 studies, combined (87% in 2006 and 80% in 2017).

The commercial landings data are only an indirect measure of fish populations in the lake. Importantly, the commercial landings are not normalized to the level of effort expended to make the landings. Despite this, it is reasonable to conclude that landings are directly, if imperfectly, related to fish stocks, and can be used as an approximation of population trends in the lake.

[12] http://www.st.nmfs.noaa.gov/commercial-fisheries/commercial-landings/other-specialized-programs/great-lakes-landings/index

Table 4-2. Total Number of Fish Harvested by Year by Species Across All Angler Groups in Wisconsin Waters of Lake Michigan 2003-2018

Species	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total (Since 1986)
Brook Trout	126	1	18	17	62	13	27	0	26	18	0	0	0	0	0	0	39,040
Brown Trout	23,654	20,918	27,489	17,769	37,947	23,763	15,792	13,029	9,936	21,337	17,094	23,324	20,174	23,879	20,398	12,529	1,165,557
Rainbow Trout	48,548	25,529	48,490	48,420	62,249	41,552	46,529	49,121	75,442	75,981	58,311	73,105	59,106	76,846	66,441	57,095	2,265,735
Chinook Salmon	317,619	360,991	418,918	398,905	431,143	256,796	214,621	315,294	169,752	390,385	145,301	130,698	113,973	139,082	83,873	84,142	7,005,617
Coho Salmon	50,625	76,944	59,244	56,136	94,677	25,453	42,690	42,445	157,367	73,395	89,061	52,297	41,010	125,964	119,686	85,411	2,699,587
Lake Trout	23,881	14,209	14,139	10,638	19,281	12,763	14,946	17,483	17,788	29,094	27,240	25,425	35,715	19,137	20,345	26,747	1,450,068
TOTAL	464,453	498,592	568,298	531,885	645,359	360,340	334,605	437,372	430,311	590,210	337,007	304,849	269,978	384,908	310,743	265,924	14,625,604
Harvest Per Hour	0.1719	0.1904	0.2036	0.1916	0.2108	0.1443	0.1171	0.1539	0.1693	0.2337	0.1213	0.1163	0.099	0.1464	0.1222	0.1086	0.1432

Source: WDNR, 2019.

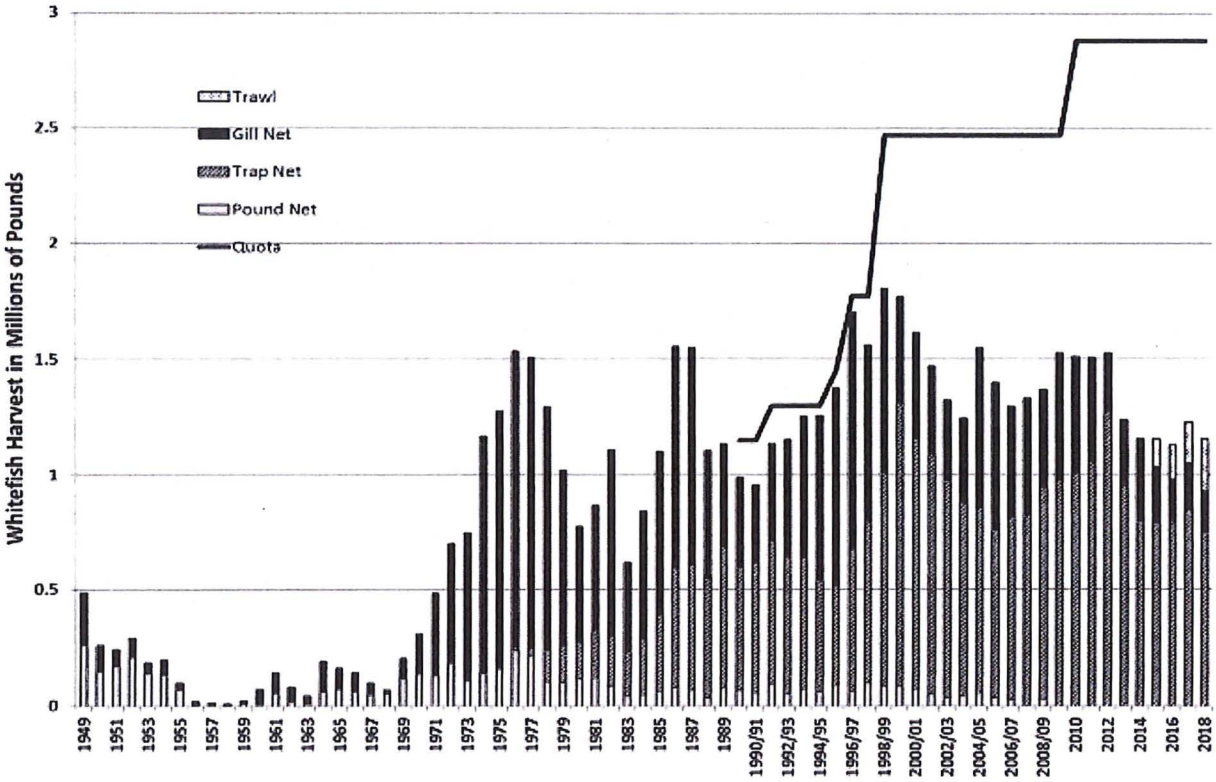


Figure 4-4. Lake whitefish reported commercial harvest by gear in pounds dressed weight from Wisconsin waters of Lake Michigan (1949 to 2018)

Source: WDNR, 2019.

Fish landings in Wisconsin for eight important Lake Michigan species are presented in Figure 4-5. Data coinciding with the 2006 Phase II study and the 2017 entrainment sampling at PBNP are indicated in red symbols on the figures.

4.2.4.2 Findings

With the exception of lake trout, burbot, lake whitefish, yellow perch, and lake herring, reported live weights of all landed finfish have generally trended downward since the early 2000's (Figure 4-5). While a few species had incomplete datasets (gizzard shad and freshwater drum), data are available for those species for a number of years since the Phase II study characterization and all of the measurements during that period are consistently low.

The three commonly entrained species at PBNP (Alewife, Burbot, and Rainbow Smelt), and the two most commonly impinged species (Alewife and Rainbow Smelt), have experienced historical declines in commercial landings in the last several years:

- Alewife: Commercial landings fell sharply from 2005 to 2011 and rebounded in 2012. However, live weights fell in 2013 and have remained low. Since the Phase II entrainment program, commercial landings of alewife have been a small fraction of historical highs.
- Burbot: Commercial landings of burbot have remained relatively consistent between the Phase II study and 2017 studies, with an overall slight decline with the exception of a peak in 2013.
- Rainbow smelt: Landings of this species have decreased substantially since 2006 and are likely a reflection of the longer-term declines in several populations. These trends mimic those seen in the USGS survey data shown in Table 4-1.

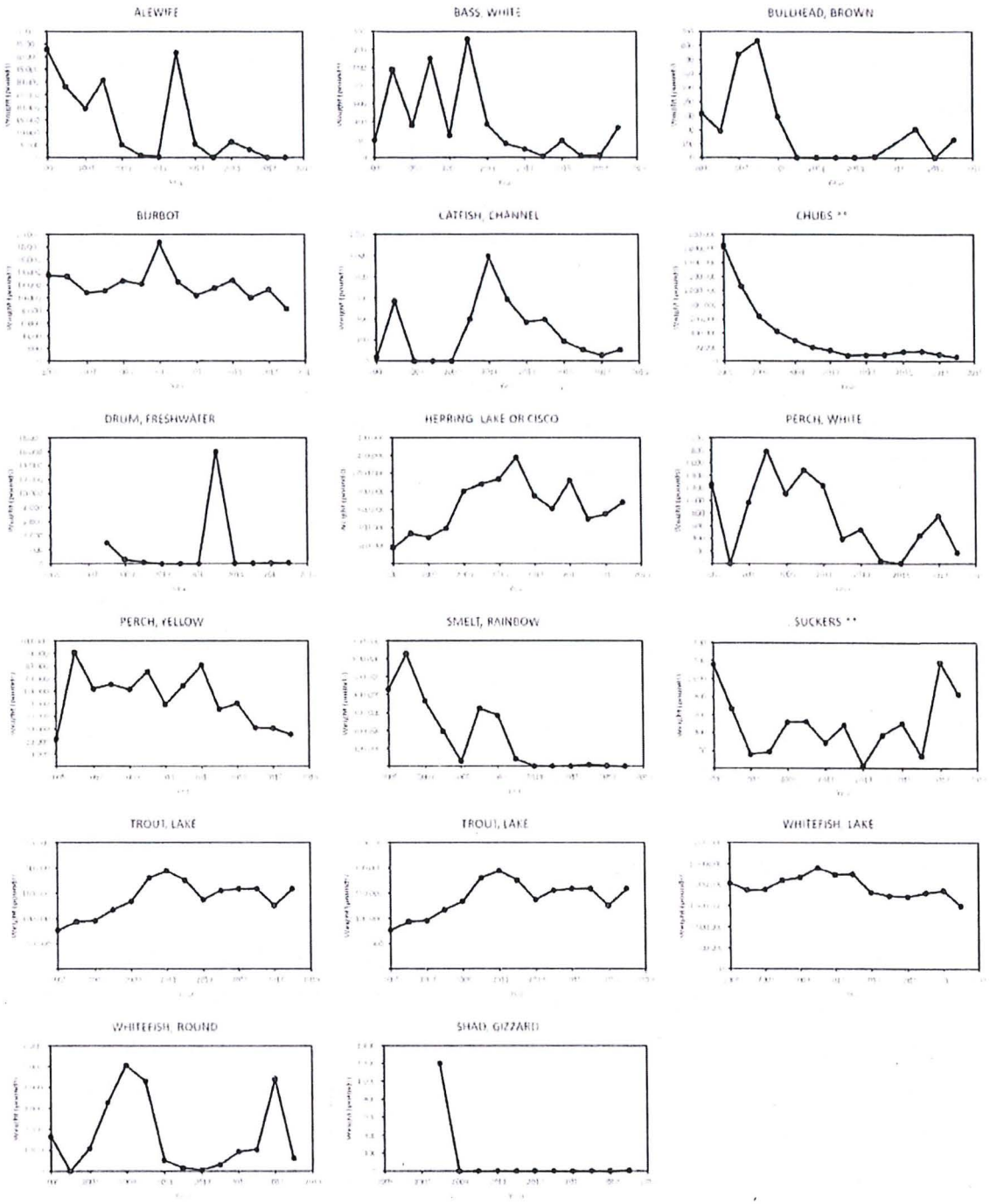


Figure 4-5. Commercial Landings from Lake Michigan for Seventeen Fish Species (2005-2018)

Source: NMFS, 2020.

Alewife, Burbot, and Rainbow Smelt comprised 84% of entrained organisms at PBNP for both entrainment studies combined, while Alewife and Rainbow Smelt comprised 99.7 percent of impingement. Since the Phase II study, the commercial landings would suggest that the fish stocks (and likely impingement and entrainment rates) are largely unchanged (e.g., burbot) or reduced (e.g., alewife and rainbow smelt). The trends for alewife and rainbow smelt landings are confirmed by the USGS survey record in which lake-wide populations have declined over the last two to three decades.

4.2.5 Impingement and Entrainment Studies at PBNP

Studies were conducted from March 1975 through February 1976 to evaluate the impacts of the CWIS (WEPCO, 1976). In 88 impingement sampling events, 256,644 alewife were collected, 84.8 percent of the total fish impingement.

Impingement studies were conducted from December 2005 through November 2006 (EA, 2007). Sampling was initially conducted on a weekly basis from December 7, 2005 through May 11, 2006. Twice weekly samples, separated by at least 48 hours, were conducted from May 15, 2006 through November 2006. Fish and invertebrates were classified as alive or dead and identified to the lowest practical taxon. Up to 50 individuals of each taxon were individually weighed and measured. The program excluded invasive species such as Asiatic clam (*Corbicula* sp.) and zebra and quagga mussels (*Dreissena* sp.).

The 2005-2006 impingement sampling collected a total of 1.6 million fish and crayfish, including 40 fish species and one crayfish species. A total of 1,595,015 alewife were collected, representing 99.1 percent of the total impingement. Two other forage species, 9,144 introduced rainbow smelt (0.6%) and 1,276 native spottail shiner (0.1%), were the second and third most frequently collected individuals. Gizzard shad (738) occurred as the fourth most frequently collected species, accounting for less than 0.1% of the total number of fish collected. Other species which were collected in excess of 100 individuals were mottled sculpin (627), yellow perch (579), ninespine stickleback (556), threespine stickleback (517), white sucker (198), slimy sculpin (135), and bloater (105).

The relative abundance of the most common species impinged during the 2005 to 2006 study was somewhat different than encountered during the 1975 to 1976 study (WEPCO, 1976); primarily reflecting more alewife and fewer rainbow smelt in 2005 to 2006 (Table 4-3).

Entrainment sampling was conducted in the intake forebay weekly from mid-April through September 2006, along with concurrent ambient sampling in the lake adjacent to PBNP. A total of 37 ichthyoplankton taxa/life stage groups were encountered in the concurrent entrainment and ambient samples, of which 19 occurred in the entrainment samples. Ambient samples were collected at three locations: 6 to 8-foot depth contour (to represent a hypothetical shore-line intake), 18-foot depth contour (near the intake), and 30-foot depth (offshore from the intake). Samples at the 6 to 8-foot contour were dominated by Alewife type eggs (73.7 percent) while the deeper locations had more of a mix of species.

The most abundant ichthyoplankton taxa in the entrainment samples were rainbow smelt (62 percent of total individuals counted), followed by alewife-type eggs (18.1 percent), unidentified eggs (4.7 percent), juvenile alewife (3.2 percent), unidentified stickleback (2.4 percent), and unidentified Coregoninae (1.6 percent). All other taxa/life stage groups accounted for less than 1.0 percent of the ichthyoplankton occurring in the entrainment samples. Two "shellfish" species were included in the entrainment samples: scuds (*Gammarus* sp.) and one *Hyalella Azteca* individual. Overall, entrainment was dominated by *Gammarus* sp.

Entrainment sampling collected during the 2017 study included 72 ichthyoplankton specimens in six taxa, primarily rainbow smelt, burbot, and alewife. Invertebrates again dominated overall entrainment rates, with nearly 100% of the sample comprised of taxa in the Gammaridae family (*Echinogammarus ischnus* and *Gammarus* sp.). Smaller proportions of Mysidae were also present in the invertebrate collections, primarily *Hemimysis anomala*. Table 4-4 compares annualized entrainment rates for fish and invertebrates between the two study periods based on weekly extrapolations using measured flow rates.

Table 4-3. Comparison of 1975-1976 and 2005-2006 Impingement Data

Species	2005-2006		1975-1976	
	Number	%	Number	%
Alewife	1,595,015	99.1	265,644	84.8
Rainbow smelt	9,144	0.6	43,416	13.8
Spottail shiner	1,276	0.1	19	<0.1
Gizzard shad	738	<0.1	577	0.2
Mottled sculpin	627	<0.1	0	0
Yellow perch	579	<0.1	66	<0.1
Ninespine stickleback	556	<0.1	212	<0.1
Threespine stickleback	517	<0.1	0	0

EA, 2007.

Table 4-4. Estimated Flow-weighted Entrainment in the 2006 (Phase II) and 2017 Entrainment Taxa

	2006 (Phase II)		2017		Total	
	No./yr Estimate*	%	No./yr Estimate*	%	No./2 yr Estimate*	%
Ichthyoplankton						
Rainbow smelt	5,663,806	53%	4,273,710	43%	9,937,516	48 %
Alewife	3,418,449	32%	1,141,218	11%	4,559,667	22 %
Burbot	243,137	2%	2,663,186	26%	2,906,323	14 %
Unidentified	451,516	4%	970,347	10%	1,421,863	7%
Round goby			713,006	7%	713,006	3%
Clupeidae	64,740	1%	291,625	3%	356,365	2%
Stickleback	192,288	2%			192,288	1%
Sculpin	129,437	1%			129,437	1%
Cyprinidae	128,826	1%			128,826	1%
Slimy Sculpin	128,775	1%			128,775	1%
Coregoninae	125,676	1%			125,676	1%
Common carp	64,740	1%			64,740	0%
Catostomidae	63,786	1%			63,786	0%

	2006 (Phase II)		2017		Total	
	No./yr Estimate*	%	No./yr Estimate*	%	No./2 yr Estimate*	%
Lepomis	63,786	1%			63,786	0%
Invertebrates ("Shellfish")						
Gammarus sp.	4,057,474,137	100 %	1,307,295,469	28%	5,364,769,606	61 %
Echinogammarus ischnus			3,349,193,628	72%	3,349,193,628	38 %
Hemimysis anomala			12,863,458	0%	12,863,458	0%
Gammaridae			2,189,783	0%	2,189,783	0%
Mysis diluviana			141,929	0%	141,929	0%
Hyalella azteca	62,838	0%	62,838	0%		
* Based on weekly extrapolations using actual pumping rates						

Source: EA, 2020.

4.3 Identification of Species and Life Stages Susceptible to I and E

§122.21(r)(4)(iii) *- Identification of the species and life stages that would be most susceptible to impingement and entrainment. Species evaluated should include the forage base as well as those most important in terms of significance to commercial and recreational fisheries;*

The most representative data for identifying species that are susceptible to impingement and entrainment at PBNP are impingement and entrainment data recently collected at the facility. Impingement and entrainment studies were conducted in 1975 to 1976, 2005 to 2006, and 2017. The commonly collected species in the more recent studies[13] (2005 to 2006 and 2017) are included in Table 4-5 and discussed in the following sections.

[13] Includes species with at least 10 individuals collected for fish and at least 100 for invertebrates, some groups that comprised low percentage of I&E have been removed

Table 4-5. Species Common in Recent Impingement and Entrainment Studies at PBNP

Scientific Name	Common Name
FISH	
Alosa pseudoharengus	Alewife
Catostomidae	Suckers
Clupeidae	Herrings, shads, and sardines
Coregoninae	Freshwater whitefish
Cottus bairdii	Mottled sculpin
Cottus cognatus	Slimy sculpin
Cyprinidae	Minnows and carps
Cyprinus carpio	Common carp
Dorosoma cepedianum	Gizzard shad
Gasterosteus aculeatus	Threespine stickleback
Lepomis	Sunfishes
Lota lota	Burbot
Neogobius melanostomus	Round goby
Notropis hudsonius	Spottail shiner
Osmerus mordax	Rainbow smelt
Perca flavescens	Yellow Perch
Pungitius pungitius	Ninespine stickleback
INVERTEBRATES	
Corbicula sp.	Asian clam
Dreissena sp.	Zebra and quagga mussels
Echinogammarus ischnus	A scud
Gammaridae	Scuds (family)
Gammarus sp.	Scuds (genus)
Hemimysis anomala	Bloody red shrimp
Hyalella azteca	
Mysis diluviana	Opossum shrimp

Source: ECT, 2020.

4.4 Identification and Evaluation of Primary Growth Period

§122.21(r)(4)(iv) - Identification and evaluation of the primary period of reproduction, larval recruitment, and period of peak abundance for relevant taxa;

The primary growth period for most species follows spawning and subsequent hatching. Shortly after hatching, larvae are at their greatest abundance and have rapid growth rates. The timing of these activities for species present in Lake Michigan is discussed below.

4.4.1 Reproduction

With some exceptions, the majority of the species found in the vicinity of PBNP spawn in the spring and summer and therefore have their primary growth period in the summer and early fall when the water is relatively warm and food is abundant. Exceptions include lake whitefish which spawns in the fall and yellow perch which also spawns in late winter. Salmon and trout may spawn in some tributaries on the Wisconsin shoreline of Lake Michigan, with salmon spawning in the fall and trout in the fall or early spring. Opossum shrimp also breed in the winter. Table 4-6 summarizes the seasonal activities and spawning periods for species of common fish found in the vicinity of the CWIS.

4.4.2 Larval Recruitment and Period of Peak Abundance

The larval recruitment period follows spawning by a few days to a week or more, depending on incubation times for each species and ambient water temperature. The period of peak abundance generally occurs around the time of hatching as the new larval recruits greatly add to the abundance of each species. The spawning period for most species common in this area is in the spring and summer months, leading to peak abundance in eggs around this time and larvae shortly after.

Peak abundance of juvenile fish will lag spawning and larval recruitment by weeks to a few months.

Table 4–6. List of Seasonal Activities, Spawning Migration, Daily Activities, Migration, and Habitat Dominant Species Present Near PBNP

Species Name	Common name	Seasonal Activities/Spawning Migration	Daily Activities/Migration/Habitat
CATOSTOMIDAE	**Suckers**		
Catostomus catostomus	Longnose sucker	Spawns in spring. Eggs hatch in about 2 weeks. Often migrates between upstream spawning areas and nonspawning habitat. Spawning occurs often in flowing shallow stream water over gravel; otherwise in lakes. Eggs sink and stick to the bottom. Young stay in gravel 1-2 weeks before emerging.	Habitat of this bottom dweller usually is cold, clear, deep water of lakes and tributary streams, to depths of 600 feet in the Great Lakes; this fish also occurs in brackish water near the mouths of Arctic streams. Eats mostly benthic invertebrates
Catostomus commersonii	White sucker	Spawning occurs usually in spring or early summer. Eggs sink and usually stick to and become lodged in gravel. Eggs hatch in 5-15 days, depending on temperature. Mature individuals may not spawn every year. May migrate dozens of kilometers between spawning and nonspawning habitats in stream or lake tributaries. Spawning occurs usually in swift water or rapids, often in small, clear, cool creeks and small to medium rivers in water less than 30 cm deep. Sometimes spawning occurs on lake shoals, beaches, or river mouths (areas with wave action).	Occur in a wide variety of lake and stream habitats. Larvae feed near surface on protozoans, diatoms, small crustaceans, and bloodworms. Adults feed opportunistically on benthic organisms, both plant and animal.
CLUPEIDAE	**Herrings, shads, and sardines**		
Alosa pseudoharengus	Alewife	Spawns in spring or summer, later in northern populations. Eggs hatch within a week. Spawns in freshwater and migrates downstream to marine habitat after spawning. Some populations do not migrate. Marine populations spawn in quiet portions of rivers (fresh or brackish water) or in small streams, in lagoons behind barrier beaches, or in lakes above influence of tide. Lake populations spawn at night in shallow inshore waters.	Non-native. Found in marine waters or open lakes except when breeding. Overwinter in deep waters in lakes. Eats mainly zooplankton, especially crustaceans; fish eggs, crustacean eggs, insects and insect eggs, and small fishes.
Dorosoma cepedianum	Gizzard shad	Seasonally variable diet dominated by zooplankton and organic detritus in early summer and detritus throughout the rest of the growing season. Spawns at night in spring and summer in shallow water over sandy/rocky substrates.	Inhabits slow-moving or standing waters; relatively tolerant of turbidity as long as prey is plentiful. May become lethargic or moribund when water temperatures drop below 15 degrees Celsius (°C). Schooling fish. Juveniles are planktivores, adults are bottom feeders.

COREGONINAE	**Freshwater whitefish**		
Coregonus clupeaformis	Lake whitefish	Spawns in fall. Eggs hatch in early spring. Spawning occurs usually in shallow water over a hard or stony bottom, but sometimes over sand and sometimes in deeper water.	Habitat includes lakes and large rivers; this is a cool water species that may enter brackish water in some areas. Adults usually eat bottom-dwelling invertebrates and small fishes; in some regions they eat plankton or terrestrial insects at surface, also fish and their eggs and fry. Young eat mainly planktonic crustaceans.
COTTIDAE	**Sculpins**		
Cottus bairdii	Mottled sculpin	Spawns in spring. Breeding season may last 2-3 months from time of nest selection to departure of young. Female spawns once per season. Male guards eggs (sometimes from multiple females). Male selects a spawning site under flat rock or ledge, in crevice among large gravel, among aquatic plants, or in tunnels	Inhabits clear, cold to warm (typically cool) headwaters, creeks, springs, small rivers, and lakes, with sand and gravel or (more typically) rocky substrate. Benthic feeder; forages among rocks, mainly on immature aquatic insect larvae.
Cottus cognatus	Slimy sculpin	Spawning recorded in April-May. Eggs guarded by male, hatch in about a month. Eggs are laid under a rock, ledge, submerged tree root, or in similar situation in stream. Lake spawning behavior is poorly known	Typical habitats are deep oligotrophic lakes and swift rocky-bottomed streams. Sometimes occurs in brackish water. It may move into lake shallows at night, into deeper water during day. Eats mainly immature aquatic insects and crustaceans obtained from bottom.
CYPRINIDAE	**Minnows and carps**		
Cyprinus carpio	Common carp	Spawning occurs in spring and summer. Spawning begins by segregation into small groups of 4-20 individuals, led by a large female. With their backs and dorsal fins sticking above the water, the female broadcasts her eggs while swimming and splashing and several males release milt into the water. The sticky eggs adhere to plants, logs, and rocks and harden in 15-25 minutes. Very large and old females can produce 1-2 million eggs. Usually, carp spawn in shallows and flooded areas in water depths of less than 0.5 m. Carp fry stay attached to the vegetation for about two days.	Non-native. Extensive movements sometimes occur. In mark-recapture studies most remain within 1 or 2 miles but some are recorded up to 676 miles away. Usually occurs in rivers, lakes, ponds, reservoirs, swamps, or low-salinity estuaries; usually in shallow water with abundant vegetation and little or no current. Adults eat mainly invertebrates, detritus, fish eggs, and plant material.
Notropis hudsonius	Spottail shiner	Spawns in spring or early summer. Spawns in aggregations over areas of gravelly riffles near mouths of brooks, or along sandy shoals of lakeshores. May migrate up tributary streams to spawn.	Eats mainly insects, crustaceans, and filamentous algae. Atlantic slope: large sluggish coastal rivers and brackish water to small clear rapidly flowing montane streams. Western populations: more closely restricted to large rivers and lakes, usually over sandy or rocky shallows with scant vegetation
GADIDAE	**Cods**		

Lota lota	Burbot	May be confined to lakes or rivers or migrate between lakes and rivers. Often moves into tributaries in late winter and early spring, post spawning. May move to rivers to spawn, or spawning occurs in lakes. Broadcast spawns over sand or gravel in up to 10 feet of water.	Found in deep cold waters in lakes. May move into shallow water at night. Young eat mainly aquatic insects, crayfish, molluscs, and other invertebrates. Adults eat mostly fish.
GASTEROSTEIDAE	**Sticklebacks**		
Gasterosteus aculeatus	Threespine stickleback	Marine populations migrate to freshwater to spawn. Spawns in spring and summer. In most populations, most adults are 1-2 years old, do not live beyond 4 years, and presumably die at the end of their first breeding season. Male builds nest of plant material and guards eggs and fry. Eggs hatch in about a week. Nest may contain eggs of several females.	Non-native. Found in schools except while spawning. Freshwater populations are found in weedy pools and backwaters, among emergent plants at stream edges, over bottoms of sand and mud. Marine populations are near-shore pelagic. In some lakes, two morphologically and ecologically distinct forms may occur, (one littoral, the other mainly limnetic). Eats various invertebrates and fish eggs and fry.
Pungitius pungitius	Ninespine stickleback	Spawns in spring and summer. Spawns in fresh water; estuarine populations move into creeks and streams to spawn. Eggs laid in nest made by male among rocks or plants. Male fans eggs and guards young.	Cool quiet waters of ponds, lakes, estuaries, and streams; usually in shallow vegetated areas, sometimes in open water over sand. In lakes, may occupy deep water in winter, shallows in summer. Marine populations occur near shore. Eats mainly small crustaceans and aquatic insects; sometimes also fish eggs and fry.
GOBIIDAE	**Gobies**		
Neogobius melanostomus	Round goby	Spawns over a long period in the warmer months; male guards eggs. Eggs are deposited in nests on the tops or undersides of rocks, logs, or cans; aggressively defends spawning sites	Non-native. Diet includes bivalves, large invertebrates, and the eggs and fry of native fish. In the Black and Caspian seas, habitat is mainly nearshore areas, with movements to deeper water (up to 60 m) for winter; occurs also in rivers and slightly brackish water; prefers rocky or gravelly habitat; when startled, hides in crevices or actively burrows into gravel; able to tolerate degraded water quality.
LEPOMIS	**Sunfishes**		
Lepomis gibbosus	Pumpkinseed	Spawns in spring and summer; eggs hatch in about 3-5 days; male guards eggs; may nest in colonies. Eggs are laid in a nest constructed by the male in shallow water (less than 1 m deep) in bottoms of sand, gravel, or woody debris.	Lakes, reservoirs, ponds, sloughs, and sluggish streams; prefers quiet, clear water with aquatic vegetation and some organic debris. May occur in large numbers in shallow sheltered situations.
Lepomis macrochirus	Bluegill	Spawning occurs over an often extended period in spring and summer. Eggs hatch in about 2-3 days.	Habitat includes warm shallow lakes, reservoirs, ponds, swamps, sloughs, and slow-flowing rivers

		Males guard the eggs and hatchlings. Bluegill often spawn in colonies that may include dozens of crowded craterlike or saucer-shaped nests. Eggs are laid in nests made in shallow water by males, on bottoms of gravel, sand, or mud that contains pieces of debris.	and streams. Bluegill often are associated with rooted aquatic plants and with bottoms of silt, sand, or gravel. They seldom go much deeper than 16 feet (5 meters). Large individuals seek more open water than do smaller ones.
OSMERIDAE	**Smelts**		
Osmerus mordax	Rainbow smelt	Spawns in spring, usually peaking with bimonthly spring tides. Eggs hatch in 2-3 weeks. Both anadromous and lacustrine populations occur. Spawning occurs in streams (to at least 25 km from lake) or on gravel of lake shores. In coastal streams, most spawn above head of tide. Eggs attach to gravel on bottom. Larvae drift downstream, concentrate near surface; later tend to congregate on bottom in deeper areas, except at night when they move to surface apparently to feed.	In Great Lakes, larvae feed mainly on dipteran larvae, crustaceans, and fish; in Lake Michigan, diet of adults and juveniles included largely mysid shrimp in winter and young-of-the-year and yearling alewives in spring and summer. Habitat includes midwaters of lakes, inshore coastal waters, rivers; individuals generally stay within 2 km of shore along coast; not in water deeper than 6 m.
PERCIDAE	**Perches, walleyes, and darters**		
Perca flavescens	Yellow Perch	Spawning occurs in spring or late winter when water temperatures reach 44° to 54° F. Spawning occurs over aquatic plants or brush, or over sand, gravel, or rubble, in quiet water. Eggs hatch in about 10-20 days. May migrate from lakes into tributary rivers to spawn, or into fresh water from brackish water.	Usually in clear weedy backwaters or pools of creeks and small to large rivers, shallow waters of lakes, and large ponds. Often associated with aquatic vegetation. Occur and spawn in brackish water in some areas. Feeding activity mostly diurnal, with peaks in morning and at dusk, inactive at night. Larvae and young primarily zooplankton feeders; older young eat mostly invertebrates associated with bottom and with aquatic plants; adults feed among plants and along bottom on larger invertebrates and small fishes.
INVERTEBRATES			
CORBICULIDAE	**Basket clams**		
***Corbicula* sp.**	Asian clam	First introduced to the US in 1938, now established in river networks across the US and in the Great Lakes. May move passively with water currents. Dispersal mainly caused by human movements.	Non-native. This species can survive in almost any freshwater or brackish habitat. Filter feeder found at the sediment surface or slightly buried.
DREISSENIDAE	**Zebra and quagga mussels**		
Dreissena bugensis	Quagga mussel	Rapidly colonize hard surfaces and soft substrata. Prolific breeder, dioecious with external fertilization. A mature female is capable of producing up to one million eggs per year. Larvae develop within a few days and drift on the currents for 3-4 weeks.	Non-native. Introduced to the Great Lakes probably through ballast water. Inhabit freshwater rivers, lakes, and reservoirs. The depth at which the mussels live varies depending on water temperature. They are not generally found in lakes near shore in

			shallow water due to wave action. The quagga mussel can inhabit both hard and soft substrates, including sand and mud, down to depths of 130 m and possibly deeper. The maximum density of quagga mussels in Lake Michigan is at 31-90 m.
Dreissena polymorpha	Zebra mussel	Spawning occurs in spring or summer, but in warm waters can occur throughout the year. Females generally reproduce in their second year. Eggs are expelled by the females and fertilized outside the body by the males. Over 40,000 eggs can be laid in a reproductive cycle and up to one million in a spawning season. After the eggs are fertilized, the larvae (veligers) emerge within 3 to 5 days and are free-swimming for up to a month.	Non-native. Introduced to the Great Lakes in the 1980s. Attach to any stable structure within the water column or benthos. Filter feeders capable of filtering about one liter of water per day, feed primarily on algae.
GAMMARIDAE	**Scuds**		
Echinogammarus ischnus	A scud	Only reproduces sexually and has no resting stages. Brood size varies from 2–51 eggs. Breeding often occurs in spring and summer and ends in the fall, but may occur twice throughout the year in warm, thermally stable waters.	Non-native. Feeds on deposits - including those associated with zebra mussels, and preys on other macroinvertebrates such as chironomids, other amphipods, or its own species. A euryhaline species that is most common in large northern rivers of the Black and Caspian Sea drainages. Found in shallow margins of lakes and large rivers with gravel or rocky bottom.
HYALELLIDAE			
Hyalella azteca	Epibenthic amphipod	Used in aquatic toxicity testing due to its niche in lake sediments, short life cycle, and ease of reproduction in the laboratory. Eggs are held in a brood pouch on the females body. Females average 15 broods over a five-month period	Fresh and slightly brackish waters of lakes, rivers, and upper tidal portions of estuaries. It feeds on algae and diatoms and is a major food of waterfowl.
MYSIDAE	**Mysid shrimps**		
Hemimysis anomala	Bloody red shrimp	Breeds from April to September/October. Sexual maturity occurs in <45 days. Females produce 2 to 4 broods per year. Brood size is correlated with female length and ranges from 6 to 70 embryos per individual.	Non-native, native to freshwater margins of the Black Sea, the Azov Sea and the eastern Ponto-Caspian Sea. This brackish-water mysid is able to adapt to freshwater environments. Normally found in lentic waters, although it has successfully established in European rivers. Found near the bottom during the day, males migrate in swarms to upper water column at twilight. Juveniles are found higher in the water column than adults. Favors rocky substrates.

Mysis diluviana	Opossum shrimp	Breeding takes place in the winter and adults carry young in a brood pouch until fully developed in the spring; live for just two years.	Found in deep, cold oligotrophic lakes; also has been reported from brackish and estuarine waters. Stays at the bottom of the water column during the day and migrates toward the surface during the night to feed on zooplankton. An opportunistic feeder with both predatory and filter feeding habits.

Source: Nature Serve, 2020; NAS, 2020

ECT

4.5 Data Representative of Seasonal and Daily Activities of Organisms in the Vicinity of CWIS

***§122.21(r)(4)(v)** - Data representative of the seasonal and daily activities (e.g., feeding and water column migration) of biological organisms in the vicinity of the cooling water intake structure;*

Table 4-6 summarized data representative of seasonal and daily activities for the dominant species observed in Lake Michigan. The Phase II entrainment study indicated spawning of resident species in the vicinity of PBNP occurs primarily from April through August. Unidentified Coregoninae were only present in the entrainment samples collected the week of April 16 to 22, and burbot were entrained the next two weeks only, from April 23 through May 6.

Depending on species, Coregonids spawn from late fall through early spring (Becker, 1983) and burbot is one of the earliest spawning fish species in Lake Michigan that typically spawns before ice-out (University of Wisconsin Sea Grant Program, 2006). These early spawning species occurred as yolk-sac larvae only once (unidentified Coregoninae) or twice (burbot) during the 24-week study. Post yolk-sac larvae and juveniles of these two taxa did not occur in the entrainment samples. Ichthyoplankton did not occur in the entrainment samples collected over a four-week period from May 7 through June 3.

Several different taxa/life stages occurred sporadically from June 11 through July 1 when estimates remained less than 400,000 ichthyoplankton per week. Entrainment rates increased when alewife-type eggs and juvenile rainbow smelt began to be entrained in early July. Alewife-type eggs were entrained through the first week of August and juvenile rainbow smelt were entrained from July 16-22 through the completion of the study in late September. Rainbow smelt were collected more frequently than any other taxa and occurred in samples from eight of the 24 sampling events, followed by alewife type eggs (four events), juvenile alewife (four events), and unidentified eggs (three events). Seasonal trends for the majority of taxa/life stages collected during the Phase II study were difficult to establish as most taxa occurred only once (15 taxa/life stages) or twice (5 taxa/life stages) suggesting they had limited vulnerability to entrainment at PBNP (EA, 2007).

During the 2017 study, burbot larvae, yolk-sac and post yolk-sac larvae occurred in samples from May 9 through July 6 and were absent the remaining sampling season. Rainbow smelt larvae dominated the earlier sampling periods (April 24 through July 6), whereas later sampling periods were dominated by post yolk-sac larvae and juvenile rainbow smelt. This species was also collected during more sampling events of any other taxa (seven). Round goby were present in early samples (April 12 and April 25), then absent until August 2 and 16. Other taxa were either present once or twice throughout the entire sampling period and in low numbers (EA, 2020).

4.6 Identification of Threatened, Endangered, and Other Protected Species Susceptible to I & E at CWIS

§122.21(r)(4)(vi) *- Identification of all threatened, endangered, and other protected species that might be susceptible to impingement and entrainment at your cooling water intake structures;*

4.6.1 Threatened or Endangered Species Occurrence

The Final Rule modified the existing requirements of 40 CFR 112.21(r)(4)(vi) by replacing the former requirement to list state- and federally listed protected species with those listed by the federal government in 40 CFR 125.95(f). Given the likely interest in state-listed species, this section will address both state- and federally listed species. Table 4-7 presents state- and federally listed species, including terrestrial species, potentially occurring in Manitowoc County near the PBNP CWIS (USFWS, 2020; WDNR, 2020). Listed aquatic species for Manitowoc County include one amphibian, one fish, and four mussel species. None of these species are expected to occur within the habitats near the PBNP CWIS.

Table 4-7. Listed Species Potentially Occurring in Manitowoc County near the PNBP CWIS

Scientific and Common Name	Federal Status	State Status	Habitat Description
AMPHIBIANS			
Acris blanchardi Blanchard's Cricket Frog		END	Prefers ponds, lakes, and a variety of habitats along and adjacent to streams and rivers including, marshes, fens, sedge meadows, low prairies, and exposed mud flats. The species tends to breed in quiet water (no or low flow) and may also move from streams and rivers to adjacent wetlands and ponds.
INSECTS			
Bombus affinis Rusty Patched Bumble Bee	LE	SC/FL	Suitable active season habitat includes but is not limited to prairies, woodlands, marshes/wetlands, agricultural landscapes, and residential parks and gardens.
Cicindela hirticollis rhodensis Hairy-necked Tiger Beetle		END	Sand beaches along Lakes Superior, Michigan and along large rivers.
SNAILS			
Vertigo hubrichti Hubricht's Vertigo		END	Primary habitat is the soil and fern-covered ledges of limestone cliffs along the upper Great Lakes.
Hendersonia occulta Cherrystone Drop		THR	Inhabitants of small areas of algific habitat or the similar cool, moist, shaded sites of cliffs where algific conditions occur without substantial talus or ice.
BIRDS			
Charadrius melodus Piping Plover	LE	END	Prefers large isolated cobble beaches on the shores of Lakes Michigan and Superior.
Chlidonias niger Black Tern	SOC	END	Prefers large shallow marshes with abundant vegetation adjacent to open water.
Falco peregrinus Peregrine Falcon		END	Nest mainly on high cliffs or bluffs, although some birds have taken up residence on ledges of skyscrapers or smoke stacks in large cities.
Bartramia longicauda Upland Sandpiper		THR	Prefers grasslands with low to moderate forb cover, moderate grass cover, moderate litter cover, and little bare ground, including lightly grazed pastures, old fields, idle upland grasslands, barrens, and hayfields for nesting.
Buteo lineatus Red-shouldered Hawk		THR	Prefers larger stands of older-aged to mature bottomland hardwoods along riparian areas, deciduous swamps, and northern hardwoods or mixed deciduous - coniferous upland forests with wetland pockets or ephemeral ponds interspersed or located in close proximity.
Centronyx henslowii Henslow's Sparrow	SOC	THR	Prefers old fields, open grasslands, wet meadows, unmowed highway rights-of-way, undisturbed pastures, Timothy hay fields, and fallow land grown up to tall weeds.
Empidonax virescens Acadian Flycatcher		THR	Prefers lowland deciduous forests and heavily wooded hillsides in large blocks of southern forests.
FISHES			
Lythrurus umbratilis Redfin Shiner		THR	Prefers turbid waters of pools in low-gradient streams over substrates of boulders, cobble, sand, silt or detritus.
MAMMALS			
Eptesicus fuscus Big Brown Bat		THR	In the summer found in various habitats including mixed landscapes of deciduous woodlands, farmlands, edges near water and urban areas. During the winter months, they are found in natural and manmade structures such as caves, mines and human dwellings.
Myotis lucifugus Little Brown Bat		THR	Forages primarily over open water and along edge habitat and hibernates in caves and mines from October through April.

Scientific and Common Name	Federal Status	State Status	Habitat Description
Myotis septentrionalis Northern Long-eared Bat	LT	THR	Habitat for the summer may include day roosts in buildings, under tree bark or shutters, or caves during the night. Hibernation sites are often in mines or caves. Foraging habitat includes forested hillsides and ridges, and small ponds or streams.
Perimyotis subflavus Eastern Pipistrelle		THR	Typically roosts in caves for hibernation. Have been found roosting in trees and tree foliage. For foraging, prefers habitat such as forest edges and waterways.
MUSSELS			
Alasmidonta viridis Slippershell Mussel		THR	Found in small to medium-sized streams with flowing hard water, sand, or gravel bottoms.
Theliderma metanevra Monkeyface		THR	Found in the western part of the state in swift, clean water in larger rivers in gravel or mixed sand and gravel.
Venustaconcha ellipsiformis Ellipse		THR	Prefers shallow, flowing, clean small streams with stable substrate in the eastern and southern part of the state.
PLANTS			
Salix cordata Sand Dune Willow		END	Found on Lake Michigan dunes.
Calamovilfa longifolia var. *magna* Sand Reedgrass		THR	Found on Lake Michigan sand dunes.
Calypso bulbosa Calypso Orchid		THR	Found only in old growth white cedar swamps.
Carex lenticularis Shore Sedge		THR	Found in rock splash pools on Lake Superior and inland on lake beaches.
Cirsium pitcheri Pitcher's Thistle	LT	THR	Found on open sand dunes adjacent to the Great Lakes.
Elymus lanceolatus ssp. *psammophilus* Thickspike		THR	Found on Lake Michigan dunes and beaches.
Orobanche fasciculata Clustered Broomrape		THR	Found in dry prairies and dunes (both near Lake Michigan and inland).
Ranunculus cymbalaria Seaside Crowfoot		THR	Found in sandy or muddy shores and marshes, ditches and harbors along Lake Michigan, and salted roadsides near the city of Superior.
Triantha glutinosa False Asphodel		THR	Found on marly shorelines, cold calcareous seeps, and fens.
Trillium nivale Snow Trillium		THR	Found in hardwood forests, sometimes second-growth, often adjacent to rivers or streams.

Notes:

US Status: Federal protection status designated by the FWS. LE = listed endangered; LT = listed threatened; *SOC = species of concern.

*Federal species of concern are those species that may be in need of concentrated conservation actions, which vary depending on the health of the populations and degree and types of threats. They receive no legal protection and are not necessarily species that will eventually be proposed for listing as threatened or endangered.

WI Status: Protection category designated by the DNR. END = endangered; THR = threatened; *SC = special concern.

*Wisconsin Department of Natural Resources and federal regulations regarding special concern species range from full protection to no protection. SC/FL = federally protected as endangered or threatened, but not so designated by DNR.

Sources: USFWS IPaC, 2020. WDNR Natural Heritage Inventory, 2020.

4.6.1.1 Federally Listed Species

Federally listed threatened and endangered species and critical habitat are protected by the Endangered Species Act (ESA) of 1973 and subsequent amendments. The ESA is administered by two federal agencies, the U.S. Fish and Wildlife Service (USFWS) and NOAA Fisheries. NOAA Fisheries oversees marine species, and the USFWS has responsibility over freshwater fish and all other terrestrial and aquatic species. Federally listed T&E species are protected by the ESA; special concern species indicate a species in danger of becoming threatened but not officially protected by the ESA. USFWS recommends use of its Information Planning and Conservation (IPaC) tool for determining which species may be affected by a project.

Four federally listed threatened or endangered species and two federally listed species of concern are potentially found in Manitowoc County (rusty patched bumble bee, piping plover, northern long-eared bat, and Pitcher's thistle; along with black tern and Henslow's sparrow). None of these species are aquatic or are likely to be found near the CWIS due to a lack of suitable habitat. NextEra notes that a piping plover "inspection" is performed every year in June along the shoreline at PBNP. No piping plovers have ever been spotted on the beaches at PBNP since inspections began (approximately 2008)

4.6.1.2 State-Listed Species

Wisconsin's endangered and threatened species laws are found at Wisconsin State Statute 29.604 and Administrative Rule Chapter NR 27. WDNR lists protected species and the Natural Heritage Inventory maintains a database with locational information for these species. Table 4-7 includes state-designations for species listed in Manitowoc County (WDNR Natural Heritage Inventory, 2020). No species are returned when the search is performed for the project area including a one-mile buffer for terrestrial species and a two-mile buffer for aquatic species (WDNR Natural Heritage Inventory, 2020).

4.6.1.3 Designated Critical Habitat

On May 7, 2001 the USFWS designated critical habitat for the Great Lakes breeding population of piping plover in certain areas along the Great Lakes shorelines of Minnesota, Wisconsin, Michigan, Illinois, Indiana, Ohio, Pennsylvania, and New York. This designation included 35 individual units of habitat including one located within Point Beach State Park along the

shoreline of Lake Michigan to the south of PBNP. Continued use of the CWIS at PBNP is not likely to adversely modify this habitat.

4.6.2 Likelihood of Impingement or Entrainment

None of the listed species in Table 4-7 are subject to direct effects from the CWIS.

4.7 Documentation of Consultation with Services

§122.21(r)(4)(vii) *- Documentation of any public participation or consultation with Federal or State agencies undertaken in development of the plan;*

No consultation with the Services has been initiated for PBNP.

4.8 Methods and QA Procedures for Field Efforts

§122.21(r)(4)(viii) *- If you supplement the information requested in paragraph (r)(4)(i) of this section with data collected using field studies, supporting documentation for the Source Water Baseline Biological Characterization must include a description of all methods and quality assurance procedures for sampling, and data analysis including a description of the study area; taxonomic identification of sampled and evaluated biological assemblages (including all life stages of fish and shellfish); and sampling and data analysis methods. The sampling and/or data analysis methods you use must be appropriate for a quantitative survey and based on consideration of methods used in other biological studies performed within the same source water body. The study area should include, at a minimum, the area of influence of the cooling water intake structure.*

Information obtained from the literature to support the Source Water Baseline Biological Characterization included field surveys conducted in 2006 under the Phase II rule as well as studies implemented under the Final Rule in 2017. Methodologies, quality assurance, and data analysis for these studies were documented in WDNR-approved Study Plans and are summarized in Sections 4 and 9.

4.9 Definition of Source Water Baseline Biological Characterization Data

§122.21(r)(4)(ix) *- In the case of the owner or operator of an existing facility or new unit at an existing facility, the Source Water Baseline Biological Characterization Data is the information in paragraphs (r)(4)(i) through (xii) of this section.*

This report acknowledges the Final Rule added three additional subsections to the requirements of 40 CFR 122.21(r)(4). While this report has provided data to address 40 CFR 122.21(r)(4)(i) through (viii) and (x) through (xii), there is no required submittal under this subsection 40 CFR 122.21(r)(4)(ix).

4.10 Identification of Protective Measures and Stabilization Activities

§122.21(r)(4)(x) *- For the owner or operator of an existing facility, identification of protective measures and stabilization activities that have been implemented, and a description of how these measures and activities affected the baseline water condition in the vicinity of the intake.*

A rock crib was constructed around the intake area to reduce impingement (Section 3.1). A high frequency ADS surrounds the crib in order to reduce alewife impingement. The acoustic array at PBNP consists of 16 Integrated Projector Assemblies ("IPAs") uniformly spaced around the outer circumference of the crib. The deterrent signal consists of high frequency broad band (122 – 128 kHz) pulses, 0.5 second in duration, at 1-second intervals.

4.11 List of Fragile Species

§122.21(r)(4)(xi) *- For the owner or operator of an existing facility, a list of fragile species, as defined at 40 CFR 125.92(m), at the facility. The applicant need only identify those species not already identified as fragile at 40 CFR 125.92(m). New units at an existing facility are not required to resubmit this information if the cooling water withdrawals for the operation of the new unit are from an existing intake.*

In the Final Rule EPA identified 14 species as fragile or having post-impingement survival rates of less than 30 percent:

- Alewife
- American Shad
- Atlantic Herring
- Bay Anchovy
- Blueback Herring
- Bluefish
- Butterfish
- Gizzard Shad
- Grey Snapper
- Hickory Shad
- Menhaden
- Rainbow Smelt
- Round Herring
- Silver Anchovy

Impingement at PBNP is dominated by fragile species, consisting of over 99 percent Alewife. Other fragile species listed by Wisconsin include Gizzard Shad and Rainbow Smelt. Nuisance species are also excluded from required impingement mortality protection by modified traveling screens and system of technologies. However, as discussed in Section 6.4, NextEra believes that the forage provided by the three fragile species justifies application of the system of measures in this case. Given WDNR's expressed concern over Alewife, this approach complies with the potential requirement for additional measures to protect fragile species under 40 CFR 125.94(c)(9) and NR 111.12(2).

4.12 Information Submitted to Obtain Incidental Take Exemption or Authorization from Services

§122.21(r)(4)(xii) *- For the owner or operator of an existing facility that has obtained incidental take exemption or authorization for its cooling water intake structure(s) from the U.S. Fish and Wildlife Service or the National Marine Fisheries Service, any information submitted in order to obtain that exemption or authorization may be used to satisfy the permit application information requirement of paragraph 40 CFR 125.95(f) if included in the application.*

PBNP has not sought to obtain an incidental take permit from the Services.

5.0 Cooling Water System Data 40 CFR 122.21(r)(5)

This section provides information on the cooling water system, with rule-required components listed at the beginning of each subsection.

5.1 Cooling Water System Description

§122.21(r)(5)(i)- *A narrative description of the operation of the cooling water system and its relationship to cooling water intake structures; the proportion of the design intake flow that is used in the system; the number of days of the year the cooling water system is in operation and seasonal changes in the operation of the system, if applicable; the proportion of design intake flow for contact cooling, non-contact cooling, and process uses; a distribution of water reuse to include cooling water reused as process water, process water reused for cooling, and the use of gray water for cooling; a description of reductions in total water withdrawals including cooling water intake flow reductions already achieved through minimized process water withdrawals; a description of any cooling water that is used in a manufacturing process either before or after it is used for cooling, including other recycled process water flows; the proportion of the source waterbody withdrawn (on a monthly basis).*

PBNP has two, two-loop Westinghouse pressurized water reactors. Heat from the primary coolant loop vaporizes the water in the secondary loop in the steam generator. Steam then turns the main turbine to generate electricity. Once-through cooling water is withdrawn from Lake Michigan and used to condense the steam. PBNP is a baseload facility, operating at a high capacity utilization rate with outages typically only occurring for refueling or maintenance.

PBNP has four circulating pumps which are typically operated during normal generation to maintain maximum thermal efficiency, each with a capacity of 243,000 gpm (350 MGD). Due to suction head loss on the cooling water intake side and head loss effects on the discharge side of the pumps, the cooling water system has a combined design intake capacity of 1,108 MGD. In addition, there are three service water pumps (5,320 gpm), two screen wash pumps (1,100 gpm), and two firewater pumps (2,000 gpm) which are not included in the cooling water flow.

The majority of the water withdrawn through the CWIS is used in the cooling water system for steam condensation. Water withdrawn through the CWIS also supplies service water and nuclear-safety related systems. During the winter, normally mid-December through March, only one circulating pump per unit is used, reducing the circulating water withdrawal rate. In addition, a portion of the discharge is recirculated through the offshore crib to prevent the formation of frazil ice. This is accomplished by throttling the discharge valve between the seal well and the discharge flume, allowing a maximum of 288 MGD (200,000 gpm) from one of the units to be recirculated to the intake crib through one of the two intake pipes.

5.2 Calculations and Supporting Data

§122.21(r)(5)(ii) - Design and engineering calculations prepared by a qualified professional and supporting data to support the description required by paragraph (r)(5)(i) of this section.

5.2.1 Through-Screen Velocity Calculations

For the design and configuration of the CWIS (See Section 3 for more details) and four pump operation (1,108 MGD DIF), the calculated through-screen velocity (v) is:

$$v = (MGD) \times (1000000) \times \left(\frac{1\ day}{24\ hours}\right) \times \left(\frac{1\ hour}{3600\ sec}\right) \times \left(\frac{0.1337\ ft^3}{gal}\right) \times \left(\frac{1}{total\ open\ area\ of\ intake}\right)$$

$$v = (1{,}108) \times (1000000) \times \left(\frac{1}{24}\right) \times \left(\frac{1}{60}\right) \times \left(\frac{1}{60}\right) \times (0.1337) \times \left(\frac{1}{864.6}\right)$$

$$v = 2.0\ ft/sec$$

Where:

$$\begin{aligned} total\ open\ area\ of\ intake &= 8\ screens\ \times\ open\ area\ of\ individual\ screen \\ &= 8\ \times\ overall\ sreen\ area\ \times\ screen\ open\ area \\ &= 8\ \times 10\ ft\ (width)\ x\ 19.3\ ft\ (low\ water\ depth)\ x\ 0.56 \\ &= 864.6\ ft^2 \end{aligned}$$

Screen open area based on screen mesh openings of 0.375 in x 0.375 in.

5.2.2 Flow Reduction Calculations

PBNP utilizes only one of two circulating pumps per unit during the winter. Based on the DIF of 1,108 MGD and the five-year AIF of 925 MGD, this operational measure reduces annual cooling water flow rates by approximately 17 percent.

5.2.3 Proportion of Source Waterbody Withdrawn

Cooling water at PBNP is withdrawn from the west shore of Lake Michigan in Manitowoc County, Wisconsin. Lake Michigan is the second largest of the Great Lakes by volume (1,180 cubic miles; 1,290 trillion gallons) and the third largest by surface area (22,300 square miles). Water in Lake Michigan circulates in a generally counterclockwise motion, with the prevailing current along the western coastline to the south. The 1,108 MGD DIF (equivalent to 33,240 million gallons per month) is a very small fraction of the volume of the source waterbody (0.0026 percent).

5.3 Description of Existing Impingement and Entrainment Reduction Measures

§122.21(r)(5)(iii) *- Description of existing impingement and entrainment technologies or operational measures and a summary of their performance, including but not limited to reductions in impingement mortality and entrainment due to intake location and reductions in total water withdrawals and usage.*

Existing impingement and entrainment reduction measures at PBNP include an offshore intake location, intake crib, seasonally deployed high-frequency ADS, and flow reduction during winter. The PBNP intake is located 1,750 feet offshore, which EPA recognizes as a region of lower biological activity and thus offshore intakes can result in reduced rates of impingement and entrainment. The intake was constructed with a rock crib to further reduce impingement rates. The top of the rock crib was initially designed to be above the lake surface level. However, cormorants were attracted to the rock crib structure and would occasionally fall into the rock enclosure and be drawn into the pumphouse. To address this issue, the intake crib was decreased in height to a level approximately eight feet off the bottom of the lake, and a high-density polyethylene grating designed to exclude debris was added to the top of the crib.

Alewives were attracted to the area when the PBNP thermal plume was present on the surface of the lake near the intake crib. The CWIS was outfitted with a high-frequency ADS specifically designed to deter alewife. The deterrent system is deployed in the warmer months (May to October), which corresponds to high periods of historic alewife impingement and prevents ice damage to the equipment. The sound frequency deployed (125 kHz) has been shown to be

effective at deterring alewife at other facilities including a power plant with a similar offshore intake structure on Lake Ontario.

In combination, these measures have been estimated to result in an overall 96.2 percent reduction in impingement compared to a shoreline intake at the surface with no deterrents (see Section 6.3.4.2).

6.0 Chosen Method(s) of Compliance with Impingement Mortality Standard – 40 CFR 122.21(r)(6)

This section addresses a portion of the rule's requirements under CFR Title 40 Part 122.21(r)(6), Chosen Method(s) of Compliance with Impingement Mortality Standard[14]) for PBNP.

6.1 Introduction and Background

6.1.1 Rule Requirement

Under the Final Rule, the station must submit information required in 40 CFR 122.21(r)(6), Chosen Method(s) of Compliance with Impingement Mortality Standard.

The Final Rule under 40 CFR 125.94(c) provides seven pre-approved compliance options for meeting impingement mortality requirements (Table 6-1). Two other options allow for flexibility in the application of the impingement mortality BTA requirements (rates of impingement that are *de minimis* and generating capacity factors of less than eight percent) and expected to be applicable under special circumstances.

The text of 40 CFR 122.21(r)(6) is as follows:

[14] As noted in Section 1, the State of Wisconsin has promulgated its own rule, Chapter NR 111, Cooling Water Intake Structures, that also governs the assessment of the CWIS at PBNP. While NextEra believes that NR 111 was intended to be consistent with the EPA Final Rule, there are some slight differences that will be pointed out when relevant.

Table 6-1. Review of the Final Rule's BTA Alternatives for Impingement Mortality

Impingement Mortality BTA Approach (#) per 40 CFR 125.94(c)
(1) Closed-cycle cooling
(2) Through-screen velocity less than 0.5 ft/s; DIF
(3) Through-screen velocity less than 0.5 ft/s; AIF
(4) Existing Offshore Velocity Cap
(5) Modified traveling screens
(6) System of technologies
(7) Impingement mortality performance standard (<24 percent mortality)
(11) *De minimis* rate of impingement
(12) Capacity utilization rate less than 8 percent

Note: AIF = actual intake flow
BTA = best technology available
CFR = Code of Federal Regulations
DIF = design intake flow
ft/s = foot per second

Source: EPA, 2014.

§122.21(r)(6) *- The owner or operator of the facility must identify the chosen compliance method for the entire facility; alternately, the applicant must identify the chosen compliance method for each cooling water intake structure at its facility. The applicant must identify any intake structure for which a BTA determination for Impingement Mortality under 40 CFR 125.94 (c)(11) or (12) is requested. In addition, the owner or operator that chooses to comply via 40 CFR 125.94 (c)(5) or (6) must also submit an impingement technology performance optimization study as described below:*

§122.21(r)(6)(i) *- If the applicant chooses to comply with 40 CFR 125.94(c)(5), subject to the flexibility for timing provided in 40 CFR 125.95(a)(2), the impingement technology performance optimization study must include two years of biological data collection measuring the reduction in impingement mortality achieved by the modified traveling screens as defined at 40 CFR 125.92(s) and demonstrating that the operation has been optimized to minimize impingement mortality. A complete description of the modified traveling screens and associated equipment must be included, including, for example, type of mesh, mesh slot size, pressure sprays and fish return mechanisms. A description of any biological data collection and data collection approach used in measuring impingement mortality must be included:*

(A) Collecting data no less frequently than monthly. The Director may establish more frequent data collection;

(B) Biological data collection representative of the impingement and the impingement mortality at the intakes subject to this provision;

(C) A taxonomic identification to the lowest taxon possible of all organisms collected;

(D) The method in which naturally moribund organisms are identified and taken into account;

(E) The method in which mortality due to holding times is taken into account;

(F) If the facility entraps fish or shellfish, a count of entrapment, as defined at 40 CFR 125.92(j), as impingement mortality; and

(G) The percent impingement mortality reflecting optimized operation of the modified traveling screen and all supporting calculations.

§122.21(r)(6)(ii) *- If the applicant chooses to comply with 40 CFR 125.94(c)(6), the impingement technology performance optimization study must include biological data measuring the reduction in impingement mortality achieved by operation of the system of technologies, operational measures and best management practices, and demonstrating that operation of the system has been optimized to minimize impingement mortality. This system of technologies, operational measures and best management practices may include flow reductions, seasonal operation, unit closure, credit for intake location, and behavioral deterrent systems. The application must document how each system element contributes to the system's performance. The applicant must include a minimum of two years of biological data measuring the reduction in impingement mortality achieved by the system. The applicant must also include a description of any sampling or data collection approach used in measuring the rate of impingement, impingement mortality, or flow reductions.*

The potential requirements of 40 CFR 122.21(r)(6) can be divided into three portions:

- Identification of the proposed method of compliance with IM BTA for each intake as described in the introduction to the section;
- Description in Section (i) of the requirements of the impingement technology performance optimization study for those facilities pursuing the IM BTA method that relies on modified traveling screens and a fish return (40 CFR 125.94(c)(5)); and
- Definition in Section (ii) of the requirements of the impingement technology performance optimization study for those intakes that are proposed for IM BTA method based on the system of technologies (40 CFR 125.94(c)(6)).

This section will focus on the first goal of 40 CFR 122.21(r)(6): NextEra's chosen method of IM BTA at PBNP. NextEra has preliminarily short-listed coarse-mesh modified traveling water screens (MTWS) with an organism return system and system of technologies as its impingement mortality compliance measures; one of these would be further developed and installed at PBNP. Final selection is subject to WDNR's selection of BTA for entrainment (and could potentially deviate from these shortlisted technologies). As discussed below, PBNP has proposed an IM BTA that triggers an impingement technology performance optimization study but it plans to submit the optimization study plan at a later date following WDNR action on the proposed IM BTA (as well as its BTA determination on entrainment).

6.1.1.1 The Nature of the Impingement Technology Performance Optimization Study May Change with the IM BTA Decision

The rule's requirement to develop an impingement technology performance optimization study is triggered in the event that the facility installs modified traveling water screens (MTWS) and a fish return or by installation/operation of a system of technologies. As discussed below, the approach to IM BTA proposed by NextEra at PBNP relies on one of these measures but NextEra believes that it is premature to define the optimization study until the IM BTA and its specific basis have been accepted by WDNR and more fully defined. NextEra notes that while the conceptual approach to optimizing MTWS is relatively clear, optimizing the system of measures that includes deterrents is much more difficult, as is acknowledged by the rule. This issue is discussed further below.

6.1.1.2 The IM BTA May Change with the Entrainment BTA Decision

While NextEra has proposed an approach to IM BTA for PBNP, we note that the rule's preamble is clear that the entrainment BTA decision should precede the IM BTA determination. This sequence is intended to avoid unnecessary costs associated with IM BTA measures that might be redundant or irrelevant in the context of the entrainment BTA remedy. NextEra is aware of two facilities that have omitted the IM BTA recommendation from their submittal, proposing to submit it only after the entrainment BTA decision. Such a precedent supports delaying development of the optimization study plan until PBNP's entrainment BTA has been defined.

6.1.1.3 Section Organization

Section 6.2 of this document discusses the evaluation by NextEra of the methods for compliance with the Impingement Mortality Standard of 40 CFR 125.94(c). This includes assessment of each of the candidate approaches in the context of circumstances at PBNP. Section 6.3 provides an integrated review of the three retained options for IM BTA at PBNP. Section 6.4 provides NextEra's recommendation for IM BTA at the site.

6.2 Evaluation of Options to Address the Impingement Mortality Standard of 40 CFR 125.94(c)

The rule allows for seven different approaches to IM BTA at affected facilities, each of which, if it meets the goals defined for the approach by the Final Rule, would be considered fully compliant. In addition, two other plant-related circumstances allow WDNR additional latitude in considering IM BTA: the potential for *de minimis* rates of impingement (40 CFR 125.94(c)(11)) and a capacity utilization rate (CUR) of less than eight percent over a 24-month period (40 CFR 125.94(c)(12)). NextEra does not believe that either the *de minimis* or low CUR approaches are relevant to the circumstances at PBNP.

Depending upon site-specific considerations, the potential to retrofit to each of the seven IM BTA options is likely to vary substantially in terms of feasibility, cost, and effectiveness. In addition, some alternatives may include costs and/or uncertainties that NextEra should consider while selecting an IM BTA. For example, IM BTA approach 7 based on an IM performance standard would trigger additional impingement monitoring and is associated with a definitive performance standard, factors that, in the rule-making, EPA acknowledges make the approach unlikely to be adopted by permittees.

Table 6-2 presents a summary of IM BTA options and provides comments on their constraints at PBNP. Owing to site-specific conditions, several of the IM BTA options are rejected for PBNP at this screening step. Three of the alternatives retained for further consideration are discussed in more detail in the following subsection.

Table 6–2. Review of IM BTA Approaches for PBNP

Citation – 40 CFR 125.94(c)	Title and Summary	Advantages	Disadvantages	Decision and Basis
(1)	Closed-Cycle Recirculating System (CCRS) consistent with 40 CFR 125.92(c)	Monitoring required by the rule restricted to intake and blowdown flows. Substantial reductions in entrainment and impingement (e.g., >90%) relative to DIF. Reduction in thermal loading to receiving water.	As discussed in Section 10, existing infrastructure imposes substantial constraints on the retrofit resulting in high costs and potential infeasibility. Cooling towers would be placed at some distance from the existing condensers and new large-diameter water lines would be constructed along the lake shore and near the protected area. Tie-in to the condensers would be complex and costly. Costs of construction as well as costs of lost generation due to parasitic load, loss of efficiency, and construction down time are far higher than other alternatives. Other environmental impacts (e.g., particulate emissions, higher consumptive use of water) would result.	Rejected in the context of IM BTA alone but will be evaluated for entrainment BTA in Sections 10-12. Costs are prohibitive relative to other alternatives for IM BTA. EPA did not intend the rule to force CCRS retrofit to address IM BTA alone: "As stated in the June 11, 2012 NODA, EPA does not intend for facilities to install closed-cycle cooling solely for the purpose of meeting the IM requirements. In fact, EPA expects all facilities could comply with IM requirements without relying on retrofitting to closed-cycle cooling."[15]. Although not evaluated in this section, CCRS is evaluated in Sections 10-12 in the context of a technology that would satisfy both entrainment and impingement reduction requirements.

[15] EPA. 40 CFR Parts 122 and 125. National Pollutant Discharge Elimination System – Final Regulations to Establish Requirements for Cooling Water Intake Structures at Existing Facilities and Amend Requirements at Phase I Facilities; Final Rule. Federal Register Volume 79. p. 48329. August 15, 2014.

Citation – 40 CFR 125.94(c)	Title and Summary	Advantages	Disadvantages	Decision and Basis
(2)	0.5 Feet per second (ft/s) Through Screen Velocity under design conditions (DIF and lowest known water depth)	No post-installation monitoring needed. Optimization studies and performance goals are not necessary. Likely more effective at protecting fragile species than MTWS.	Several alternative approaches to achieving the critical TSV were considered (e.g., relocation and expansion of the traveling water screens, offshore wedgewire screens, barrier nets, etc.). Installation of a barrier net was determined to be the lowest cost and simplest to permit of the available options but have poor effectiveness and reliability due to the need to deploy in the open lake subject to wind, waves, debris, and ice. As described in Section 10.5 relative to FMS, expansion of the intake to include substantially more modified traveling water screens would be extremely involved and costly, resulting in a facility outage of several months. Installation of wedgewire screens with wide slots was also considered but rejected due to constraints on head loss within the cooling system as well as adverse effects of frazil ice[16] demonstrated at other facilities on Lake Michigan in Wisconsin (see Section 10.5).	The three potential configurations for this approach were all rejected due to issues of reliability, effectiveness, and high costs. Importantly, a barrier net and wedgewire screens cannot be judged to be reliable through wintertime conditions due to icing and would suffer from debris loading throughout the year. More specifics on the constraints on head loss given the potential installation of wide-slot wedgewire screens is discussed below. While this option is "retained" for further evaluation, this is done to better document the basis by which NextEra has concluded it is infeasible. Expansion of the screen area to achieve less than 0.5 ft/s for traveling water screens would be extremely costly and result in an unacceptable plant outage (see Section 10.5).

[16] NRC (1996) provides the following description of frazil ice along with its potential impact on nuclear plant operations and safety. "Frazil icing is a phenomenon that affects the operation of intake structures in regions that experience cold weather. The accumulation of frazil ice on intake trash racks can completely block the flow of water into the intake. The process starts when the water flowing into the intake is supercooled (a condition where the water is below the freezing point). The supercooling may be very small, on the order of a few hundredths of a degree. The supercooling occurs with a loss of heat from a large surface area such as a lake with open water and clear nights. High winds contribute to the problem by providing mixing of the supercooled water to depths as great as 6 to 9 m [20 to 30 ft]. The frazil ice, which is composed of very small crystals (1-15 mm) with little buoyancy because of their size, is carried along in the water and mixed all through the supercooled water. The suction of the supercooled water and the suspended frazil ice crystals through an intake structure brings the frazil ice crystals in contact with the trash rack bars. Frazil ice crystals easily adhere to any object with which they collide. The ice collects first on the upstream side of the trash racks, then steadily grows until the space between the trash racks is bridged. This bridging rapidly blocks the trash racks. The accumulation of ice can withstand high differential pressures; effectively damming the intake suction. Facility vulnerability to icing events is a function of plant design. Frazil and other ice formation is dependent on specific environmental conditions and represents a potential common-mode failure that can cause the loss or degradation of multiple cooling water systems, including the potential loss of the ultimate heat sink."

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Citation – 40 CFR 125.94(c)	Title and Summary	Advantages	Disadvantages	Decision and Basis
(3)	0.5 fps Through Screen Velocity under actual conditions (real-time intake rates and water depth)	See discussion of alternative 2. Potential lower compliance costs relative to alternative 2 for smaller intake to achieve reduced velocity at actual intake flow.	To maintain its full generation capacity – which is its normal mode of operation, PBNP must be able to pump cooling water at its DIF at all times and typically actual flow is at DIF. Such operation would not meet the requirements of 40 CFR 125.94(c)(3). Need to continuously measure or estimate through-screen velocity. It is not possible to measure through-screen velocity accurately, therefore need to measure intake flow rate, water depth and extent of net fouling continuously.	Rejected. Given the mode of operation of PBNP, AIF is essentially the same as DIF providing no advantage to this option relative to alternative 2. See discussion above for IM BTA alternative 2.
(4)	Existing Offshore Velocity Cap per 40 CFR 195.92(v)	Potentially relatively simple technology requiring little monitoring and maintenance.	To avoid costly and highly uncertain confirmatory studies under 40 CFR 125.94(c)(6) or (7), must have been installed prior to 2014. PBNP does not have an installed offshore velocity cap.	Rejected. This technology needs to have been in place when the Final Rule was promulgated, otherwise performance studies are required. PBNP does not currently have offshore velocity caps therefore this is considered unavailable to PBNP.
(5)	Modified Traveling Screens per 40 CFR 125.92(s)	No biological performance goal. Effective for many non-fragile fish species at intake velocities greater than 0.5 ft/s. The screens themselves are meant to be an off-the-shelf technology and their operation has broad precedent in the industry.	High capital costs and relatively high maintenance costs given unusually long fish return system. Challenges with locating the fish return terminus due to ice on the lake during winter months as well as the geometry of the intake relative to the discharge canal. Poor performance with "fragile" species (e.g., Alewife) which dominate impingement at PBNP. Costly requirement to perform two years of optimization studies per 40 CFR 122.21(r)(6)(i).	Retained for additional consideration due to precedents for installation and operation. See Section 6.3.2.

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Citation – 40 CFR 125.94(c)	Title and Summary	Advantages	Disadvantages	Decision and Basis
(6)	System of Technologies as the BTA for Impingement Mortality	Allows for consideration of multiple factors in reductions to IM (e.g., seasonal intake flow reduction, intake position and acoustic deterrents). Low incremental installation and operation costs	System of measures is based on three separate contributing factors complicating quantification. Subject to optimization study which is poorly defined for this alternative and the three component measures. Performance of the approach should be "informed by" the quantitative standard at 40 CFR 125.94(c)(7).	Retained for additional consideration due to measures that are in place at PBNP and the poor biological performance of MTWS and a fish return. See Section 6.3.2.
(7)	Impingement Mortality Performance Standard	None apparent relative to IM BTA measures (5) and (6).	Requires ongoing performance monitoring and includes quantitative performance standard. Costs are not reduced relative to IM BTA measure (5) and regulatory risk increased.	Rejected. EPA expected this option to apply to new/innovative technologies. PBNP is not aware of any such technologies and, due to concerns regarding safety and reliability, is reluctant to pursue any such first-in-industry technology. The preamble to the rule acknowledges that few, if any, facilities are likely to pursue this alternative due to the risk and more favorable alternatives.
(11)	*De minimis* rate of impingement mortality	If rates of impingement are demonstrated to be *de minimis* to the satisfaction of the Director, existing design and operational measures could be maintained.	PBNP impingement rates may be too high to qualify under this compliance measure.	Rejected as unlikely to be applicable at PBNP.
(12)	Low capacity utilization power generating units	Allows for relief from otherwise applicable IM BTA standards.	The capacity utilization of both generating units for the last contiguous 24 months far exceeds 8 percent.	Rejected. Not applicable at either of PBNP's units.

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6.3 Additional Assessment of IM BTA Measures

This section presents additional assessment of three candidate measures for IM BTA at PBNP. The first assessment is focused on the feasibility of wide-slot wedgewire screens as a potential means to reduce the intake velocity to less than 0.5 ft/s per 40 CFR 125.94(c)(2). The second two assessments include the conceptual approach for the two IM compliance options retained for further analysis: modified traveling screens (40 CFR 125.94(c)(5)) and a system of measures (40 CFR 125.94(c)(6)). This section will begin with a brief review of impingement patterns at PBNP as context for evaluation of IM BTA measures.

6.3.1 Patterns of Impingement at PBNP

Impingement at PBNP was characterized following the Phase II Rule in the 2007 Impingement Mortality and Entrainment Characterization Study (IMECS) (EA, 2007 - see also Section 4.2.5). Annualized impingement estimates based on sampling conducted during 2006 was highly dominated by Alewife (representing 99 percent of the annual impingement). The next most abundant species was Rainbow Smelt (0.44 percent). Both of these species are considered to be "fragile" by the Final Rule (see 40 CFR 125.92(m)) which has implications for the potential impingement BTA at PBNP (see below). The majority of impingement at PBNP occurs during the spring and summer months but some impingement is observed in the fall and winter as well (see Figure 6-1). Alewife impingement, in particular, can be especially variable with episodes of very high rates associated with the schooling nature of the fish and the seasonal die-off that occurs in Lake Michigan.

The seasonal pattern of impingement of non-fragile species as measured in the Phase II investigation is presented in Figure 6-2 (note the substantial difference on the y-axis scale compared with Figure 6-1). It is important to note that non-fragile fish could be impinged throughout the year indicating that an IM BTA measure would be more effective if deployed year-round including during the winter.

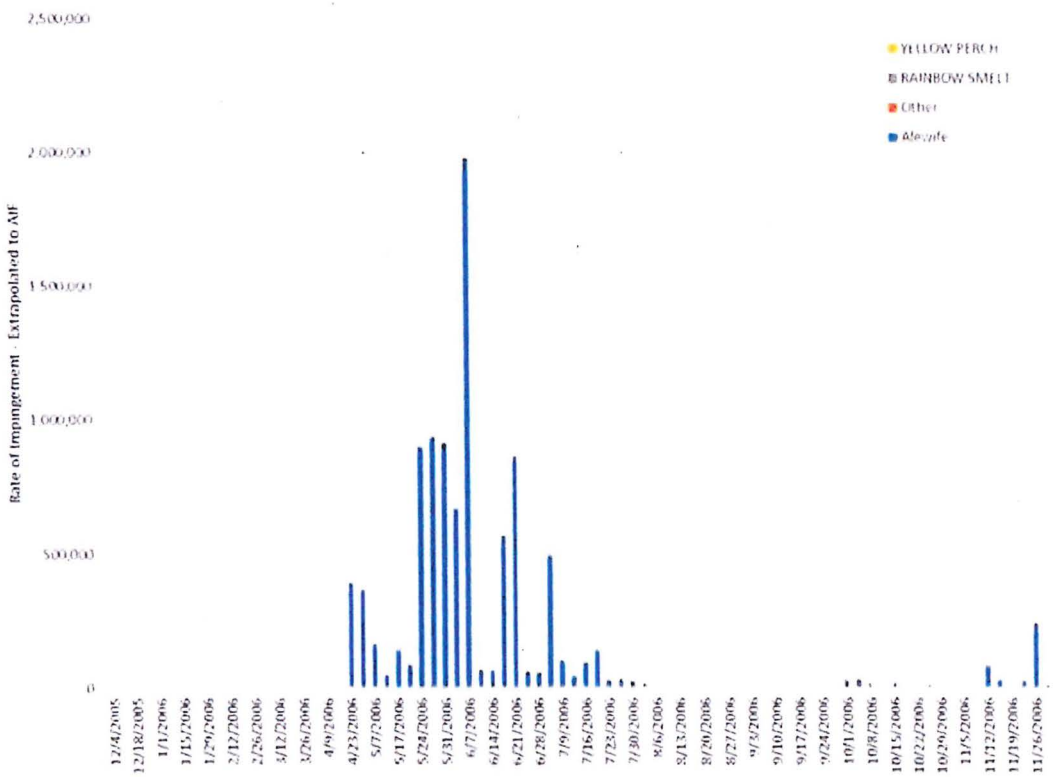


Figure 6-1. Seasonality of Impingement at PBNP

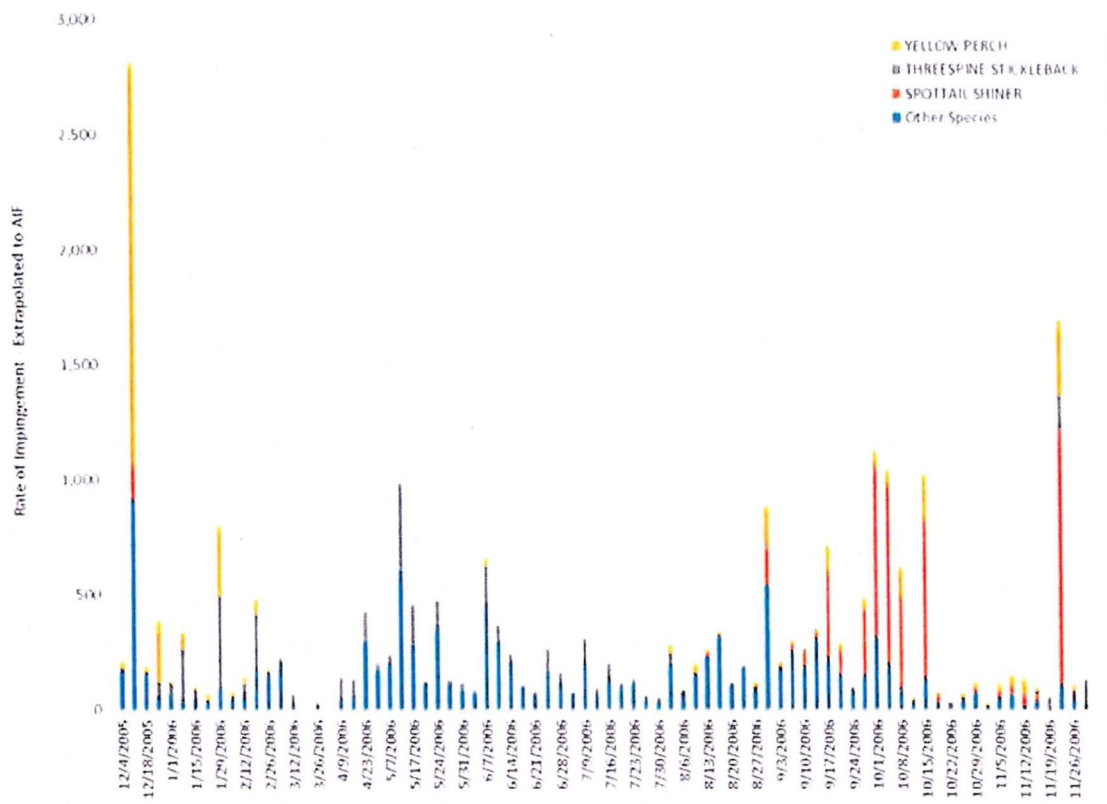


Figure 6-2. Seasonality of Impingement of Non-Fragile Species at PBNP

Because of the provisions of the Phase II Rule, the IMECS included an evaluation of the intake's differences from the "calculation baseline", including impingement reductions due to three measures in place at PBNP during sampling: offshore intake, acoustic deterrent system (ADS), and reductions in cooling water intake. These measures are still in place at PBNP and are evaluated further in the analysis of the system of measures (see below).

6.3.2 Additional Assessment of Wide Slot Wedgewire Screen

PBNP considered the potential to install a wide-slot wedgewire screen system to reduce a through-screen velocity (TSV) to less than 0.5 ft/s consistent with IM BTA under 40 CFR 125.94(c)(2). Such an installation must be considered relative to constraints on the water level in the pump bay. These water level constraints are documented in PBNP's internal operating procedures (designated TLOC 3.7.7 and discussed further in Section 10.5) which indicates that water levels in the forebay and/or pump bays should not be less than elevation -11.5 feet (relative

to the station's datum) and a low-level alarm should be set no less than elevation -11.0 feet. These represent critical water level conditions that jeopardize the plant's operation. The potential that normal operating conditions of wide-slot wedgewire screens and/or a rapid clogging event could result in insufficient water in the pump bays is of paramount concern to PBNP.

Sixteen (16), 84-inch tee-screens (84-inch diameter tee-shaped screens) would be needed to accommodate the total PBNP withdrawal while maintaining a through-screen velocity (TSV) of less than 0.5 ft/s. The screens would have 0.375-inch slot openings which will prevent the entrainment of impingeable-sized organisms. The low TSV and approach velocities would facilitate escape from the screen surface by fish. These screens would be mounted to large header pipes connected to a bulkhead wall constructed around the existing offshore intake. The bulkhead walls would extend above the maximum wave height and support a work deck, the screen cleaning equipment and emergency bypass system. An approximately 1,750 ft long pier would be used to provide year-round access to the work deck and other equipment. NextEra believes that such a work deck would be necessary to provide access and service to the screens and emergency bypasses given the critical nature of cooling and service water supplies at PBNP.

The major concerns to be considered when determining the feasibility of a wide-slot wedgewire screen installation at PBNP are the same as those for narrow-slot as identified in Section 10.5. These factors include: potential for adverse head loss, absence of sweeping currents, debris accumulation, sediments, icing, and biofouling. Some of these concerns are fairly tractable for wide-slot wedge wire screens but they still represent important challenges and uncertainties[17].

Head loss through the screens and intake piping and the presence of frazil ice in the winter are critical issues that would impact screen, cooling water and service water reliability. Under best case, clean-screen conditions, the head loss through the intake would increase by approximately 2 feet relative to current conditions (see Table 6-3[18]). This would result in forebay water levels

[17] Note that the Manitowoc Water Treatment Plant and Oak Creek Elm Road Power Plant utilized wide-slot wedgewire screens in Lake Michigan that failed. Such a failure would be unacceptable at a nuclear power plant.
[18] When the wedgewire screens are clean, they do not contribute substantially to head loss through the system. Under these conditions, additional head loss relative to current conditions is imposed by the additional piping and manifolds, etc. associated with the screen array. For this reason, under clean screen conditions, the additional head losses for wide-slot and fine-slot wedgewire screens are very similar. As the slots of either type of screens are

below the low water alarm elevation of -11.0 feet during low water periods with clean screens. Table 6-3 also provides the pump bay water levels under conditions of 6 inches of additional head loss. This condition could occur frequently under debris loading and such a head loss would be greatly exceeded in the event of a major frazil ice event.

While emergency bypass gates located at the offshore intake would be included to bypass the wedgewire screens in the event of clogging, NextEra believes that such a system is a poor choice as it would reduce the margin of safety in the pump bay water level. Given the constraints on water levels in the cooling system, the transition from through-screen operation to by-pass may be too slow to prevent damage to the CWIS and/or prevent a forced outage. Finally, NextEra believes that the risk of frazil ice in the winter is substantial enough that months-long bypass would be proactively pursued, thereby eliminating the biological effectiveness during those periods.

Water levels would be lowered further by debris, biofouling and frazil ice on the screens as well as biofouling of the new intake piping. Of importance to PBNP is the unacceptable potential for the rapid formation of frazil ice and increased head loss as occurred on two occasions at the Oak Creek-Elm Road facility[19] and once at the Manitowoc intake. Reliable supply of cooling water is necessary for operation of PBNP. More importantly, reliable supply of service water is essential for the facility and, while the discharge flumes may be used for service water supply, NextEra believes that building a new intake configuration that reduces the margin of safety in such a way

occluded either by debris or frazil ice, the head loss at the screen surface will contribute to additional head loss with substantial losses at high percentages of blockage.

[19] The Oak Creek Elm Road facility has an emergency by-pass system that allows for cooling water withdrawal at the lake shore if the wedge wire array is unavailable. Installation of such a system at PBNP would be difficult and costly due to the constrained nature of the pump house with the intake and discharge lines (see Section 10). It would also suffer from the issues described above for by-passes located at the wedgewire screen array. It should be noted that one of the Oak Creek Elm Road frazil ice events resulted in substantial damage to the intake system despite the presence of bypass gates.

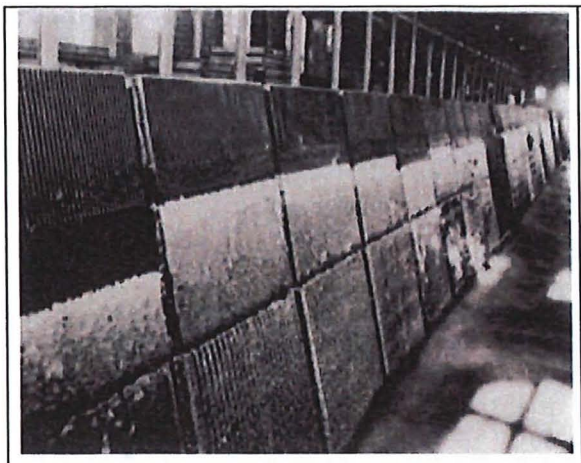
Table 6–3. Estimated Pump Bay Water Levels with 9.5 mm Slot Wedgewire Screens

Case	Head Loss (ft)	Pump Bay Water Elevation (ft)
Normal Operations (2 intake pipes and 4 CW pumps Operating)		
Existing Conditions	-4.3	-9.2
Existing Conditions with Six Inches of Additional Headloss[1]	-4.8	-9.7
9.5 mm Slot Wedgewire Screens	-6.3	-11.2[2]
9.5 mm Slot Wedgewire Screens with Six Inches of Additional Head Loss[1]	-6.8	-11.7[3]
Worse Case Operations (1 intake pipe and 2 CW pumps, 1 per unit)		
Existing Conditions – Clean Screens	-6.0	-10.9
Existing Conditions with Six Inches of Additional Head Loss[1]	-6.5	-11.4[2]
9.5 mm Slot Wedgewire Screens	-6.3	-12.9[3]
9.5 mm Slot Wedgewire Screens with Six Inches of Additional Head Loss[1]	-6.8	-13.4[3]

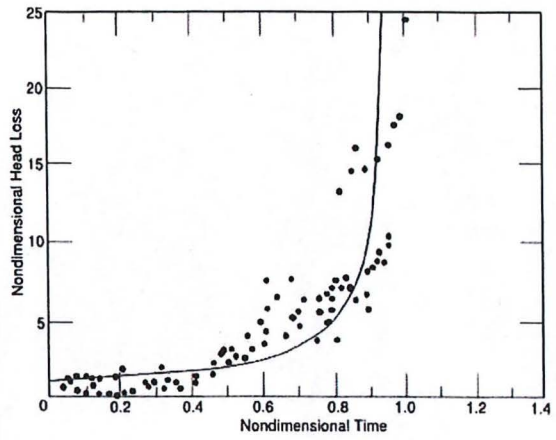
1. Six inches of additional head loss corresponds to 58% screen blockage for the traveling water screens under normal operations. For wedgewire screens, biofouling and blockage may occur at several points in the system making calculation of a unique percentage of blockage impossible.
2. Yellow Cells are below the Low-Level Alarm
3. Red Cells are below the Low Low-Level Alarm and are in violation of TLOC 3.7.7

and relies on a rapid transition of service water source is highly imprudent. Therefore, NextEra concludes that wide-slot wedgewire is not a feasible IM BTA option at PBNP.

Figure 6-3 shows a photograph and a graph that demonstrates the head loss impact on frazil ice on trash racks. Because of the smaller aperture size, the increase in head loss across traveling screens and wedgewire screens would be much faster than at trash racks. The increase in head loss and potential loss of water to PBNP must be avoided. In 2006, in Contested Case Hearing (No IH-05-06) regarding the WPDES Permit issued to Wisconsin Electric Power Company for Oak Creek Power Plant and Elm Road Generating Station, WDNR noted that frazil ice formation poses the greatest risk for clogging the intake screens, and that fouling of wedgewire screens will cause a hydraulic head loss and reduction of water levels in the intake forebays [at Oak Creek-Elm Road facility] (State of Wisconsin, 2006). Figures 6-4 and 6-5 show photographs of frazil ice at a Wisconsin wedgewire intake and a Canadian traveling water screen (respectively). NextEra believes that similar issues could impact PBNP and endeavors to avoid such issues.



Accumulated frazil ice on trash racks raised from the water



Head loss through a trash rack during frazil ice accumulation in laboratory tests

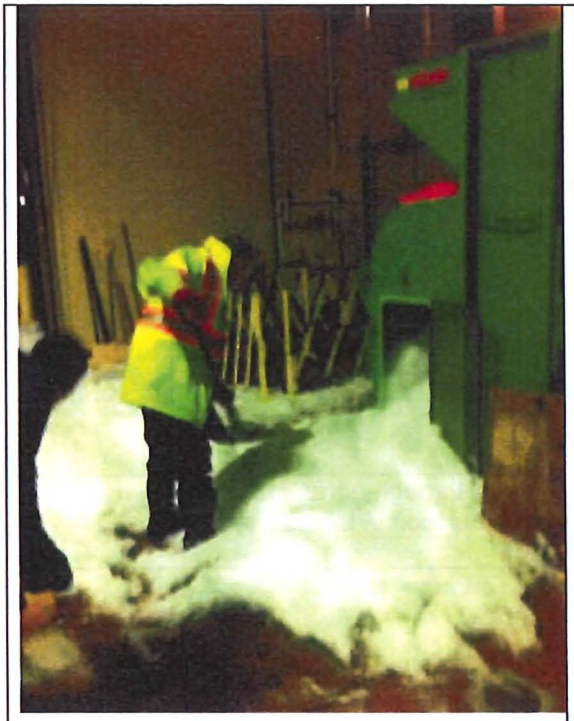
Figure 6-3. Head loss across trash racks during frazil ice events

Source: USACE, 1991.

Water Intake at Manitowoc WI

Figure 6-4. Frazil Ice at Wisconsin Intake

Source: Treatment Plant Operators Magazine, 2014



Intake in Lemieux Island	

Figure 6-5. Frazil Ice at a Canadian Intake

Source: CBC News, 2016.

6.3.3 Modified Traveling Water Screens (Coarse-Mesh)

MTWS equipped with coarse-mesh screens represent a common approach to impingement mortality (IM) reduction for non-fragile species and are described as a potential IM BTA at 40 CFR 125.94(c)(5). The MTWS would have essential features such as a low-pressure wash that precedes a high-pressure wash, buckets at the lower edge of the screen panel to collect and protect the fish, and smooth mesh that reduces descaling and other damage to the animal. The fish return would be constructed and its terminus placed to reduce predation, reduce re-impingement, and avoid large vertical drops (see 40 CFR 125.92(s)).

While use of the approach fully addresses the IM BTA standard under the rule, part of the approach is optimization of the screen operation to maximum post-impingement survival. The Final Rule acknowledges that some "fragile species" are known to survive impingement and

handling at MTWS at low rates (see 40 CFR 125.92(m)). Alewife, Rainbow Smelt, Gizzard Shad are among the species defined as fragile.

At PBNP, such a technology would be subject to several constraints that increase costs and reduce biological performance. These include:

- Modified screens coupled with a fish-friendly return would not result in the live return of the fragile species that dominate impingement at PBNP (Alewife and Rainbow Smelt).
- The end of the fish return would need to be placed beyond the surf zone and would need to be designed to deal with seasonal icing. Placing the fish return between the two thermal discharges is expected to reduce icing concerns, however an ice barrier will still be necessary.
- The return would require dual, insulated return pipes with provision for "pigging" to remove debris and biofouling.
- The current wash water return at PBNP is frequented by avian predators such as seagulls, eagles, and pelicans. This phenomenon would persist with a fish return whether it discharges above or below the water surface. Discharge below the water is not favored because such systems typically require a pressurized discharge and associated "fish pumps", the pipe and supporting structures are subject to damage by ice and debris, and there is no clear reduction in predation relative to an above-surface discharge.

Addressing these issues affects the likely cost of the technology and results in a considerably higher cost than the alternative measure discussed below. Critically, fish handling and return is not expected to result in the live return of fragile species that dominate impingement at PBNP. Even for non-fragile species, post-impingement mortality is expected to occur at some frequency. Therefore, the higher costs incurred for MTWS will not result in fisheries protection that is as effective as the existing measures and would only marginally reduce impingement mortality.

A discussion of the concept, schedule and cost for MTWS and fish return system is provided below for comparison purposes.

6.3.3.1 Description of the Conceptual Design

Each of the eight existing traveling water screens would be replaced with a MTWS consistent with the definition in the Final Rule. In addition to the screen panels and the required buckets, the entire chain, sprocket set motors, controls and framing would be replaced to allow for continuous or near-continuous operation. While it is common for the screen-chain-sprocket assembly to be installed as an integrated unit with the use of a crane, the roof of the PBNP pump house will not accommodate use of a crane so each MTWS will be assembled within the respective bays.

A new set of screen wash pumps, low pressure wash spray heads, and separate trough for collection of fish would be installed and operated nearly continuously. A separate high-pressure wash, after the low pressure, and a debris collection trough would be maintained and provide nearly continuous wash water. Debris would continue to be collected for disposal offsite with the wash water returned to the lake. Collected fish would be routed to a fish return trough with sufficient water to ensure immersion of the fish as well as reliable transport to the lake. It is anticipated that the return will feed by gravity flow to the lake. Under freezing conditions, the fish return will need to be supplied with thermal effluent to prevent icing in the trough as well as at the point of return to the lake.

6.3.3.2 Sizing

The dual spray header would cause the modified traveling screens to be approximately 2 feet taller than the existing screens. The current debris removal system could remain in place; however, the fish trough would need to be routed back to Lake Michigan.

The fish return system would be approximately 400 feet long and consist of two parallel pipes. Each pipe would be 18 inches in diameter, sufficient to route water from both Units 1 and 2. Only one pipe would be used at any time. As noted above, the pipes would have to be cleaned periodically and this would be done using a "pig" that travels through the pipe scouring debris from the walls. Debris collected by the pig would need to be disposed of offsite. Consistent with security measures required at nuclear power plants, the fish return pipe would need to be secured to prevent unauthorized entry into PBNP via the fish return pipe. Such details were not fully assessed for this evaluation.

6.3.3.3 Effectiveness

Modified traveling screens are a proven technology for non-fragile species. Organism survival is based on at least three phenomena: (1) exclusion by the mesh, (2) through-screen velocity and the organism's ability to withstand that velocity, and (3) transfer efficiency from the screen to the organism return trough and successful conveyance back to the waterbody. This option would approximately maintain current through-screen velocities, and assumes that the two-year optimization study of the screens, spray wash headers and organism return system would help improve system performance to the extent practicable.

However, the majority of impinged species are fragile (see below), and their survival on the screen is expected to be low. The rule notes that the fragile species are those that are expected to survive at rates of less than 30% and Alewife have been observed to survive at much lower rates. It is important to note that, in available studies, survival is nearly always measured after fish are washed from the screen and not at the point of return. It is expected that the rate of survival will be lower at the point of return, particularly in extreme weather and icing conditions but also routinely due to predation.

Impingement at PBNP includes three fragile species: Alewife, Rainbow Smelt, and Gizzard Shad. These three species, mainly due to the extreme dominance of Alewife, make up more than 99 percent of impingement. To simplify the analysis, survival of these species upon return to the source water was estimated to be 15 percent and survival of the remaining impinged species was assumed to be 100 percent. This results in an estimate of approximately 15.2 percent reduction in IM with the installation and operation of MTWS at PBNP.

It is important to recognize that the estimate of 15.2 percent reduction in IM is based on the relative numbers of fish impinged in the Phase II IMECS (EA, 2007) and includes the dominance of impingement rates by fragile species. Under the rule, the performance and optimization of MTWS does not extend to any fragile species subject to impingement. For non-fragile species, the rate of impingement survival will be less than the 100 percent assumed in this simple analysis and would be assessed in the optimization study should MTWS be installed and operated as IM BTA.

6.3.3.4 Permitting Effort

Installation and operation of the modified traveling screens and a fish return system would likely trigger the following permits and approvals.

- CWA Section 401/404 permits from WDNR and the US Army Corps of Engineers (USACE) to install the fish return within waters of the state and the Lake Michigan watershed.
- Rivers and Harbors Act Section 10 Permit from the USACE for construction of a pier in Lake Michigan for the fish return system
- WDNR for construction in and along Lake Michigan.
- Local and state construction permits.
- Nuclear Regulatory Commission review and approval of modifications.

6.3.3.5 Monitoring Requirements

Operation of modified traveling screens and a fish return system under the Final Rule requires the technology to be optimized for non-fragile species by conducting two years of biological field studies at a minimum monthly frequency. Such a study will be logistically complicated and costly (i.e., greater than $500,000).

6.3.3.6 Uncertainty

Modified traveling screens are a proven technology for non-fragile species. However, survival of fragile species on a modified traveling screen and fish return system like that considered for PBNP would be low. Post-impingement survival of non-fragile species is likely to be reduced during winter conditions and may be adversely affected by return of the fish to the vicinity of the thermal plumes.

6.3.3.7 Ancillary Advantages and Disadvantages

MTWS are considered to be an off-the-shelf technology and their operation would be similar to the existing screens. Therefore, the impact on the station's operating procedures and staff training would be relatively modest. The implementation of this BTA will increase power consumption, would require regular repair and parts replacement to compensate for wear and tear from continuous operations.

Maintenance and cleaning of the fish return will represent an increase in effort from the current situation. Winter-time operation of the fish return could generate maintenance issues.

As noted above, selection of this approach for IM BTA would require optimization of the screens for non-fragile taxa. Given the relatively low numbers of non-fragile species[20], such optimization may be challenging as it would require sorting through several fish to segregate and hold the non-fragile species.

The fish return system could contribute to fish mortality. When the lake surface is frozen, survival would be lower. A warm-water recirculation system, continuous flow and an ice barrier would help maintain an ice-free opening at the discharge location.

6.3.3.8 Schedule

A tentative schedule for the modified traveling screen implementation is shown in Table 6-4. The following key assumptions are built into this schedule:

- Permit applications would be prepared using a 30 percent design while detailed design may be performed prior to obtaining permits and approvals.
- The fish return system for both units would be constructed in the spring following the installation of the screens. The screens would be operated intermittently with only the high–pressure spray wash prior to installation of the fish return.
- The 2-year optimization study would be performed after the MTWS system, including the fish return, is in place and operational.

[20] Fragile species are excluded from the optimization requirement of the Final Rule.

Table 6–4. Modified Traveling Screen and Fish Return Implementation Schedule

Task	Task Completion Date
Submit 316(b) application	20-Dec
Permit expiration / Final BTA Determination	21-Jun
Engineering Contract, site investigations	21-Sep
Prepare 30% design, prepare permit applications	21-Dec
Prepare 60% and 100% designs (permit approvals ongoing)	22-Jul
Procure screens, receive permits and approvals, bid construction work, select contractor	22-Dec
Site preparation	23-Apr
Install screens for both Units	23-Jun
Upgrade spray wash system and install fish return	23-Jul
Install Ice Barrier	23-Jul
Test and commission screens and fish return	23-Jul
Complete field work for biological optimization studies for impingement compliance	25-Aug

6.3.3.9 Costs

The initial capital cost of implementing MTWS at PBNP, based on an AACE Class 5 estimate, would be approximately $16.2 million[21] in 2020 dollars. This cost includes the design, permitting, procurement and installation of the MTWS. This includes the following installed components:

- Eight modified traveling water screens capable of continuous or near-continuous rotation (based on quotes from other facilities adjusted to the site conditions at PBNP).
- A 400-foot fish return system consisting of two 18-inch diameter pipes, supported on a fixed pier with an ice barrier around the terminus in the lake.
- New high-pressure and low-pressure screen wash pumps and dedicated collection troughs to facilitate continuous concurrent washing of all screens.

[21] This capital cost estimate is a very simple one and NextEra believes that the costs could be substantially higher given the constraints on construction within the screen house.

- Allowances for distributable costs at 15 percent of direct costs, overhead and profit for construction firm at 10 percent of direct costs, administrative cost at 10 percent of overall project costs, and 20 percent contingency of project costs.
- Two years of biological field studies to optimize screen and fish return performance.

Annual O&M costs are estimated to be approximately $1.1 million if the screens and spray wash systems are operated continuously, assuming that:

- On average, one full-time equivalent staff would be required for the overall maintenance of the MTWS and associated pumps.
- Continuous rotation of screens results in additional wear and tear, therefore annual parts repair and replacement would be approximately 10 percent of capital costs.
- No additional chemicals (e.g., biocides) would be required.
- Continuous rotation of the eight MTWS would consume 196 MW-hours per year. Continuous concurrent screen washing would consume 2,189 MW-hours per year. This is approximately 2,307 MW-hours per year more energy than the existing TWS.
- Power costs to operate the screens were assumed to be $85.33 per MW-hour.
- The screens would need to be replaced once every 20 years, but no screen replacement costs are included in the overall O&M estimate.

6.3.4 System of Measures – Currently In-Place at PBNP

One of the three IM BTA options retained for further analysis is a system of measures consisting of the technologies currently in place at PBNP. This system of measures consists of the offshore intake location, the acoustic deterrent system, and the reduction in cooling water flow. A fourth change to the CWIS, the reduction in the size of intake crib so that it no longer projects from the water surface, is also likely to reduce impingement of schooling Alewife that are attracted to the thermal plume. Any benefit from this measure is difficult to quantify and is not considered below. The efficacy of the three measures at reducing impingement at PBNP was evaluated in the IMECS (EA, 2007) and those methods are adapted[22] here to estimate the potential IM reductions afforded by the system of measures.

[22] Changes from EA's approach include adjustment of the proportions of impinged taxa to reflect changed AIF and accounting for seasonality of flow reduction and ADS effects.

Under 40 CFR 125.94(c)(6), the applicant may operate a set of measures which, in combination, reduce impingement mortality. That section of the Final Rule is provided below:

***§125.94(c)** - BTA Standards for Impingement Mortality*

....

***§125.94(c)(6)** - Systems of technologies as the BTA for impingement mortality. A facility must operate a system of technologies, management practices, and operational measures, that, after review of the information required in the impingement technology performance optimization study at 40 CFR 122.21(r)(6)(ii), the Director determines is the best technology available for impingement reduction at your cooling water intake structures. As the basis for the Director's determination, the owner or operator of the facility must demonstrate the system of technology has been optimized to minimize impingement mortality of all non-fragile species. In addition, the Director's decision will be informed by comparing the impingement mortality performance data under 40 CFR 122.21(r)(6)(ii)(D) to the impingement mortality performance standard that would otherwise apply under paragraph (c)(7) of this section. The Director must include verifiable and enforceable permit conditions that ensure the system of technologies will perform as demonstrated;*

The Phase II 316(b) rule allowed comparison of existing conditions to a "Calculation Baseline" (shoreline intake with traveling screens) as an unmitigated pattern of impingement mortality that would occur at a facility. The Final Rule notes that consideration of the system of measures is similar in concept to the Calculation Baseline in that each assesses reductions in impingement mortality associated with different aspects of the cooling system and combines them to evaluate the degree of protection. Such similarity is noted in the preamble to the Final Rule including the note that the applicants are anticipated to use data collected under Phase II to assess potential systems of measures[23].

6.3.4.1 Description of the Technology

The inlet to the PBNP CWIS is located 1,750 feet offshore at a water depth of approximately 22 feet (see Section 3.0). Historical impingement data from other Lake Michigan power plants indicate that offshore intakes impinge fewer fish than those located at the shoreline. Impingement data for several facilities in Lake Michigan, including four plants with offshore intakes (D.C. Cook, Kewaunee, Point Beach, and Bailly) and three with intake canals located at the shoreline (Oak Creek, Port Washington, and Waukegan) were tabulated in the IMECS (EA, 2007).

[23] Federal Register. Volume 79, No. 158. p. 48374 – 48375. August 15, 2014.

When these data are compared, they indicate that shoreline intakes impinge approximately 4.9 times the number of Alewife and 3 times the number of Rainbow Smelt as offshore intakes. Yellow Perch were found to be more common at the offshore intakes. Applying these ratios to estimated annual impingement at PBNP and, assuming that all other species densities remain the same, results in a 79 percent reduction in IM for the offshore intake versus a shoreline intake.

A high-frequency ADS designed to reduce impingement of Alewife surrounds the CWIS (Section 3.0). The ADS is typically operated from April through September. The IMECS reports an estimated 87 percent reduction in Alewife impingement based on literature values from James A. Fitzpatrick Nuclear Power Plant in Lake Ontario (EA, 2007). With the seasonal use of ADS applied at the facility, an 82.2 percent reduction in impingement is estimated.

Additionally, PBNP reduces its cooling water withdrawals through operational measures including the use of a single pump per intake during the winter months and intermittent refueling shut-downs. This results in approximately a 16 percent reduction in flow (AIF 2015-2019 versus DIF, see Section 3.1), which due to the timing of the flow reduction and IM results in a 2.5 percent reduction in IM.

6.3.4.2 Effectiveness

To illustrate these reductions, a hypothetical annual IM rate of 10 million fish was defined using the percent composition, the seasonal distribution of impinged taxa defined by EA (2007) and the recent AIF of the facility. Each of the three impingement reduction measures defined above was then assumed to affect the total impingement rate based on the taxa and the seasonality of the reduction measure:

- The rate of Alewife impingement was reduced from April to September (when the ADS is operating) using the 87 percent reduction of Alewife impingement estimated by Ross *et al.* (1996). Impingement rates from October through March (while the ADS is not active) for Alewife, Rainbow Smelt, Yellow Perch, and other fish species were unaffected by the ADS[24].

[24] The ADS system was deployed and active during the impingement characterization study but up to three of the 16 noise generators were found to be non-functional during some or all of the study. The failure of these generators was estimated to impair the sound field and is likely to have degraded the biological performance of the system in a

- To estimate the reduction in IM for the offshore intake, a 79.6 percent reduction was applied to Alewife and a 66.7 percent reduction applied to Rainbow Smelt; an increase to Yellow Perch (as reported by EA [2007]) was incorporated.
- The IM for flow reduction measures is estimated by reducing IM for each species by the percent difference between the estimated annualized IM based on changes and timing of AIF (i.e., reduced cooling water flow) relative to DIF. These reductions occur during "shoulder month" refueling events and during the winter.

As noted below, the Final Rule acknowledges the challenges of demonstrating the effectiveness of measures to reduce impingement using technologies such as deterrents and offshore intake locations. NextEra notes that the estimated effectiveness of the ADS and the offshore position of the intake are based on careful and extensive studies available in the literature. For example, EA (2007) considered impingement studies at several plants constituting hundreds of samples at the actual CWIS in estimating the changes in impingement rates with movement from onshore to offshore. Repeating such a demonstration at PBNP would not be possible given the intake configuration and the lack of suitability of surrogate measurements such as net collection. Similarly, Ross *et al.* (1996) cycled an ADS array on and off over an extended period of time to arrive at their estimates of effectiveness. There is no expectation that the sensitivity of Alewife would differ at PBNP and compromising the ADS's performance by such a controlled study is counter-productive, as well as costly.

To estimate the total reductions for these three technologies combined, the percent reduction for each technology was applied in series: ADS, offshore intake, flow reduction, and, finally, the three measures in combination. The approach to estimating reductions in IM summarized in Table 6-5 is the one illustrated for a system of measures in the preamble to the rule[25]. The approach accounts for species-specific effectiveness as well as the seasonality of impingement measures and rates of impingement.

manner that is difficult to quantify. Therefore, it is likely that rates of Alewife impingement, and their proportion of annual impingement, are somewhat over-estimated by Phase II effort. Regardless of this, NextEra believes that Alewife are likely to dominate impingement at PBNP with or without the action of the ADS.

[25] FR Volume 79, pp. 48375-48376. August 15, 2014.

The combined system of measures is estimated to reduce IM by 96.1 percent given the timing of deployment of the ADS and the reductions in intake flow as well as the seasonal patterns of impingement. As such, this system satisfies the requirements of IM BTA defined at 40 CFR 125.94(c)(6); i.e., that assessment of the performance of the system of measures be "informed by" the performance goal defined by 40 CFR 125.94(c)(7) or a reduction in IM of 76 percent. In fact, each of two of the independent components of the system, the ADS and the offshore position, are estimated to exceed the performance target of 76 percent by themselves.

NextEra notes that the reduction in IM by 76 percent applies to fish determined to be "non-fragile". Non-fragile fish represent approximately 0.3 percent (or about 30,000 fish) in the AIF-annualized data set. NextEra believes it is appropriate to consider Alewife in the goal of IM reduction under the system of measures given their importance in the site-specific data and their importance as a forage species.

Table 6–5. Efficacy of Measures to Reduce Impingement at PBNP

Case	Total Impingement - #/yr	Percent Reduction from Baseline for Factor	Cumulative Percent Reduction from Baseline	Notes
Base Case	10,000,000	-	-	Proportions of Species Based on EA (2007) and Adjusted for Changes in AIF
	↓			
Seasonal ADS	1,779,402	82.2%	-	Reduce Alewife Impingement by 87% During Deployment Season
	↓			
Offshore Position	418,523	79.0%	95.8%	Reduce Impingement of Alewife and Rainbow Smelt and Increase Yellow Perch by the Changes in Impingement Densities Defined by EA (2007)
	↓			
Seasonal Outages	393,107	2.5%	96.1%	Reduce Species- and Season-Specific Impingement Accounting for Flow Reduction with Outages and Pump Idling

ECT

6.3.4.3 Permitting Effort

These measures are currently in place at PBNP and would not require permits and approvals beyond the IM BTA finding in the WPDES permit.

6.3.4.4 Monitoring Requirements

The nature of the Final Rule's requirement to monitor the system of measures is an important criterion for evaluation of the workability of the system of measures at PBNP. The relevant monitoring requirements are discussed in two sections of 40 CFR 125.94(c)(6): a general introduction and a more specific review of the monitoring for impingement reduction as distinct from reduction in mortality following impingement.

A performance optimization study is required to comply with 40 CFR 125.94(c)(6), as described in the following excerpt:

40 CFR 122.21(r)(6)(ii) *- If the applicant chooses to comply with 40 CFR 125.94(c)(6), the impingement technology performance optimization study must include biological data measuring the reduction in impingement mortality achieved by operation of the system of technologies, operational measures and best management practices, and demonstrating that operation of the system has been optimized to minimize impingement mortality. This system of technologies, operational measures and best management practices may include flow reductions, seasonal operation, unit closure, credit for intake location, and behavioral deterrent systems. The applicant must document how each system element contributes to the system's performance. The applicant must include a minimum of two years of biological data measuring the reduction in impingement mortality achieved by the system. The applicant must also include a description of any sampling or data collection approach used in measuring the rate of impingement, impingement mortality, or flow reductions.*

The rule goes on to define study requirements separately for reductions in impingement and those in impingement mortality. All three components of the system of measures currently in place at PBNP act to reduce impingement as distinct from impingement mortality, therefore the relevant section of the rule is as follows:

40 CFR 122.21(r)(6)(ii)(A) *- Rate of Impingement. If the demonstration relies in part on a credit for reductions in the rate of impingement in the system, the applicant must provide an estimate of those reductions to be used as credit towards reducing impingement mortality, and any relevant supporting documentation, including previously collected biological data, performance reviews, and previously conducted performance studies not already submitted to the Director. The submission of studies more than 10 years old must include an explanation of why the data are still relevant and representative of conditions at the facility and explain how the data should be interpreted using the definitions of impingement and entrapment at 40 CFR 125.92(n) and (j), respectively. The estimated reductions in rate of impingement must be based on a comparison of*

the system to a once through cooling system with a traveling screen whose point of withdrawal from the surface water source is located at the shoreline of the source waterbody. For impoundments that are waters of the United States in whole or in part, the facility's rate of impingement must be measured at a location within the cooling water intake system that the Director deems appropriate. In addition, the applicant must include two years of biological data collection demonstrating the rate of impingement resulting from the system. For this demonstration, the applicant must collect data no less frequently than monthly. The Director may establish more frequent data collection.

The preamble to the Final Rule in its discussion of Impingement Mortality Standards (p. 48326) provides additional perspective on the EPA's intentions for the approach as well as the monitoring required following its selection of IM BTA:

• *Systems of Technologies to Meet the IM Standard—EPA received a substantial number of comments asking whether previously installed technologies or various combinations of technologies and operating conditions could also meet the BTA standard for impingement mortality. For example, some technologies, such as louvers, reduce the rate of impingement, but the effect on overall impingement mortality reduction cannot easily be measured and would not appear in biological sampling of the technology. In EPA's view, the Director should take into account the reduction in impingement—for example, that associated with such technologies as louvers or behavioral deterrents, or due to intake location— when determining permit conditions to include in the facility's permit in order for a combination of technologies to achieve the required impingement mortality standards. Thus, the facility should obtain credit toward the impingement mortality standard for such reductions in the rate of impingement. A number of the flexibilities above were described in the June 11, 2012 NODA, and EPA has included a provision to allow additional flexibility in achieving compliance through the use of a combination of technologies and operating conditions. A facility may use a system of technologies, management practices and operational measures to achieve the impingement mortality standard, including, for example, flow reductions, seasonal operation, unit closures, credit for intake location, behavioral deterrent systems, and other technologies and operational measures. The Director must determine, based on a demonstration by the facility to the Director, that the system of technologies or operational measures, in combination, have been optimized to minimize impingement mortality of all non-fragile species. The Director may require additional operational measures, best management practices, and monitoring as part of the demonstration. In addition, the facility's permit must include conditions to ensure that the facility operates its cooling water intake structures in a manner consistent with the conditions and measures identified in its demonstration to the Director.*

From these excerpts of the Final Rule, NextEra reaches a number of conclusions regarding the requirements to optimize and monitor the system of measures:

- All three measures to reduce impingement that are quantified above are specifically referenced by the Final Rule as potential components of a system of measures to reduce impingement. It is also clear that performance of the system of measures should be

compared to the impingement mortality of a shoreline intake employing traveling screens. This is the evaluation performed by EA (2007) and updated above.

- The potential that the existing system of measures may address IM BTA is clearly supported.
- The Final Rule notes that direct measurement of reductions in impingement may be difficult or impossible. It is clearly anticipated that "flexibilities" should be considered and "any relevant supporting data" may be used to support the estimation in reductions.
- The Final Rule focuses on protecting non-fragile fish, which at PBNP make up a very small fraction of the total annual impingement. NextEra has invested in an ADS designed to reduce impingement of Alewife based on concern that Alewife, while fragile, are an important forage fish in Lake Michigan[26]. NextEra continues to believe that reducing Alewife impingement is an important goal despite the species exclusion from the optimization requirement of the Final Rule.
- The Final Rule requires "two years of biological data collection demonstrating the rate of impingement resulting from the system". Given the intended flexibility available to WDNR regarding evaluating the reductions in impingement achieved by the system, it is important to note that the requirement is to measure the "rate" not the "reduction". The Final Rule also indicates that existing data may be used to address that requirement while noting that data that are more than ten years old require demonstration of continuing relevance.

NextEra concurs with the Final Rule that direct measurement of the rates of impingement reduction associated with the operation of the ADS and the offshore position of the intake is difficult and impractical. These difficulties stem from the highly episodic nature of impingement associated with the schooling of the relevant fragile species as well as the inability to quantify the benefits of the protection measures in a controlled fashion. NextEra also notes that the ADS system has been optimized during its development to be effective at deterring Alewife indicating that additional optimization is not possible. Similarly, the other two components of the system of measures (offshore position and reduction in intake flow) are fixed and not subject to optimization.

[26] NextEra notes that the WDNR 316(b) rule NR 111 considers Alewife to be a nuisance species except that as it occurs in Lake Michigan or Lake Superior.

Should this approach to IM BTA be selected, NextEra would develop a work plan to address the impingement monitoring required by the Final Rule. While the details have yet to be defined, the work plan will have two major elements: a) re-statement of the quantitative basis of the estimated impingement reduction; and b) an effort to characterize rates of impingement with the current system of measures.

6.3.4.5 Uncertainty

Acoustic deterrent systems are a proven technology, specifically for reducing impingement of Alewife, and this technology has been accepted in several contexts including PBNP. It is also widely accepted that an offshore intake reduces rates of impingement. Portions of the ADS were not operating at the time of the 2005 to 2006 impingement sampling study. Therefore, it is difficult to determine the rate of impingement estimated at the facility when the ADS is fully operational.

The calculations presented above were based on Phase II Rule data and the fisheries community may have changed[27]. Rates of impingement are inherently episodic, particularly for Alewife. These factors are also potentially affected by contributing factors such as weather, etc.; however, these contributing factors would marginally impact the overall IM reduction value presented here.

6.3.4.6 Ancillary Advantages and Disadvantages

The ADS system is protective of fragile species which represent the dominant number of impinged organisms at PBNP and important forage taxa in Lake Michigan. Flow reduction and location of the intake more generally affect all impingement.

6.3.4.7 Schedule

As the existing set of technologies, no additional design, procurement, or installation is necessary for this approach. A two-year impingement characterization study would be required for this

[27] While change in the fisheries community has been documented, the number of Alewife larvae entrained in the recent entrainment sampling effort and under Phase II Rule were very similar, providing some evidence that the Alewife recruitment near PBNP has not changed substantially between the two programs.

measure. NextEra proposes to submit a work plan for that study for review by WDNR within six months of the WPDES permit effective date.

6.3.4.8 Costs

As PBNP has already incurred the costs of the system of measures and plans to continue ADS operation, no additional capital or operation/maintenance costs would be incurred. The impingement monitoring study would involve implementation costs of several hundred thousand dollars or more depending upon the scope of the study.

6.4 Proposed Approach for Impingement BTA

Three approaches to IM BTA have been evaluated in the previous subsection. In this section, NextEra summarizes the basis for its recommendation that the existing system of measures is IM BTA under 40 CFR 125.94(c)(6).

Based on design, operational characteristics and efficacy, this evaluation found that wide-slot wedgewire screens and MTWS with a fish return system would be impractical, ineffective and could potentially reduce PBNP operational reliability. Therefore, these two technologies are not recommended. Reducing TSV to below 0.5 ft/s using either a barrier net, a greatly expanded set of traveling water screens[28], or an array of wedgewire screens was found to be infeasible at PBNP.

Wide-slot (9.5-mm) wedge wire screens have application in Lake Michigan but the head loss constraints at PBNP and its essential reliance on service water make the risk associated with frazil ice encountered in these applications unacceptable. For this reason, NextEra has concluded that wide-slot wedge wire screens are infeasible at PBNP.

Installation and operation of MTWS and a fish return consistent with 40 CFR 125.94(c)(5) is a costly and logistically complex process at PBNP. Most importantly, it would not result in additional protection of the great majority of fish impinged at PBNP. Alewife represent 99.3 percent of annual impingement at the recent AIF, while the three fragile species represent 99.7

[28] The potential to expand the traveling water screens associated with FMS panels is discussed in Section 10 and found to be extremely costly and, due to the constraints on the intake, would require an unacceptably long facility outage. The costs and schedule of expanding the coarse mesh screens to achieve TSV of less than 0.5 ft/s are even more substantial given the lower target TSV.

percent of impinged fish. Installation of MTWS would be poorly effective, result in increased maintenance effort, and would have a high installation cost. Given the availability of more effective and far less costly IM BTA in the form of the existing measures, described below, NextEra does not believe that installation and operation of MTWS is warranted at PBNP.

NextEra has chosen to comply with IM reduction requirements using 40 CFR 125.95(c)(6) with a system of technologies consisting of the ADS, offshore intake and seasonal flow reduction. This section documents that the existing system of measures at PBNP greatly reduces rates of impingement. Two aspects of the system of measures, based on literature information as allowed by the rule, each reduce total impingement by approximately 80 percent. These measures, in combination with reductions in intake flow, are estimated to reduce impingement by approximately 96 percent, well above the guideline for system performance alluded to by the rule (76 percent reduction in impingement mortality).

The ADS portion of this system of measures was installed specifically to reduce impingement of Alewife, a species that has been of concern to WDNR due to its importance as forage taxa. NextEra acknowledges that the system of measures approach to IM BTA at 40 CFR 125.94(c)(6) excludes fragile species but believes that the forage provided by the three fragile species justifies application of the system of measures in this case. Given WDNR's concern over Alewife, this approach to compliance complied with the potential requirement for additional measures to protect fragile species under 40 CFR 125.94(c)(9).

Given the nature of the proposed system of measures and the strong basis documenting their performance in the literature, NextEra does not believe that a program of optimization, as required for systems that reduce impingement mortality are necessary at PBNP. NextEra does believe that monitoring of the rates of impingement for two years is required by the rule for such a system.

7.0 Previous Studies - 40 CFR 122.21(r)(7)

The Final Rule's requirements for submittal of information from previous entrainment performance studies are as follows:

§122.21(r)(7) - The owner or operator of an existing facility must submit any previously conducted studies or studies obtained from other facilities addressing technology efficacy, through-facility entrainment survival, and other entrainment studies. Any such submittals must include a description of each study, together with underlying data, and a summary of any conclusions or results. Any studies conducted at other locations must include an explanation as to why the data from other locations are relevant and representative of conditions at your facility. In the case of studies more than 10 years old, the applicant must explain why the data are still relevant and representative of conditions at the facility and explain how the data should be interpreted using the definition of entrainment at 40 CFR 125.92(h).

Entrainment studies were conducted at PBNP in 2006 under the Phase II Rule and again in 2017 under the Final Rule. In its letter to DNR dated January 23, 2018, PBNP requested DNR's concurrence for use of the Phase II entrainment data to partially fulfill the two-year requirement for entrainment data under the Final Rule. DNR responded that entrainment data collected under the Phase II Rule are "reasonable and relevant to address a portion of the entrainment characterization requirements of the 40 CFR 122.21(r)(9) rule".[29] Section 9 describes the entrainment characterization program undertaken for compliance with the Final Rule.

Entrainment sampling was conducted in the intake forebay weekly from mid-April through September 2006. A total of 37 ichthyoplankton taxa/life stage groups were encountered in the concurrent entrainment and ambient samples, of which 19 occurred in the entrainment samples. The most abundant ichthyoplankton taxa in the entrainment samples were rainbow smelt (62 percent of total individuals counted), followed by alewife type eggs (18.1 percent), unidentified eggs (4.7 percent), juvenile alewife (3.2 percent), unidentified stickleback (2.4 percent) and unidentified Coregoninae (1.6 percent). All other taxa/life stage groups accounted for less than

[29] February 9, 2018 letter from WDNR's Jason Knutson to Randy Hastings at PBNP

1.0 percent of the ichthyoplankton occurring in the entrainment samples. Two "shellfish" species were included in the entrainment samples: scuds (*Gammarus* sp.) and one *Hyalella Azteca* individual. Overall, entrainment was dominated by *Gammarus* sp.

Entrainment sampling collected during the 2017 study included 72 ichthyoplankton specimens in six taxa, primarily rainbow smelt, burbot, and alewife. Invertebrates again dominated overall entrainment samples, with nearly 100% of the sample comprised of taxa in the Gammaridae family (*Echinogammarus ischnus* and *Gammarus* sp.). Smaller proportions of Mysidae were also present in the invertebrate collections, primarily *Hemimysis anomala*. Table 7-1 compares annualized entrainment rates for fish and invertebrates between the two study periods based on weekly extrapolations using measured flow rates.

Table 7-1. Ranking of Dominant Entrained Taxa in the 2006 (Phase II) and 2017 Entrainment Taxa

	2006 (Phase II)		2017		Total	
	No./yr Estimate*	%	No./yr Estimate*	%	No./2 yr Estimate*	%
Ichthyoplankton						
Rainbow smelt	5,663,806	53%	4,273,710	43%	9,937,516	48%
Alewife	3,418,449	32%	1,141,218	11%	4,559,667	22%
Burbot	243,137	2%	2,663,186	26%	2,906,323	14%
Unidentified	451,516	4%	970,347	10%	1,421,863	7%
Round goby			713,006	7%	713,006	3%
Clupeidae	64,740	1%	291,625	3%	356,365	2%
Stickleback	192,288	2%			192,288	1%
Sculpin	129,437	1%			129,437	1%
Cyprinidae	128,826	1%			128,826	1%
Slimy Sculpin	128,775	1%			128,775	1%
Coregoninae	125,676	1%			125,676	1%
Common carp	64,740	1%			64,740	0%
Catostomidae	63,786	1%			63,786	0%
Lepomis	63,786	1%			63,786	0%
Invertebrates ("Shellfish")						
Gammarus sp.	4,057,474,137	100%	1,307,295,469	28%	5,364,769,606	61%
Echinogammarus ischnus			3,349,193,628	72%	3,349,193,628	38%
Hemimysis anomala			12,863,458	0%	12,863,458	0%
Gammaridae			2,189,783	0%	2,189,783	0%
Mysis diluviana			141,929	0%	141,929	0%
Hyalella azteca	62,838	0%	62,838	0%		

** Based on weekly extrapolations using actual pumping rates*

8.0 Operational Status-40 CFR 122.21(r)(8)

The owner or operator of an existing facility must submit a description of the operational status of each generating, production, or process unit that uses cooling water, including but not limited to:

(i) For power production or steam generation, descriptions of individual unit operating status including age of each unit, capacity utilization rate (or equivalent) for the previous 5 years, including any extended or unusual outages that significantly affect current data for flow, impingement, entrainment, or other factors, including identification of any operating unit with a capacity utilization rate of less than 8 percent averaged over a 24-month block contiguous period, and any major upgrades completed within the last 15 years, including but not limited to boiler replacement, condenser replacement, turbine replacement, or changes to fuel type;

(ii) Descriptions of completed, approved, or scheduled uprates and Nuclear Regulatory Commission relicensing status of each unit at nuclear facilities;

(iii) For process units at your facility that use cooling water other than for power production or steam generation, if you intend to use reductions in flow or changes in operations to meet the requirements of 40 CFR 125.94(c), descriptions of individual production processes and product lines, operating status including age of each line, seasonal operation, including any extended or unusual outages that significantly affect current data for flow, impingement, entrainment, or other factors, any major upgrades completed within the last 15 years, and plans or schedules for decommissioning or replacement of process units or production processes and product lines;

(iv) For all manufacturing facilities, descriptions of current and future production schedules; and

(v) Descriptions of plans or schedules for any new units planned within the next 5 years.

PBNP Unit 1, currently rated at 631 megawatts (MW) generation capacity, was licensed in October 1970 and came online in December 1970. Its license was renewed in December 2005 and it expires in October 2030. Unit 2, currently rated at 632.5 MW, was licensed in March 1973 and came online that month. Its license was renewed in December 2005 and it expires in March 2033. The original steam generator in Unit 1 was replaced by a new generator in 1984; Unit 2's steam generator was replaced in 1996 (PBNP, 2004).

Both units underwent measurement uncertainty recapture power uprates in 2002 of 1.4 percent from 1518.5 megawatts thermal (MWt) to 1540 MWt) in 2002 (NRC, 2002). An extended power uprate of 17 percent was approved by the NRC for PBNP in 2011 (NRC, 2019). The extended power uprate increased the licensed core power output from 1,540 MWt to 1,800 MWt.

Both units are on a staggered 18-month operation cycle, with scheduled outages for maintenance and refueling. When not in an outage condition or temporary downpowers for NRC-required testing or during minor maintenance as required throughout the cycle, PBNP operates at or near 100 percent of rated capacities on a monthly basis. The capacity utilization rates for each unit over the past five years are provided in Table 8-1. During this five-year period, Unit 1 underwent refueling outages during March/April 2016, October 2017, March/April 2019, and October 2020. Unit 2 underwent refueling outages during October 2015, March/April 2017, and October 2018 2020. Monthly average generation rates for the five-year period are tabulated in Section 10.7.2.2.

Table 8–1. Capacity Utilization Rates 2015-2019

Year	Net Capacity Factor (%)	
	Unit 1	Unit 2
2015	98.6	91.3
2016	92.3	99.4
2017	92.3	90.7
2018	98.7	93.4
2019	91.2	98.9
5-year Average	**94.6**	**94.7**

Source: NextEra, 2020

9.0 Entrainment Characterization Study - 40 CFR 122.21(r)(9)

The Final Rule's requirements for an Entrainment Characterization Study are as follows:

> ***§122.21(r)(9)*** *- The owner or operator of an existing facility that withdraws greater than 125 MGD AIF, where the withdrawal of cooling water is measured at a location within the cooling water intake structure that the Director deems appropriate, must develop for submission to the Director an Entrainment Characterization Study that includes a minimum of two years of entrainment data collection. The Entrainment Characterization Study must include the following components: (i) Entrainment Data Collection Method; (ii) Biological Entrainment Characterization; and, (iii) Analysis and Supporting Documentation.*

The provisions of this section of the Final Rule have been addressed by characterizing the rates of entrainment at PBNP under the review and approval of WDNR. This effort has included summarizing the entrainment characterization methods, summarizing the results of the entrainment characterization, documenting the utility of using data collected under the Phase II Rule for the entrainment BTA analysis, and documenting the attending analyses and other relevant documentation.

As allowed by the Final Rule and approved by WDNR, PBNP has used entrainment rate data collected under the Phase II Rule in 2006 (EA, 2007) to address two years of the required data collection. At the request of WDNR, PBNP prepared an assessment of potential changes in Lake Michigan since the Phase II entrainment characterization that might affect the current relevance of those data. WDNR approval of the findings of this Waterbody Status Report (Appendix 9-A) and consent to use the Phase II data as partial fulfillment of the Final Rule's 2-year data requirement was confirmed in February 2018 (Appendix 9-B).

The integrated results of the entrainment characterization effort (Appendix 9-C) were used in assessment of technology effectiveness and estimation of social benefits described in Section 11. Methods and results of the entrainment assessment as well as the assessment of ecological

changes in Lake Michigan are presented in the form of EA's and ECT's reports in the following appendices to this document.

10.0 40 CFR 122.21(r)(10)—Technical Feasibility and Cost Evaluation Study

10.1 § 122.21(r)(10) Introduction and Background

10.1.1 Plant

The Point Beach Nuclear Plant (PBNP or Plant) is a steam electric generating station owned and operated by NextEra Energy Point Beach, LLC (NextEra). The Plant operates two nuclear-powered steam generating units under United States Nuclear Regulatory Commission (NRC) licenses. Unit 1, rated at 631 megawatt (MW) generation capacity, came online in December 1970 and has NRC Docket No: 05000266. Unit 2, rated at 632.5 MW, came online March 1973 and has NRC Docket No: 05000301.

The original steam generators were replaced by new generators in Unit 1 in 1984 and in Unit 2 in 1996 (PBNP, 2004). Both units underwent measurement uncertainty recapture power uprates in 2002 and extended power uprates in 2011 (NRC, 2019). The Plant uses cooling water withdrawn from Lake Michigan.

10.1.2 Final Rule Requirement

PBNP is regulated under the United States Environmental Protection Agency's (USEPA's) 2014 Rule for existing facilities developed under the Clean Water Act's (CWA) Section 316(b) (Final Rule[30]) because it has a design intake flow (DIF) of greater than 2 million gallons per day (MGD), uses more than 25 percent of the total water withdrawn exclusively for cooling, and its discharge is regulated under the authorization of a Wisconsin Department of Natural Resources Wisconsin Pollutant Discharge Elimination System (WPDES) permit (WPDES No. WI0000957-08-0). The Plant's actual intake flow (AIF) is greater than 125 MGD; therefore, the Plant is

[30] As noted in Section 1, the State of Wisconsin has promulgated its own rule, Chapter NR 111, Cooling Water Intake Structures, that also governs the assessment of the CWIS at PBNP. While NextEra believe that NR 111 was intended to be consistent with the EPA Final Rule, there are some slight differences that will be pointed out when relevant.

required to submit information requested in the Code of Federal Regulations (CFR) Title 40 Section 122.21(r)(10), among others. This report addresses requirements in Section 122.21(r)(10).

In Title 40 of CFR Part 122.21(r)(10), *Comprehensive Technical Feasibility and Cost Evaluation Study*, the regulations state:

> *The owner or operator of an existing facility that withdraws greater than 125 MGD AIF must develop for submission to the Director an engineering study of the technical feasibility and incremental costs of candidate entrainment control technologies.*
> 122.21(r)(10)(i): *Technical feasibility. An evaluation of the technical feasibility of closed-cycle recirculating systems as defined at 40 CFR 125.92(c), fine-mesh screens with a mesh size of 2 millimeters or smaller, and water reuse or alternate sources of cooling water. In addition, this study must include:*
>
> *(A) A description of all technologies and operational measures considered (including alternative designs of closed-cycle recirculating systems such as natural draft cooling towers, mechanical draft cooling towers, hybrid designs, and compact or multi-cell arrangements);*
> *(B) A discussion of land availability, including an evaluation of adjacent land and acres potentially available due to generating unit retirements, production unit retirements, other buildings and equipment retirements, and potential for repurposing of areas devoted to ponds, coal piles, rail yards, transmission yards, and parking lots;*
> *(C) A discussion of available sources of process water, grey water, waste water, reclaimed water, or other waters of appropriate quantity and quality for use as some or all of the cooling water needs of the facility; and*
> *(D) Documentation of factors other than cost that may make a candidate technology impractical or infeasible[31] for further evaluation.*
>
> 122.21(r)(10)(ii): *Other entrainment control technologies. An evaluation of additional technologies for reducing entrainment may be required by the Director.*
>
> 122.21(r)(10)(iii): *Cost evaluations. The study must include engineering cost estimates of all technologies considered in paragraphs (r)(10)(i) and (ii) of this section. Facility costs must also be adjusted to estimate social costs. All costs must be presented as the net present value (NPV) and the corresponding annual value. Costs must be clearly labeled as compliance costs or social costs. The applicant*

[31] Based on the distinction made regarding infeasibility and impracticality, this evaluation defines infeasibility as a technology that cannot be implemented by allocating additional resources to it, and impractical as a technology that can be implemented if significant resources are allocated to it, but when it does not make sense to implement it.

must separately discuss facility level compliance costs and social costs, and provide documentation as follows:

(A) Compliance costs are calculated as after-tax, while social costs are calculated as pre-tax. Compliance costs include the facility's administrative costs (including costs of permit applications) while the social cost also include Government administrative costs. Any outages, downtime, or other impacts to facility net revenue, are included in compliance costs, while only that portion of lost net revenue that does not accrue to other producers is included in social costs. Social costs are discounted using social discount rates of 3 percent and 7 percent. Assumptions regarding depreciation schedules, tax rates, interest rates, discount rates and related assumptions must be identified;

(B) Costs and explanation of any additional facility modifications necessary to support construction and operation of technologies considered in paragraphs (r)(10)(i) and (ii) of this section, including but not limited to relocation of existing buildings or equipment, reinforcement or upgrading of existing equipment, and additional construction and operating permits. Assumptions regarding depreciation schedules, interest rates, discount rates, useful life of the technology considered, and any related assumptions must be identified; and

(C) Costs and explanation for addressing any non-water quality environmental and other impacts identified in paragraph (r)(12) of this section. The cost evaluation must include a discussion of all reasonable attempts to mitigate each of these impacts.

This document evaluates the technical feasibility and associated costs of a closed-cycle recirculating system (CCRS), fine-mesh screens (FMS), and alternate cooling water sources at PBNP, as required by the Final Rule, as well as other technologies that may reduce entrainment at the Plant.

10.1.3 Report Organization

This report is organized as follows:

- The remainder of this subsection discusses the feasibility and cost evaluation approach in this report, provides an overview of technology types to be assessed, and discusses the social cost evaluation approach.
- Section 10.2 provides an overview of the existing Plant to the extent needed to evaluate feasibility and costs of technologies. Additional Plant data may be found in the 122.21(r)(3), (5), and (8) Reports.

- Section 10.3 discusses the specific approaches and costs of a hypothetical CCRS retrofit of PBNP. A matrix comparing the different cooling tower types as they apply to the Plant is provided in Section 10.3.3.
- Section 10.4 discusses the feasibility and cost of retrofitting PBNP with CCRS;
- Section 10.5 discusses the feasibility and cost of replacing the existing coarse-mesh traveling screens with fine-mesh traveling screens or narrow-slot wedgewire screens);
- Section 10.6 evaluates alternate water sources, such as on-site water reuse, groundwater, and grey water sources. Current water uses and needs are compared to potential alternate water sources within a reasonable distance from the Plant;
- Section 10.7 discusses other technologies that may reduce entrainment at PBNP; and,
- Section 10.8 provides a summary of findings regarding the technical feasibility and cost evaluations.

10.1.4 Technologies and Measures to Be Assessed

The focus of this section, as well as 122.21(r)(11) and 122.21(r)(12), is to examine various measures that may reduce entrainment rates. The Final Rule requires that at least three technologies be considered at the relevant facilities: retrofit to closed-cycle cooling, installation of FMS in the form of traveling water screens or narrow-slot wedgewire screens, and water reuse and/or securing of alternative water supplies.

While the focus of the assessment is a reduction in entrainment, it is very useful to consider how each candidate technology or measure may address impingement mortality (IM) as well. While IM compliance is the subject of the 122.21(r)(6) Report (as required by 40 CFR 122.21(r)(6)), the candidate approaches in this section will be considered in the context of IM and entrainment Best Technology Available (BTA). Measures and technologies that are focused more exclusively on impingement compliance rather than entrainment BTA are not considered here but are in the 122.21(r)(6) Report.

Finally, it should be noted that the range of measures that can be reasonably expected to reduce entrainment is relatively limited. Given the largely planktonic (or non-motile) nature of the majority of entrained organisms, behavioral deterrents will not be effective. Similarly, entrained organisms are generally small (e.g., on the order of a single millimeter [mm]) so that coarse-

mesh screening devices (e.g., 9.5 mm) are ineffective. The mesh size selection for protecting entrainable organisms needs to be informed by the types and abundance of organisms entrained at PBNP; that analysis is provided in Section 10.5. Therefore, a relatively limited set of technologies and measures are available and will be considered here. In the following discussion, the measures are grouped by their essential mode of action (e.g., exclusion, intake flow reduction).

10.1.4.1 Overall Approach—Reduced Intake Flow

Specific Technology: Retrofit to Closed-cycle Cooling. Under this scenario, the existing once-through cooling system would be retrofitted to allow for a CCRS[32]. A variety of closed-cycle configurations are available and will be considered below (see Section 10.3). A common characteristic of all of the systems is that intake flow is reduced substantially, potentially by more than 95 percent in freshwater systems, relative to once-through cooling systems. On the other hand, retrofit to CCRS must account for the existing infrastructure and its constraints. Therefore, consideration of this scenario involves evaluation of several factors related to the existing facility and the potential closed-cycle retrofit.

Specific Technology: Winter Flow Reduction and Warm Water Recirculation. This technology is currently used and is based on reducing the pumping rate in the winter and recirculating warm condenser water from the discharge back to the intake to prevent ice formation at the intake crib. Reductions in flow would reduce entrainment as well. The Plant needs to be able to use the necessary water quantities to support generation in various seasons, therefore this technology does not allow the Plant to commit to potential future reduction rates outside of the winter months. This measure is discussed in Section 10.7.1.

Specific Technology: Variable Speed Pumps. This technology is based on changing the pumping rate on a regular basis to match the generation rate, while meeting thermal criteria in the WPDES permit. PBNP is a baseloaded plant with each unit generating at or near 100 percent capacity during non-outage months. It cannot reduce flow beyond what it already does. This technology is discussed in Section 10.7.2.

[32] CCRS as defined in the regulations at 40 CFR § 125.92 includes cooling towers, a system of impoundments, or any combination thereof. Because Point Beach Nuclear Plant does not have any existing impoundments, this report will focus on cooling towers as a hypothetical CCRS retrofit.

Specific Technology: Water Reuse and/or Alternative Water Supplies. This measure relies on the potential for one or more alternate water sources to replace part or all of the cooling water withdrawn from Waters of the United States. Water reuse within the facility is also to be considered. This measure will consider alternate sources of water to supply the existing once through- system rather than a hypothetical CCRS, as described above.

10.1.4.2 Overall Approach—Fixed Screening Devices

Specific Technology: Wedgewire Screens. This technology relies on the exclusion of the organisms from the intake flow by a fixed screen (typically cylindrical, thus they are commonly referred to as bullet screens) with slots of ≤ 2-mm. It is common for these systems to have low through-slot velocities to address IM BTA while reducing entrainment. Such systems can be quite large at facilities with high electricity generating capabilities and have the potential to interfere with navigation in the source waterbody. The technology's effectiveness of biological exclusion is greatly facilitated by water moving across and past the screen at velocities that are similar to or higher than the through-slot velocity. Such water movement is referred to as a sweeping flow. This represents one of the two forms of FMS (≤ 2-mm mesh or slot), the other one being traveling water screens with a fish handling and return system (see Section 10.1.4.3).

Specific Technology: Aquatic Filter Barrier (AFB). AFBs consist of fabric barriers that are suspended from the water surface and secured to the bottom such that all cooling water should pass through the fabric. The pore size in the fabric is fine enough that entrainable fish and shellfish larger than the pore size are excluded. Design guidelines for AFBs include target through-fabric velocities to prevent organism impingement as well as address other operational issues. AFBs include cleaning systems generally based on release of compressed air from within the AFB to directly remove debris and biofouling as well as shaking these materials from the AFB face.

Specific Technology: Porous Dikes. In theory, porous dikes behave in a fashion that is similar to AFB, but the system is based on a dike that emerges from the water surface. The dike is porous enough to allow water passage while excluding organisms. Porous dikes are not common, because they require several acres of area and can pose significant operational challenges

depending on the operating environment. Porous dikes constructed of a fine-grained material have been considered as a means of excluding entrainable organisms. This technology extends a significant distance out into the waterbody from the Cooling Water Intake Structure (CWIS), and is not suitable for confined waterways with significant navigation.

10.1.4.3 Overall Approach—Modification of Traveling Water Screens

Specific Technology: Installation of Fine-Mesh on Traveling Water Screens with a Fish Handling and Return System. This system is based on the exclusion and collection of the otherwise entrainable organisms from the intake water, washing them from the FMS, and returning them to the source waterbody. This represents one of the two forms of FMS (≤ 2-mm mesh or slot), the other one being wedgewire screens (see Section 10.1.4.2).

Based on the assessment provided in Table 10-1, the following approaches will be discussed further: both forms of FMS (i.e., fine-mesh traveling water screens, fixed wedgewire screens), alternate water sources, closed-cycle cooling, and variable speed pumps.

Table 10-1. Entrainment Reduction Technologies to be Assessed

Alternative	Approach to IM BTA	Effectiveness at reducing Entrainment	Retained for More Detailed Assessment?	Basis of Decision
Modifications of Traveling Water Screens				
Modified traveling water screens, consistent with 40 CFR 125.92(s), with fine-mesh and a fish handling and return system	Modified Traveling Water Screens per 40 CFR 125.94(c)(5)	Based on rates of exclusion and post-exclusion survival as affected by mesh size and species type	Yes, see Section 10.5	Potential approach to FMS, assessment of which is required by 40 CFR 122.21(r)(10).
Fixed Screening Devices				
Wedgewire screens with fine slot and through-slot velocity < 0.5 feet per second (fps)	Through-screen/slot velocity (TSV) less than 0.5 fps at DIF consistent with 40 CFR 125.94(c)(2)	Slot size of 0.5 mm expected to exclude entrainable organisms.	Yes, see Section 10.5	Potential alternative approach to FMS, assessment of which is required by 40 CFR 122.21(r)(10).
AFB	Potentially reduced TSV (40 CFR 125.94(c)(2)) or contribution to system of measures (40 CFR 125.94(c)(6)). Significant reduction in IM possible if system is properly installed and reliable.	Low to high depending upon installation and reliability.	No	AFBs have very limited application. Necessary to build out within Lake Michigan. Ambient conditions in the lake are also not suitable for AFBs due to necessary screen area. There are only a few installations of AFBs and their use for entrainment control is de-emphasized by the manufacturer.
Porous dike	Potential contribution to system of measures (40 CFR 125.94(c)(6)).	Likely low due to imperfect exclusion and creation of artificial habitat.	No	Constraints would also be severe in Lake Michigan including the necessity to fill substantial portions of the lake. Pore clogging. Insufficient space.
Flow Reduction				
CCRS	IM BTA under 40 CFR 125.94(c)(1).	High. Greater than 95 percent reduction in entrainment possible.	Yes, see Section 10.4	Assessment is required by 40 CFR 122.21(r)(10).
Winter Flow Reduction and Warm Water Recirculation	Potential contribution to system of measures (40 CFR 125.94(c)(6)).	Reductions in entrainment generally estimated as proportional to flow.	Yes, see Section 10.7.	Technology currently being utilized at the Plant.

Alternative	Approach to IM BTA	Effectiveness at reducing Entrainment	Retained for More Detailed Assessment?	Basis of Decision
Variable Speed Pumps or Variable Frequency Drives	Potential contribution to system of measures (40 CFR 125.94(c)(6)).	Reductions in entrainment generally estimated as proportional to flow.	Yes, see Section 10.7.	PBNP is expected to generate over 90 percent of the time on average and at close to 100% when not in a scheduled outage; there would be little opportunity to further reduce flow using variable speed pumps.
Alternate water sources	Potentially contributes to IM reduction under 40 CFR 125.94(c)(6)	Reductions in entrainment generally estimated as proportional to flow.	Yes, see Section 10.6	Assessment is required by 40 CFR 122.21(r)(10).
Note: A variety of other measures (including louvers, angled screens, and behavioral deterrents) have been applied at other facilities in an attempt to reduce rates of impingement, they do not provide meaningful reductions in entrainment and, therefore, are not considered here.				

10.1.5 Distinction Between Facility-level and Social Costs

USEPA's interpretation and expectations of facility-level compliance costs and social costs are discussed in 79 FR 48367.

Social costs represent the burden on all members of society; they are "the sum of all opportunity costs incurred", whereas facility-level costs represent only those costs that would be incurred by the facility. Per USEPA (2014), social costs may be higher or lower than facility-level costs. Key differences between facility-level costs and social costs include:

- Facility-level costs include taxes, whereas social costs do not as "taxes are viewed as a transfer and not a real resource cost".
- When estimating present value (PV), facility-level costs use the market cost of capital in the interest rate, whereas the Final Rule requires that social costs be evaluated using both 3 percent and 7 percent discount rates.
- Social costs include the Director's (i.e., the Government's) administrative costs (e.g., costs for agencies to review permits and evaluate compliance).
- Facility downtime associated with tie-ins results in lost revenue to the facility; however, if another facility is dispatched to compensate for lost generation, then the social cost would include only the increase in marginal cost of production at the other facility.

10.1.6 Overview of Facility Cost Development

This subsection will provide context for the nature of the facility cost estimation process.

10.1.6.1 Approach to Cost Estimation and Relationship to Design Process

The goal of this report is to understand the feasibility and approximate costs of a set of measures that may be appropriate to reduce entrainment at PBNP, and in no case is it a detailed design developed for these measures. Instead, an estimate of the technology configuration at the site is used to develop approximate facility costs as well as identify constraints on installation and operation that would affect costs, feasibility, and effectiveness. While this is appropriate for this report, there is a possibility that some significant constraint (e.g., subsurface obstacles to construction) has not been identified by this process and that a more complete design process would result in higher facility costs and/or lower feasibility. This evaluation attempts to develop

a one to 15 percent design to enable an Association for the Advancement of Cost Engineering (AACE) Class 4 estimate to facilitate a BTA determination - see Section 10.1.6.2.

Similarly, the development of these estimates has required decisions to be made regarding the specific technology configurations to be used (e.g., the nature and target velocity of the FMS; the nature and location of potential cooling towers). These items will be discussed in the relevant sections below, but the fact remains that a more complete design process may reach different conclusions about the best configurations and operational strategies.

With this in mind, an attempt has been made to specify a system for each technology that overcomes clear operational problems (e.g., does not result in unacceptable intake velocities; does not exceed the pressure specification of the condensers; accounts for obvious constraints on air emissions and discharge of cooling tower blowdown) while minimizing the facility level costs to the extent practicable. A good example of this tradeoff is the selection of evaporative cooling towers over air-cooled condensers which results in continued water use but with lower capital costs and more modest impacts on the rate of generation.

Tie-ins to the existing facility or other modifications to the existing cooling system invariably increase downtime and associated costs. Therefore, this evaluation considers scenarios where much of the hypothetical construction work would be carried out without disrupting the Plant's operations to the extent practicable and the tie-ins and invasive construction steps would only be performed after the majority of the new construction is complete. This tradeoff will be considered in several places in the following subsections.

10.1.6.2 Level of Facility Cost Estimation

The engineering evaluation presented herein aims to develop a Class 4 cost estimate as defined by AACE. A Class 4 costs estimate was conducted for all technologies except where indicated otherwise. As shown in Table 10-2, a Class 4 estimate suggests costs resulting from a system design of between 1 and 15 percent and is meant to assess the feasibility of a project (which is also the goal of the 122.21(r)(10) engineering evaluation). A Class 4 estimate does not need to assess all costs in detail; parametric estimates that apply to the system are acceptable. Such an estimate is expected to be accurate to -15 and -30 percent on the lower end to 20 and 50 percent

on the upper end. Additional information about cost estimating accuracy may be found at AACE (2016).

Table 10-2. AACE Costing Categories

ESTIMATE CLASS	Primary Characteristic	Secondary Characteristic			
	LEVEL OF PROJECT DEFINITION Expressed as % of complete definition	END USAGE Typical purpose of estimate	METHODOLOGY Typical estimating method	EXPECTED ACCURACY RANGE Typical variation in low and high ranges	PREPARATION EFFORT Typical degree of effort relative to least cost index of 1
Class 5	0% to 2%	Concept Screening	Capacity Factored, Parametric Models, Judgment, or Analogy	L: -20% to -50% H: +30% to +100%	1
Class 4	1% to 15%	Study of Feasibility	Equipment Factored or Parametric Models	L: -15% to -30% H: +20% to +50%	2 to 4
Class 3	10% to 40%	Budget, Authorization, or Control	Semi-Detailed Unit Costs with Assembly Level Line Items	L: -10% to -20% H: +10% to +30%	3 to 10
Class 2	30% to 70%	Control or Bid/Tender	Detailed Unit Cost with Forced Detailed Take-Off	L: -5% to -15% H: +5% to +20%	4 to 20
Class 1	50% to 100%	Check Estimate or Bid/Tender	Detailed Unit Cost with Detailed Take-Off	L: -3% to -10% H: +3% to +15%	5 to 100

Source: (AACE, 2016)

10.1.6.3 Engineering Cost Methodology

The overall engineering cost estimate for each feasible/practical entrainment reduction technology will include the following cost elements:

- Capital and Operational and Maintenance (O&M) Costs
- Facility Owner's taxes on capital and O&M costs
- Facility's administrative costs
- Facility downtime costs
- Mitigation costs associated with non-water quality impacts (discussed in the Section 12 Report)

Capital costs would include (as appropriate):

i. Key components based on site-specific conditions such as:

- Equipment
- Installation
- Foundation costs, potentially including piles depending on subsurface conditions
- Key electrical equipment
- Earth moving (assuming non-hazardous soils)

ii. Parametric estimates for:

- Pumps
- Pipelines
- Conduits and pipes

iii. Lump sum placeholders for:

- Permits
- Valves
- Signage

iv. Costs for modifying, restoring or relocating infrastructure impacted by the installation of the entrainment reduction technology.

- These items will be identified and associated costs developed to the extent practicable for the purposes of this evaluation. These costs will be biased low to present a conservative cost to the permit writer and for the cost-benefit analysis.

O&M Costs will include (as applicable):

- Labor to maintain the new system
- Electricity needed to power new facility systems
- Chemicals associated with increased water treatment
- Maintenance and repair costs
- Solids/sludge removal from cooling tower basin
- Recurring permitting cost (potential)

Facility's administrative costs: For simplicity, this evaluation assumed that the Plant's administrative costs would be approximately 10 percent of the total project costs and spending in each year would be proportional to project spending.

Facility downtime costs: The engineering evaluation estimated the potential downtime associated with each technology implementation.

Mitigation costs associated with non-water quality impacts (discussed in the Section 12 Report): When mitigation measures were proposed in the Section 12 Report, associated costs were included in this report.

The costs were estimated using material quantities and labor estimates developed from the conceptual designs. Most of the costing information is based on published materials and labor costs for Green Bay, WI (RS Means, 2020). Technology-specific costs are based on manufacturer quotes from several similar facilities that were adjusted for identifiable differences in project sizes and operations. The combined costs allow a valid comparison of the cost difference between alternatives and their associated benefits.

Construction-related shutdowns could have a significant impact on the feasibility and costs of the selected intake technologies. For this analysis construction techniques and sequencing were selected to minimize construction-related shutdowns and their impacts. However, when a shutdown could not be avoided the evaluation estimated the duration for the shutdown but did not estimate the resulting cost to the facility; including lost revenue generation, the cost of replacement power and penalties required per the Power Purchase Agreement.

Site-specific conditions, construction techniques, and sequencing identified during the detailed design of a selected technology may result in construction related shutdowns beyond those identified in this study. The impact of construction related shutdowns identified in this study were included in the overall cost estimates, however uncertainty in the length and timing of any construction related shutdowns could result in higher construction costs.

Annual O&M costs were determined for each of the selected technologies. These costs are based on the power, labor, and minor component replacement costs needed to operate and maintain each technology. They are based on the same assumptions used in calculating the capital costs. The power cost to operate each technology was assumed to be $52.66/MWhr (PBNP 2020).

Energy penalty costs represent the estimated loss in revenue from generation losses associated with generating inefficiencies related to flow or operating restrictions. This cost includes both the

cost to produce the electricity and profits lost by that power no longer being available for sale. Durations and amounts of generation loss were estimated, but associated costs were not calculated owing to various uncertainties. Including such costs would increase facility costs beyond what's presented in this report.

Engineering costs will be presented as PV and equivalent annual costs (EAC). PV is provided to convert all the present and future costs to a base year, assumed to be 2020. This was done to estimate the present cost of each alternative over its lifespan. EAC is the annual costs of owning, operating and maintaining each option over the life of the technology. The costs used for the NPV and EAC analysis are based on the incremental changes that NextEra could incur if it had to reduce both IM and entrainment compared to changes to reduce only IM. As discussed below, any costs associated with operation according to the status quo or dedicated to addressing IM compliance alone are not considered in the cost estimation for the entrainment BTA measure.

A period of 30 years (2020-2050) was used for the cost analysis based on an expected retirement date of 2050 for Unit 1, and a period of 33 years (2020-2053) was used for the cost analysis based on an expected retirement date of 2053 for Unit 2 (see Section 10.1.8). Permitting and preconstruction study costs are assumed to start in late 2021. Construction costs are assumed to occur after completion of the design and permitting, with annual and periodic costs occurring thereafter. Taxes were assumed to be 5 percent; interest/discount rate was assumed to be 8.5 percent; and the escalation rate was assumed to be 3 percent (NextEra, 2019).

10.1.7 Process of Estimating Social Costs

10.1.7.1 Categories of Social Costs

Social costs can be delineated as each of the following:

- Compliance costs—direct purchase installation and operation
- Government regulatory costs—monitoring, administration, enforcement
- Power system costs—increased fuel cost impacts from energy penalty and proposed outages.
- Environmental externalities—changes in environmental quality such as those to water flow, noise, emissions, and viewsheds.
- Economic Impacts—unit closures and long-term electricity price increases.

Because the Final Rule does not require quantification of all social cost components, only those social cost components expected to be large and easily quantified were monetized. Thus, the analysis conducted for PBNP includes quantitative estimates for the first three categories listed above. Social cost components that were likely to be small and/or difficult to quantify (for example, unit closure and electricity price increases) were not estimated. The result is therefore best characterized as a partial social cost estimate.

Compliance costs result from purchasing, installing, and operating technologies at PBNP. Government regulatory costs are developed from EPA's estimates in the Final Rule (79 FR 158, 48300–48439). The social costs from power system effects are developed from evaluating backpressure and auxiliary load effects, capacity losses from each of the technologies with estimated outage times, electricity consumption associated with each technology, and externality costs for the CCRS option (Veritas, 2020).

10.1.7.2 Financial and Regulatory Environment

Point Beach is owned by NextEra, a limited liability company formed in 1998 to aggregate NextEra Energy's competitive energy businesses (U.S. Securities and Exchange Commission [SEC] 2019). NextEra owns, develops, constructs, manages, and operates generation facilities in wholesale energy markets in the United States as well as internationally. NextEra assets include approximately 20,400 MW of nuclear, coal, oil, natural gas, and solar generating capacity across 36 states (U.S. SEC 2019).

Generating plants owned and operated by traditional, rate-based electric utilities were built to serve those utilities' customers. Through the ratemaking process, customers are required to pay for the plant's construction and operation and maintenance costs. Investors in the utility are then allowed a fair financial return on the capital investment. The financial return investors earn is determined by the competitive marketplace where the plants operate.

The costs associated with new entrainment reduction technologies would result in a decrease in the plant's balance sheet and are specified to be passed on to NextEra's shareholders as an additional cost of operating Point Beach. The analysis specifies that the costs are passed on to

NextEra's shareholders as a decrease in dividends. The ability to absorb these costs without significant negative financial impacts is dependent in large part on future wholesale power market conditions and the financial health of the overall company.

10.1.7.3 Market Environment

PBNP's physical location, grid connections, and history provide insight into the power system implications of reductions in output from the power plant. PBNP is located on the western shore of Lake Michigan near Two Rivers, Wisconsin. NextEra obtained PBNP in 2007 by purchasing the plant from Wisconsin Electric Power Company (WE Energies) (NextEra Energy 2007). As part of the purchase agreement, WE Energies agreed to repurchase the power produced by the plant through the current Nuclear Regulatory Commission (NRC) license terms of 2030 for Unit 1 and 2033 for Unit 2. In 2011, the NRC approved a 17 percent increase in power from both PBNP units (NRC 2011). The plant is connected to the grid by four 345 kV transmission lines: the Cypress-Arcadian line, the Point Beach-Sheboygan Energy Center line, the North Appleton Bus, and the Point Beach Bus (NextEra 2009b). There are also multiple 138 kV lines connecting PBNP to the surrounding area.

NextEra is one of the largest wholesale generators of electric power in the United States, with approximately 20,400 MW of net generating capacity across 36 states and additional generating assets in Canada and Spain (U.S. SEC 2019). Power is sold in multiple geographic regions to distribution utilities; municipalities; cooperatives; and commercial, industrial, governmental, and residential customers in competitive markets. As NextEra markets and sells electricity from PBNP to We Energies within MISO, it does so within the broadest marketplace that it can feasibly reach. Figure 10-1 depicts Local Resource Zone (LRZ) 2, MISO's service territory within the United States, and the location of Point Beach.

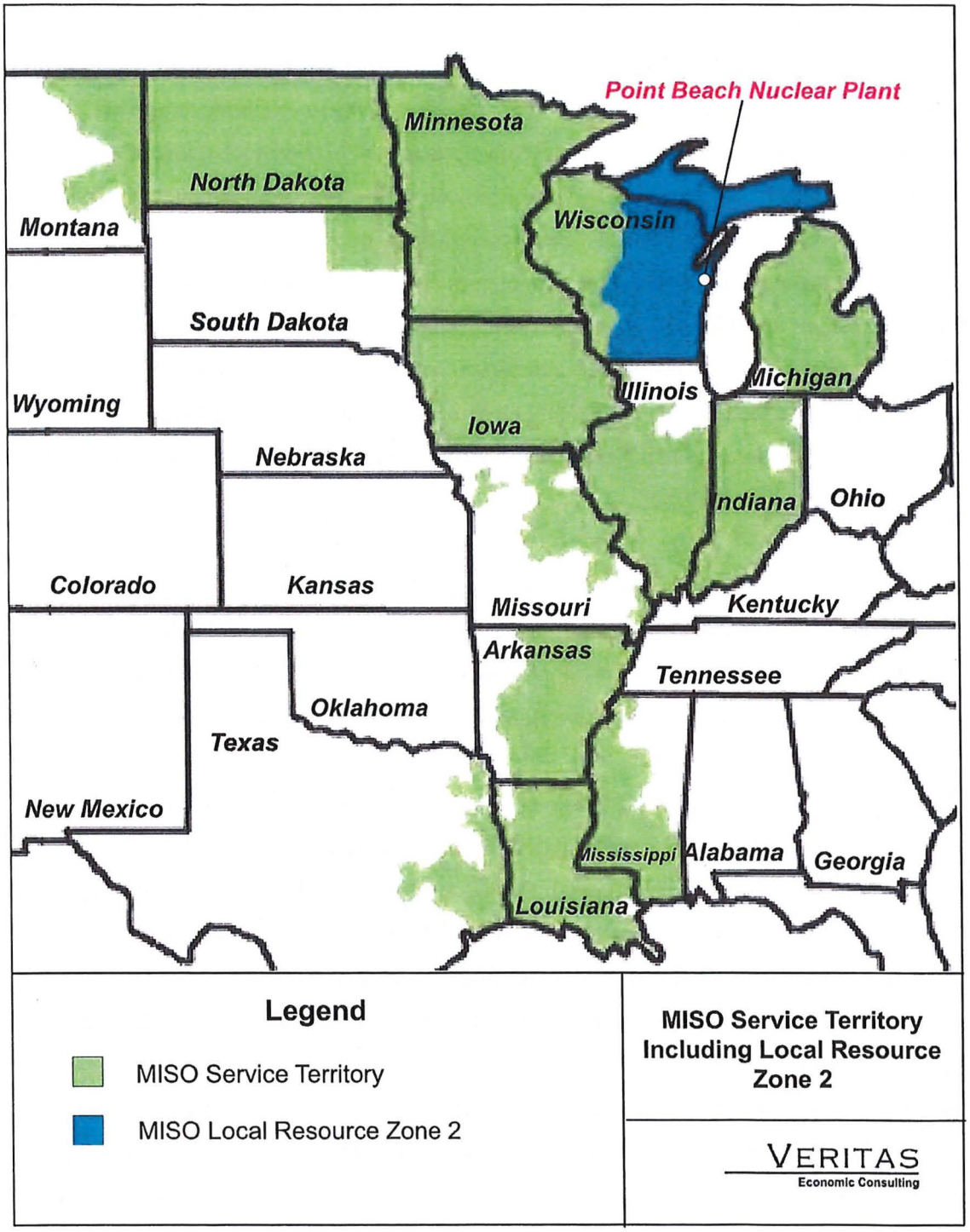


Figure 10-1. PBNP in Relation to MISO's United States Service Territory and Local Resource Zone 2

10.1.7.4 Methods for Social Cost Estimation

The first step in estimating the social costs of compliance is to determine whether the entrainment reducing technology costs result in the plant becoming uneconomic to operate. A pre-mature shutdown of the plant would have social costs related to loss of jobs, loss of income and expenditures, loss of tax base, increased electricity costs due to generation being dispatched at a higher price from less efficient plants, and increased infrastructure costs to maintain grid reliability. Installing entrainment reducing technologies at PBNP to comply with EPA's 316(b) Final Rule represents an additional operation cost that would most likely be passed on to NextEra's customers in the form of higher rates. A very significant capital investment at PBNP would cause an evaluation of premature facility closure versus making the investment. Therefore, the analysis assumes that NextEra would incur the entrainment reducing compliance costs and continue to operate PBNP.

The social costs of installing entrainment reduction technologies are estimated by first determining the design, construction, and installation costs of the evaluated technologies along with the O&M, permitting, and fuel costs. Following the requirements of the Final Rule, social costs are evaluated under two discount rates: 3 and 7 percent (79 FR 158, p. 48428).

For the determination of social costs, PBNP's estimated retirement date was extended for 20 years beyond the current U.S. Nuclear Regulatory Commission (NRC) operating licenses that expire in 2030 for Unit 1 and 2033 for Unit 2. This extension is based on the potential that PBNP may pursue a renewal of the operating licenses allowing operation to 2050 and 2053 for Units 1 and 2, respectively. Compliance costs are specified as occurring over a 27-year time period for cooling towers and a 26-year time period for the FMS technology. This follows the timing developed for the § 122.21(r)(10) report. Power system costs are specified to occur during construction, based on outage impacts, and during operation, based on efficiency and auxiliary load impacts. Regulatory documents will be submitted in 2020; permitting, design, construction, and installation is specified to occur from 2021 through 2026 for a cooling tower retrofit and 2021 through 2027 for FMS. The first full year of operation is specified to be 2027 for cooling towers and 2028 for FMS.

Social costs of a cooling tower retrofit include the compliance costs, the additional power system costs that would be incurred, and the governmental regulatory costs. To determine their social costs, the analysis specifies that the compliance costs would reduce cash flow on NextEra's balance sheet and would be passed on to NextEra's shareholders. To estimate the cash flow decreases, the design, construction, and installation costs are allocated over the specified construction and installation time periods

O&M costs are then added for each year the technology is operational, and the future stream of those costs are discounted by 3 and 7 percent to develop the present value estimate for each discount rate. For the municipal owners, the analysis specifies that their portion of the compliance costs would be passed on to their rate payers as a rate increase.

Power system costs represent the additional power needed to operate the new technologies and the net differences in fuel consumption from running other units during installation construction outages. The power system costs are developed from evaluating backpressure and auxiliary load effects, capacity losses from each of the technologies with estimated outage times, and electricity consumption associated with each technology. Details of the fuel cost estimates are presented in Appendix 10-A.

Governmental regulatory costs include the total costs associated with permitting, monitoring, administering, and enforcing the technology selection and installation. Costs are incurred by the government as the permitting and review process is undertaken. These vary with the type of technology, as certain technologies require substantially more permitting. Those with more significant environmental effects would have higher permitting costs. These costs are initially borne by the government, but ultimately paid by taxpayers. Permitting costs are developed from EPA's estimates in the Final Rule (79 FR 158, 48300-48439) and are specified to be 0.02 percent of direct capital costs.

10.1.8 Remaining Life of the Plant

The remaining life of the generating units and the potential entrainment technologies impacts both social costs and benefits (as affected by O&M costs, duration of changes in plant output, fisheries benefits). Under the current operating license, PBNP Unit 1 is permitted to operate

through October of 2030 and Unit 2 to operate through March of 2033 (NRC, 2018a and 2018b). NextEra notes that some operating licenses (e.g., Florida Power & Light's Turkey Point Nuclear Plant) are being renewed to allow for longer periods of operation (e.g., 80 years rather than the originally planned 60 years). Given this industry trend, NextEra believes that it is prudent to anticipate for the purposes of the CWA 316(b) assessment that the operating license of PBNP could similarly be extended by another 20 years. Therefore, in assessing both social costs and social benefits, this analysis assumes that Unit 1 will remain operational through October of 2050 and Unit 2 will remain operational through March of 2053.

If the original entrainment reduction technology is in good operating order at that time, it is assumed that the technology would be retired then. Any potential salvage value is assumed to be minor and is not evaluated here. If the anticipated life of the entrainment technology is shorter than the anticipated life of the unit, then this evaluation assumes that the technology would be repaired or rebuilt and somehow made available to service the generating unit through 2050 and 2053.

10.2 Existing Facility

10.2.1 Site and Surroundings Summary

PBNP is located near the city of Two Rivers in Manitowoc County, Wisconsin, on the western shore of Lake Michigan. The general layout of the Plant and its surroundings are shown on Figure 10-2 and Figure 10-3. Figure 10-4 provides the population density in the general vicinity of the Plant. The population density within a 1-mile radius of the Plant is very low and increases slightly southeast of the Plant beyond 3 miles. Potential visual, noise, and deposition impacts (discussed in the Section 12) are typically higher when the population density immediately surrounding the Plant is high.

10.2.2 Plant Intake Flows

Relevant portions of the cooling water system are described here; additional information can be found in Sections 3 and 5.

Per 40 CFR Part 125.92(g), DIF is defined as "the maximum instantaneous rate of flow of water the cooling water intake system is capable of withdrawing from a source waterbody". The

regulations allow the DIF to reflect any permanent changes to the system, such as removing pumps from service. In addition, the definition of DIF states that it "does not include values associated with emergency and fire suppression capacity or redundant pumps (i.e., back-up pumps)".

PBNP includes Unit 1 circulating water pumps, Unit 2 circulating water pumps, service water pumps for both units, and screenwash water pumps. PBNP also has fire water and jockey fire water pumps that are used in case of emergencies; these fire protection pumps are not included in the DIF. In normal operation, the flowrates will vary depending on the number of operating circulating water pumps for either or both units.

Table 10-3 provides an overview of the pump capacities, and Table 10-4 provides the different flow regimes for the Plant pump operations.

Table 10-3. Point Beach Nuclear Plant Pump Capacities

Pump Description	Number of Pumps	Pump Capacity (gpm)
Unit 1 Circulating Water Pumps	2 duty	243,000
Unit 2 Circulating Water Pumps	2 duty	243,000
Service Water Pumps	3 duty, 3 spare	5,320
Screenwash Water Pumps	2 duty	1,100
(Emergency) Fire Water Pumps	2	2,000
(Emergency) Jockey Fire Pump	1	55

Source: NextEra, 2020

Table 10-4. Point Beach Nuclear Plant Cooling Water Flowrates

Number of Operating Circulating Water Pumps		Unit 2		
		0	1	2
Unit 1	0	18,160 gpm† (26.15 MGD)	261,160 gpm (376.1 MGD)	412,160 gpm (593.5 MGD)
	1	261,160 gpm (376.1 MGD)	502,160 gpm (723.1 MGD)	641,160 gpm (923.3 MGD)
	2	408,160 gpm (587.8 MGD)	637,160 gpm (917.5 MGD)	**DIF* =** 769,160 gpm (1107.6 MGD)
Source: PBNP, 2020		Plant flowrate for circulating water pumps, service water pumps, and screenwash water pumps		

† This is service and screenwash water.
* Consistent with 40 CFR Part 125.92(g), the fire water and jockey fire pumps are not included in the DIF.

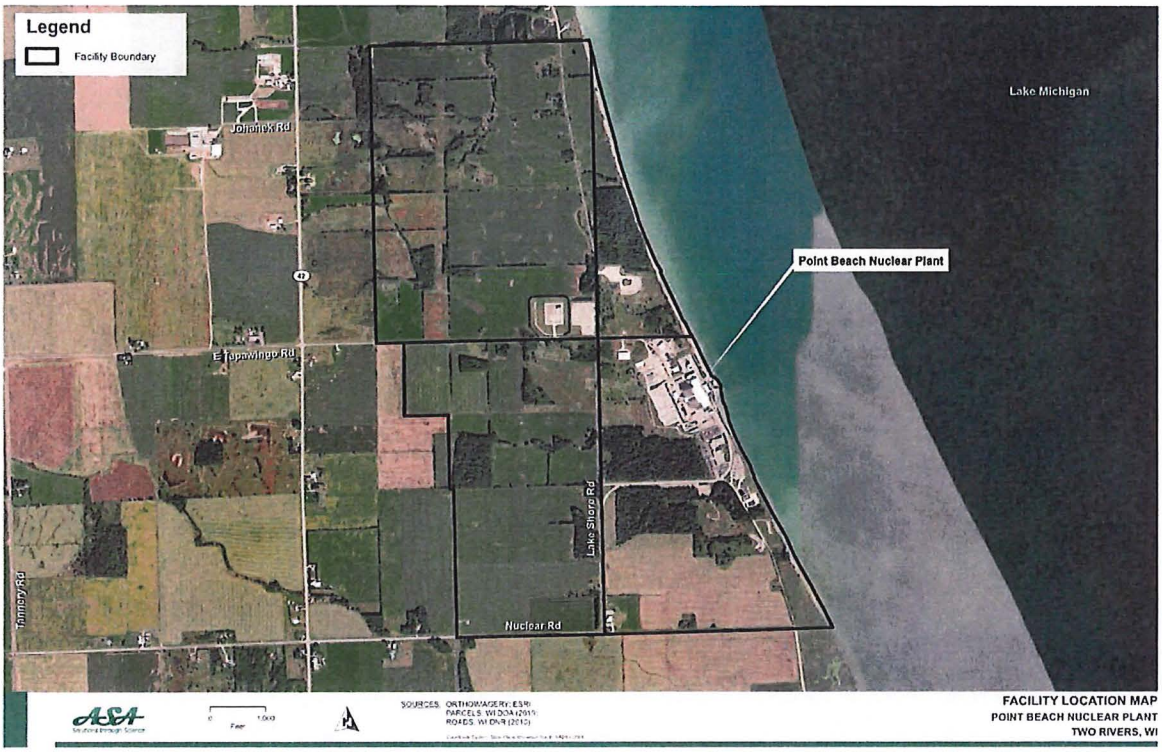


Figure 10-2. Point Beach Nuclear Plant Location Map

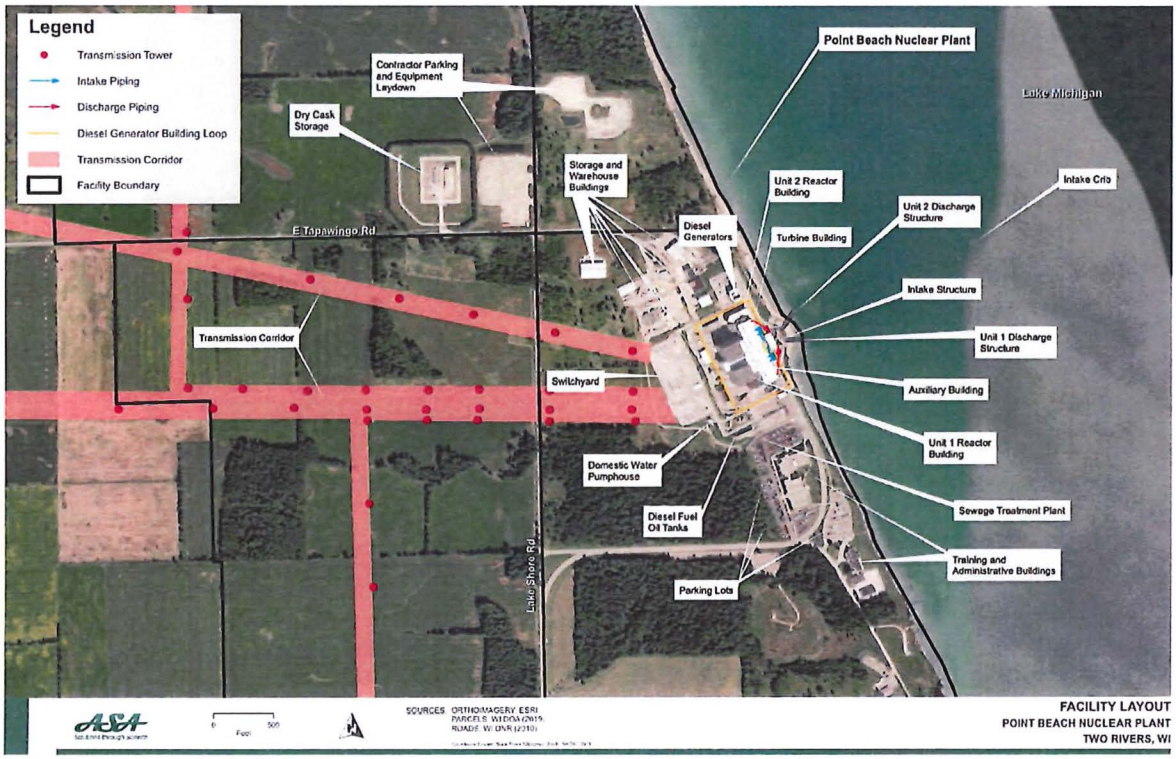


Figure 10-3. Point Beach Nuclear Plant Site Features Map

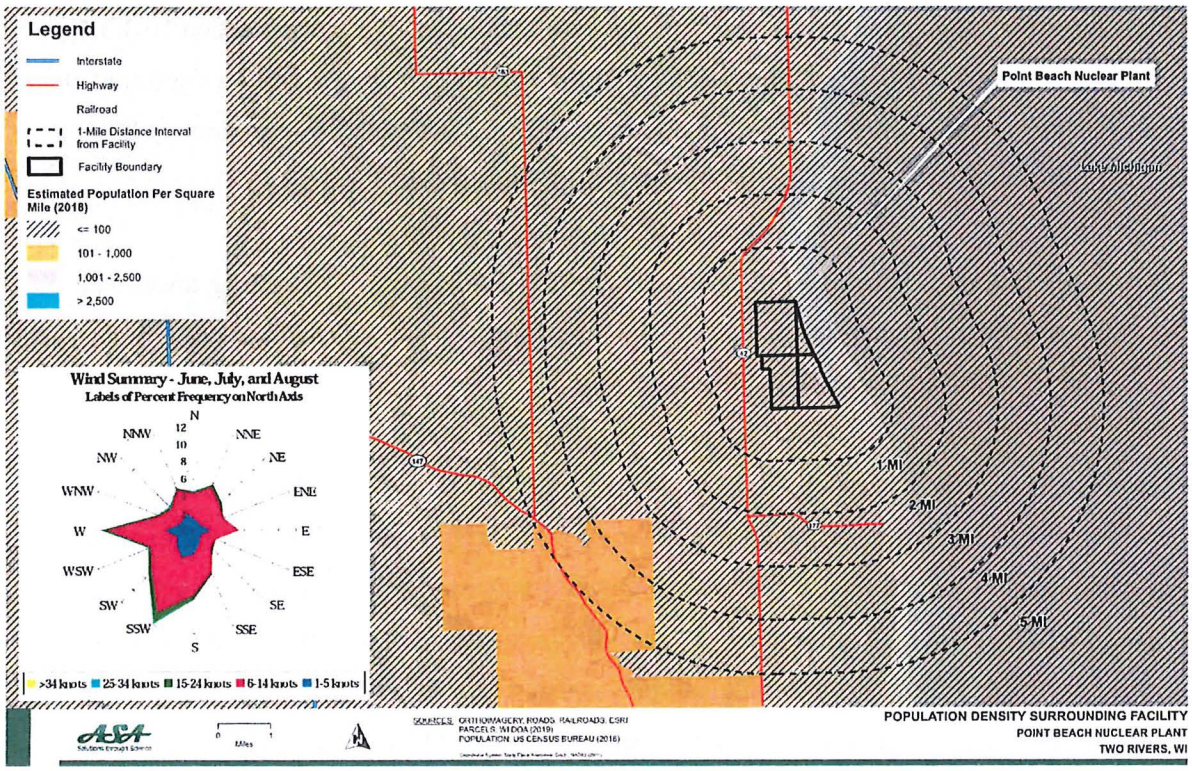


Figure 10-4. Population Density Surrounding Point Beach Nuclear Plant

10.2.3 Existing Cooling System

A plant's condensers and cooling towers need to complement each other; that is, all heat added at the condenser needs to be removed by the cooling tower. When designing a new power plant, the cooling tower and condenser would be evaluated in tandem to achieve optimal performance of both based on site conditions. However, when retrofitting an existing power plant with cooling towers, the existing condensers are used as-is to the extent practicable (EPRI, 2007). While certain reinforcements to the condenser tubes or waterboxes can facilitate continued use of the existing condensers, the design, construction, and age of the existing condensers may not always allow for conversion of an existing once-through system to closed-cycle (see Section 10.3.3.5). This evaluation assumes the existing condensers would continue to be used without substantial modification as part of a CCRS retrofit; however, if CCRS was found to be entrainment BTA, the need to modify or replace the existing condensers would be re-evaluated.

This section discusses the existing condensers at PBNP and the nature of a cooling tower that could potentially be employed. Section 10.3.3.5 discusses the nature of retrofits needed if the condensers and cooling water pipes have to be replaced.

Steam electric power generation facilities use steam turbines and condensers to generate electricity. Turbines typically consist of a rotor assembly, which is a shaft or drum with blades attached; steam is generated in the boiler and moves through the turbine turning the blades and shaft. The rotational energy from the rotor assembly is converted into usable energy to produce electricity[33]. The exhaust steam from the turbine is then condensed to liquid state for reuse in the boiler for the steam generation system by use of a condenser, which is a type of heat exchanger.

Condensers typically consist of multiple tubes encased in a shell, commonly referred to as a "shell and tube". Steam flows through the shell[34] and is condensed when passed across tubes,

[33] The rotor assembly operates in conjunction with an electrical generator.
[34] Depending on the specific design of the condenser, the steam may be instead routed through the tubes and the cold water through the shell.

which contain cold water.[35] The condensate is then collected and returned to the boiler to be reheated into steam and recirculated through the system.

A waterbox is located on both sides of the condenser. On the inlet side, the cold water enters and is directed with uniform distribution towards the tube sheet. The tube sheet is a metal sheet with perforations that allow for entry of water into the condenser tubes. On the discharge side, the warmed water is collected in the outlet waterbox and removed from the condenser. In a once-through system, the warmed water is discharged to a receiving waterbody, and in a CCRS, the warmed water is directed to the cooling tower to be cooled and reused. In the event that a facility is retrofitted with closed-cycle cooling, the waterboxes and condenser would need to be retrofitted with new reinforced piping to form a closed-loop circulating system. Alternatively, reuse of an existing system in a closed-cycle system must accommodate the constraints on the existing system.

PBNP utilizes a single condenser per unit; the design parameters for the condensers that are pertinent to the cooling tower feasibility evaluation are summarized in Table 10-5. The temperature rise across the condenser for both units has been estimated using a Plant total heat rejection rate of 8.723×10^9 British thermal units per hour (Btu/hr) and a condenser circulating water flowrate of 751,000 gpm total for both Units (EA, 2008; NextEra, 2020). The temperature rise has been estimated to be 22 degrees Fahrenheit (°F) for each unit.

Table 10-5. Pertinent Design Parameters from the Existing Point Beach Nuclear Plant Condenser

Parameter	Unit 1	Unit 2	Units	Source
Number of Condensers	1	1	-	NextEra, 2015
Number of Passes	1	1	-	NextEra, 2015
Heat Rejection Rate, Total Duty	8.273×10^9		Btu/hr	WDNR, 2016
Condenser Flow Rate[36]	373,584	377,416	gpm	NextEra, 2020

[35] Tubes may be in a single-pass or multiple-pass arrangement, depending on the design requirements of the condenser.
[36] The maximum flow when all four circulating water pumps are operating has been distributed between the two units proportionate to their maximum pumping capacity.

Cooling Surface	125,650	125,650	sq. ft[37].	PBNP, 1986
Condenser Tubes	12,000	12,000	-	PBNP, 1986
Tube Cleanliness Factor	90%	90%	-	PBNP, 1986
Temperature Rise across Shell	22	22	°F	Estimated
Cold Water Temperature In	75	75	°F	NextEra, 2015

10.2.4 Cooling Water Intake Structure

PBNP's once-through cooling water system is supported by an intake crib located in Lake Michigan approximately 1,750-feet (ft) offshore. Water enters two intake pipes through trash racks and pipe openings that are parallel with the lakebed. Water flows into two 14-ft diameter intake pipes, which then bend and are routed back to the Plant's intake structure (NextEra, 2009a). The intake pipes enter the intake structure near the bottom of the structure, which is approximately 28.5-ft. below the average water level (Alden, 2000).

Each unit has an outfall that discharges non-contact cooling water back to Lake Michigan approximately 200 ft. from the shoreline (EA, 2008). During winter months, a maximum of 200,000 gpm of the discharge is recirculated as deicing water to prevent ice formation (WDNR, 2012).

10.2.5 Constraints on the Cooling Water Intake Structure

The CWIS at PBNP is subject to a number of constraints that could affect the approach to potential retrofits as well as the performance after potential retrofit. Among the key constraints are the following:

- The CWIS is supplied from an offshore crib connected to two subsurface pipes. The system is designed with appropriate net positive suction head to address the requirements of the pumps. Any modification that increases the headloss across the system would reduce the net positive suction head available[38], and potentially reduce the presently built-in margin of safety.
- Formation of ice on the existing screens is an important phenomenon that is carefully managed. Part of the reason for locating the discharge pipes and flumes near the intake

[37] Square feet
[38] The net positive suction head available must always exceed the net positive suction head required in order to avoid cavitation, pump failure, etc. Net positive suction head required is fixed for the existing design.

pipes and intake structure is to allow for warm water recirculation during winter months. Any new traveling water screen would also require warmwater supply to control icing. As discussed below, frazil ice formation is a common and very important problem for offshore wedgewire screens. See Sections 6 and 10.5 for additional discussion.

- Similarly, blockage of the screens by aquatic debris, particularly floating vegetation and algae, have been a problem for the existing traveling water screens and must be considered when evaluating FMS retrofit.
- Maintaining continuous operation of the service water system is critically important at PBNP. During normal operations service water supply necessary to provide emergency cooling of both reactors is supplied by the intake crib and the pair of water supply pipes. During an emergency or planned outage, one or both discharge flumes can reverse its flow to feed the CWIS with lake water from which the service water system takes suction. In no event can this service water be unavailable, making it necessary to develop an alternative, reliable connection to the lake prior to any condition of the existing cooling supply pipes becoming temporarily unavailable.
- Critical water levels necessary to supply both cooling and service water are defined by a facility operating procedure (see Appendix 10-C). Operating procedure accounts for appropriate margins of safety needed at a nuclear power plant. The system as-designed and operated provides the requisite margins, but potential modifications to the intake system could cut into that safety margin. Existing hydraulic constraints on the CWIS are within 2 feet of alarm levels at low lake stage. Any increase in headloss within the system with a new intake configuration, particularly one that may be subject to increased blockage, will increase the probably of low water alarms and cutting into margin of safety.
- The existing intake screen bays and pump bays are located immediately adjacent to the conduits for the thermal effluent in that they share common concrete walls. This arrangement helps with warm water recirculation from the discharge line to the intake screens to prevent icing. But because the discharge pipes flank the intake bays, the configuration greatly complicates any effort to expand the screen area or install the necessary connections for a potential CCRS retrofit.

- In the lake, the intake pipes are located between the discharge flumes, and that configuration complicates any potential expansion of the screen area out in the lake as the width of the expanded intake is limited to the space between the discharge flumes. This configuration also demands that, in order to maintain generation by the units during construction, the subsurface pipelines either be maintained or replaced. Hypothetical expansion of the intake screen area between the discharge flumes would require severing and reconnecting these supply lines resulting in a construction outage. Because of the configuration and size of the discharge and intake lines, rerouting the intake lines would be a difficult and lengthy process.
- The thermal discharge flumes and the intake pipes are located close to each other and at very similar elevations. Tapping into these conduits either to expand the screens or to splice into a closed cycle cooling system must involve complicated construction techniques. Some of the construction steps would require the cooling and service water system to be taken offline in order to avoid an unplanned outage. Interruption of the service water supply from the lake, whether planned or unplanned, would be unacceptable from a safety standpoint.
- The CWIS and thermal effluent pipelines are located immediately adjacent to the protected area and are amongst a variety of other infrastructure (e.g., the firewater ring). Any new connections to these conduits would likely occur outside of the protected area making work next to and in the lake necessary.

These factors will be considered when evaluating potential retrofit to both closed cycle cooling and FMS.

10.3 Closed-Cycle Recirculating Systems

10.3.1 Cooling Tower Principles

Once-through cooling systems can be retrofitted with a variety of cooling tower designs. The designs can be grouped based on factors influencing the type of design, including:

- Method of heat transfer: wet, dry, or combination wet and dry heat transfer;
- Method of air flow: natural draft, mechanical forced draft, mechanical induced draft;

- Direction of air flow: counter-flow or cross-flow; and,
- Shape and Arrangement: rectilinear (i.e., in-line or back-to-back) or round.

These factors impact the cooling tower size and operation, which subsequently affect environmental and social impacts. The method of heat transfer is perhaps the most important factor in determining the type of cooling tower. The types of cooling towers are described in the following subsections.

10.3.1.1 Method of heat transfer

The cooling tower acts as a mechanism to transfer the waste heat[39] to the atmosphere. Heat transfer to the atmosphere can be carried out through one of three methods (SPX, 2009):

- Latent heat transfer, which is associated with the phase changes of water, such as evaporation;
- Sensible heat transfer, which is associated with the incremental change in temperature of a medium, such as air in the atmosphere; or
- A combination of both latent heat transfer and sensible heat transfer.

Cooling towers that employ a combination of both sensible and latent heat transfers are evaporative-type towers and are typically referred to as wet cooling towers. Cooling towers that employ only sensible heat transfer utilize a dry-surface, finned-tube heat exchanger that transfers heat to the atmosphere; these towers are typically referred to as dry towers (SPX, 2009).

Similar to wet cooling towers, once-through cooling systems typically employ a combination of both heat transfer methods; heated water from the once-through system is discharged to a receiving waterbody, which is heated through sensible heat transfer. Latent heat transfer then drives evaporation of a small portion of the waterbody to the atmosphere for further cooling. Sensible heat transfer also occurs from the waterbody to the air, but the cooling provided by sensible heat transfer is smaller than the cooling provided by latent heat transfer.

[39] Heat energy is utilized in the generation of electricity; heat energy that is not converted to electricity is removed to cooling water within the condensers.

10.3.1.2 Method of Air Flow

Air flow through the cooling tower is critical to facilitate both latent and sensible heat transfer. In the absence of air exchange, moisture and heat would accumulate within the tower and retard heat transfer from the cooling tower and the condenser.

As noted previously, the method of air flow can be either natural draft, mechanical forced draft, or mechanical induced draft. With respect to natural draft, the hyperboloid shape has been shown to improve efficiency; the density differential between the heated, less dense air inside the cooling tower and the cooler, denser air outside the cooling tower produces air flow through the tower (SPX, 2009).

Mechanical, forced draft cooling towers have a fan located on the ambient air intake side and blow air through the tower. Forced draft towers typically have high entrance velocities and low exhaust velocities; therefore, they are susceptible to recirculation (SPX, 2009). Recirculation occurs when the exhaust is drawn back into the inlet, increasing the ambient air wet-bulb temperature and decreasing the performance of the cooling tower (SPX, 2009).

Mechanical, induced draft cooling towers have a fan located on the exhaust side and draw air in through the tower. Induced draft towers can have an exhaust velocity of three to four times the entrance velocity, meaning there is little tendency for self-initiating recirculation (SPX, 2009).

10.3.1.3 Direction of Air Flow

As noted previously, air flow through the towers can be either counter-flow or cross-flow. In counter-flow towers, air moves vertically through the tower fill[40], counter to the downward cascade of water (SPX, 2009). In a cross-flow tower, the fill's configuration is such that the air flows horizontally across the downward cascading water (SPX, 2009).

[40] Fill is an important component of cooling towers, because it determines the efficiency of the tower through maximizing contact surface and contact time between air and water while providing the least amount of restriction of air flow (SPX, 2009).

In all types, the ambient air enters the cooling tower from the side and is exhausted through the top; the portion of water that evaporates into the air stream cools the remainder of the water (EPRI, 2011).

10.3.1.4 Shape and Arrangement

Cooling towers can also be characterized by their shape and arrangement. While all-natural draft cooling towers (NDCT) are round, mechanical draft cooling towers (MDCT) can be in a rectilinear arrangement or in a circular arrangement. In a rectilinear arrangement, the MDCT is comprised of cells that can be aligned in a single row (i.e., in-line) or in a double row (i.e., back-to-back) (EPRI, 2011). In a rectilinear arrangement, evaporative cooling towers should be arranged parallel to predominant wind direction corresponding to the warmest and most humid time of the year (SPX, 2009). Cells can be added to meet thermal performance requirements.

In circular MDCTs, fans are clustered as closely as possible to the center of the tower (SPX, 2009). There is an alternate version of round towers where the cells are arranged in an octagonal arrangement, allowing for larger heat loads that impact less area, compared to rectilinear towers (SPX, 2009).

10.3.2 Cooling Tower Terminology

Cooling towers are chosen based on factors that affect their performance. The atmosphere has many variations of psychrometric properties[41], and cooling towers react thermally or physically to each property (SPX, 2009). However, some factors, such as heat load, are more significant than others. The following is a discussion of some key terms.

10.3.2.1 Heat Load

Heat load is the total amount of heat removed from the circulating water by the cooling tower and is a function of the mass flow rate of water entering the cooling tower and the cooling tower range (EPRI, 2011; SPX, 2009). The heat load can be related to the approach and range temperatures; this relationship is shown on Figure 10-5.

[41] Psychrometrics is the field of study relating to physical and thermodynamic properties of gas-vapor mixtures. Typical psychrometric parameters include dry-bulb, wet-bulb, and dew point temperatures.

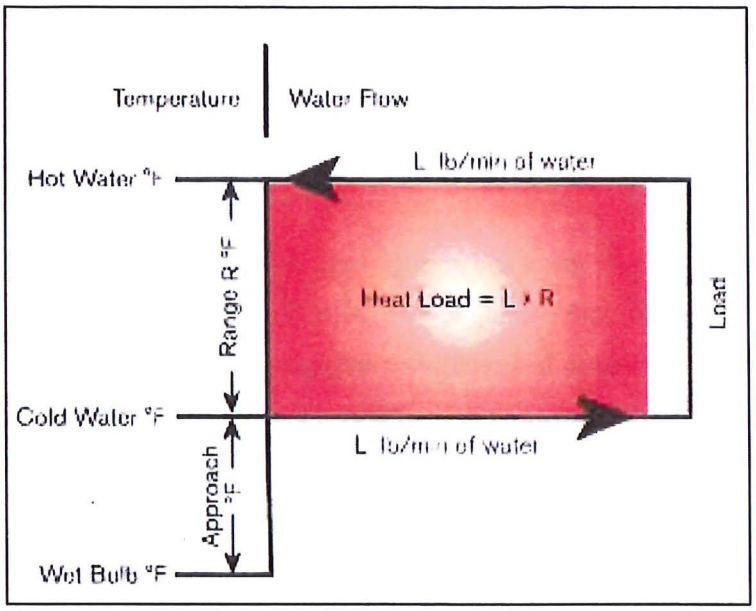


Figure 10-5. Relationship Between Heat Load, Range, and Approach (SPX, 2016)

10.3.2.2 Range

The range is the difference between the hot water temperature entering the cooling tower and the cold water temperature exiting the cooling tower. The cooling tower range is equivalent to the temperature rise across a facility's condensers, which is commonly referred to as the delta T (ΔT). The size and subsequent cost of a cooling tower is proportional to the heat load and the cooling tower range (SPX, 2009). The range is shown graphically on Figure 10-6.

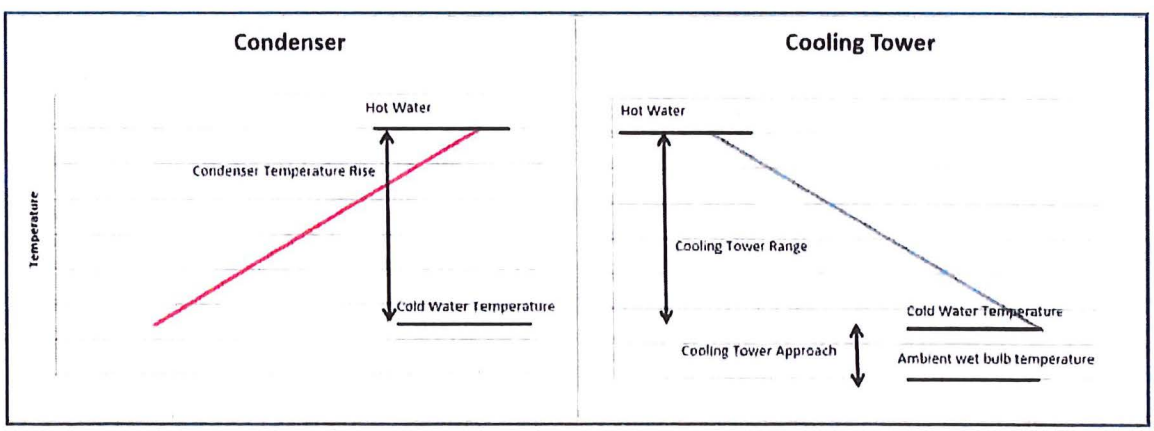


Figure 10-6. Condenser and Cooling Tower Water Temperature Relationships

10.3.2.3 Approach

Another factor that is part of the basis for thermal design and performance of a wet cooling tower is the approach. The approach is the difference between the cold water temperature exiting the cooling tower and the ambient air wet-bulb temperature[42] entering the tower (Figure 10-6). Cooling tower performance and size are inversely proportional to the approach. When varying cooling tower size, the approach starts to become asymptotic near 5°F. Approach temperatures less than 5°F are typically not guaranteed, because errors in measurement of performance are considered to be very significant (SPX, 2009). In addition, approach temperatures less than 10°F are not considered practical.

10.3.2.4 Drift

A portion of the circulating water in the cooling tower is lost[43] due to drift, evaporation, and blowdown. Drift occurs when circulating water is lost from the tower as liquid droplets become entrained in the exhaust air stream (EPRI, 2011). In order to reduce the amount of water lost, drift eliminators can control the loss of water to as low as 0.0005 percent of the circulating water flow rate, and can be installed in wet cooling towers (EPRI, 2011). Water is also lost due to evaporation, which is the main method of removing the waste heat from the circulating water.

10.3.2.5 Blowdown

Operating at high levels of total dissolved solids (TDS) with the continued evaporation of water can cause the impurities to reach saturation levels, which may produce scale and precipitate in the cooling system, lead to corrosion problems, and cause an increase in operation and maintenance costs (USDOE, 2016; USEPA, 2014). Therefore, a portion of the water that circulates between condensers and cooling towers is removed from the system to prevent the build-up of solids and minerals to concentrations high enough to cause corrosion and scaling of various cooling system components. This removal of water is called blowdown. The higher the cycles of concentration (COC), the lower the blowdown rate (see the following discussion of

[42] Wet-bulb temperature is the temperature of air if it were cooled to 100% relative humidity (i.e., saturation) by evaporation of water into it through latent heat transfer.
[43] Basin leaks and overflows can also cause water to be lost from the system when the towers are not properly operated.

COC). Blowdown discharged to a receiving waterbody that is a water of the US is permitted by the Plant's WPDES permit.

10.3.2.6 Cycles of Concentration

As water is evaporated from the tower, TDS remains in the recirculated water, and the concentration of TDS continues to increase as the process continues (USDOE, 2016). Cooling towers are designed to operate within a particular COC, which is defined by the USEPA as "the ratio of dissolved solids in the recirculated water versus that in the makeup water" (USEPA, 2014).

10.3.2.7 Makeup Water

Circulating water that is lost from the system due to evaporation, drift, and blowdown is replaced with makeup water. Makeup water is typically withdrawn from the source waterbody through the CWIS.

10.3.2.8 Cooling Tower Fill

This is one of the most important parts of a cooling tower and is where much of the heat transfer occurs. This is an approximately 7-ft high grid within each cell, that allows water to cascade down through it and air to rise up through it, increasing the air-water interaction time. Fill may be manufactured using several different materials (such as wood, PVC, fiberglass and stainless steel) and different configurations (such as splash fill and film fill). Specific material and configuration would be determined by the application.

Figure 10-7 shows an example of film fill. Additional information may be found in SPX (2009) and SPX (2016).

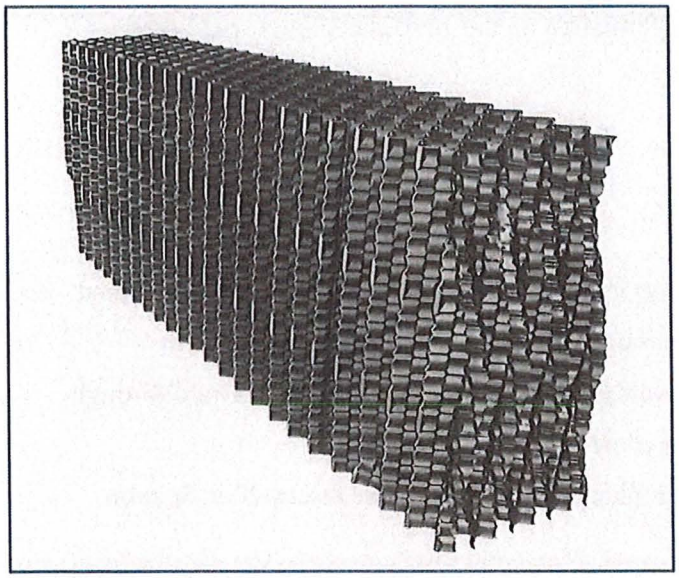


Figure 10-7. Cooling Tower Fill (SPX, 2009)

10.3.2.9 Recirculation and Interference

Recirculation occurs when the saturated air leaving the cooling tower is introduced back into the tower's air inlets (SPX, 2009). Interference is similar to recirculation, with the exception that the saturated air leaving the cooling tower is introduced into a nearby cooling tower's air inlet (SPX, 2009). When multiple cooling towers are utilized, a minimum distance[44] between the towers must be maintained to reduce interference[45].

10.3.3 Review of Candidate Approaches

Based on an initial evaluation (described below) of standard and plume-abated MDCTs, NDCTs, and air cooled condensers (ACC) described in the following sections, MDCTs have been selected for more detailed evaluations in subsequent sections. NDCT and ACC have been found to be incompatible with the design and operations of the Plant. These cooling towers would also result in higher facility costs that would very likely result in higher social costs compared to a standard MDCT.

[44] The minimum distance is typically a function of the length of the cooling tower, as well as the offset between multiple towers. When the site does not allow for the appropriate orientation of towers, the inefficiencies may be overcome by using more powerful fans or by using additional cooling tower cells.
[45] Recirculation is minimized by limiting the size of any tower. For example, if a facility needs 48 cooling tower cells, the design can minimize recirculation by utilizing four 12-cell towers instead of a single 48-cell tower.

The following sections provide additional information on the various cooling tower types, including the applicability of each at PBNP.

10.3.3.1 Mechanical Draft Cooling Towers

Description

MDCTs are usually comprised of multiple rectangular cells, arranged in a rectilinear or round fashion. MDCTs either induce or force air through the tower, and can be susceptible to recirculation and interference from other towers (SPX, 2009). Water flows downward through fill material contacting air in either a counter-flow or cross-flow pattern.
MDCTs can be designed to be plume-abated; plume-abated towers are discussed in Section 10.3.3.3.

Feasibility

The feasibility of MDCTs depends on design and siting, environmental, and overall facility impacts. The footprint of MDCTs can be larger or smaller than other towers, but in most cases, the footprint will require a relatively flat, rectangular area. Both MDCTs and NDCT counterflow designs have similar efficiencies. MDCTs use fans to move air through the towers, so they do not rely on a density differential that NDCTs rely on for cooling. However, MDCTs can be significantly shorter (up to 10 times), and because their air flow is mechanically forced, they can be designed with a lower cooling tower range and approach temperature than NDCTs.

General environmental impacts include noise, increased particulate matter (PM) emissions, increased water consumption, local fogging and icing, and increased residual waste (sludge) generation. MDCTs produce noise from the use of fans and related appurtenances in addition to the noise from cascading water. Because of the lower height of the towers, there is a higher potential for local fogging and icing due to the plume.

MDCTs typically tend to have the lowest capital costs of all cooling tower types, but the operating costs can be greater than NDCTs. The smaller capital and larger operating costs of MDCTs can make MDCT costlier than NDCT over the life of the facility, when both types of

towers are feasible. However, the feasibility and costs need to be compared to the lifespan and operating mode of the individual facility (SPX, 2009).

10.3.3.2 Natural Draft Cooling Towers

Description

A NDCT is a wet cooling tower and typically has a large hyperboloid shape. The hyperboloid shape has been found to improve performance efficiency (EPRI, 2011). Similar to MDCTs, water flows downward through fill material contacting air in either a counter-flow or cross-flow pattern.

NDCTs are often used at facilities that require larger quantities of water to be cooled; they are typically used at near-baseload facilities. The advantage of a natural draft unit is that the power required for fans is eliminated. Although NDCTs are typically very tall, the wet deck (or top of fill) is at approximately the same height as for MDCTs; therefore, the energy requirements with respect to pumps is assumed to be similar (SPX, 2016). Because of the height of NDCTs (up to 600 feet in height), ice and fogging impacts (if any) are not generally experienced within the immediate surroundings; however, these impacts are dependent upon the meteorological conditions of the site (CTI, 2003).

Feasibility

The feasibility of NDCTs depends on design and siting, environmental, and overall facility impacts. With respect to design and siting, compared to MDCTs, the footprint area of NDCTs can be larger or smaller, but in all cases, the footprint will require a relatively flat and extensive land area. The hyperboloid towers are the highest of all tower types and can be greater than 10 times the height of MDCTs; therefore, they could pose potential adverse aesthetic impacts on the viewscape. The large height required by a NDCT needs to be compared to local zoning ordinances and the allowable maximum building height, if any.

NDCTs are similar to MDCTs regarding efficiency; however, a NDCT is suitable only when a high cooling tower range and approach temperature are consistent with the existing condenser

and cooling water system. NDCTs do not have fans to force/move air through them; instead, the density differential induced by the temperature differential and saturated air causes air to move upward. When the cooling tower range is large (e.g., greater than 20°F), the density differential is relatively easily induced. When the cooling tower range is small, a taller cooling tower is needed to help induce an adequate density differential to cause air to move up through the tower.

Additionally, the performance of a NDCT is dependent on the ambient wet bulb temperature. As discussed in Section 10.3.2.3, the cooling tower approach is the difference between cold water temperature and the ambient wet bulb temperature. The cooling tower performance improves and the cost decreases when the tower is designed with a large approach (i.e., warmer cold water temperature). As the cold water temperature comes closer to (or, "approaches") wet bulb temperature, the tower efficiency decreases; therefore, a larger tower is needed to compensate for the lost efficiency. As such, the tower size increases rapidly when the approach and/or the range is smaller than 15°F to 18°F. NDCTs are infeasible when both the approach and the range are smaller than 15°F (SPX, 2009). A NDCT design is more practical when the approach temperature is larger than 20°F, and the range is larger than 25°F (SPX, 2009). The NDCT cannot successfully move air through the tower if the required range is small. MDCTs circumvent this issue by utilizing fans and related appurtenances to force air through the towers.

Environmental impacts are generally similar between MDCTs and NDCTs for PM emissions, water consumption, and residual waste. While there is no fan noise related to NDCTs, the water noise, due to cascading water, can be significant. Due to the height of the tower, there is a higher visible plume; however, local ground-level fogging and icing issues are reduced compared to MDCTs.

While operating costs for NDCTs will be lower than MDCTs, capital costs for NDCTs can be significantly greater, with approximate costs ranging from one-and-a-half to two times the cost of MDCTs (SPX, 2016).

10.3.3.3 Plume-Abated Towers

Description

Plume-abated cooling towers can be grouped into two major groups: those that add heat to the plume above the wet deck of the cooling tower and those that do not add heat.

Plume-abated cooling towers that add heat above the wet section of the cooling tower are called hybrid towers. The wet portion of a hybrid tower is similar to a MDCT or NDCT (assuming the system meets the necessary criteria for that type of tower) (SPX, 2009). A set of coils or finned-tubes are located above the wet portion to add heat/warmth to the near-saturated air leaving the tower to eliminate the visible plume. Addition of heat does not remove the water content, but only moves the air parcel away from the saturation curve as shown in Figure 10-8.

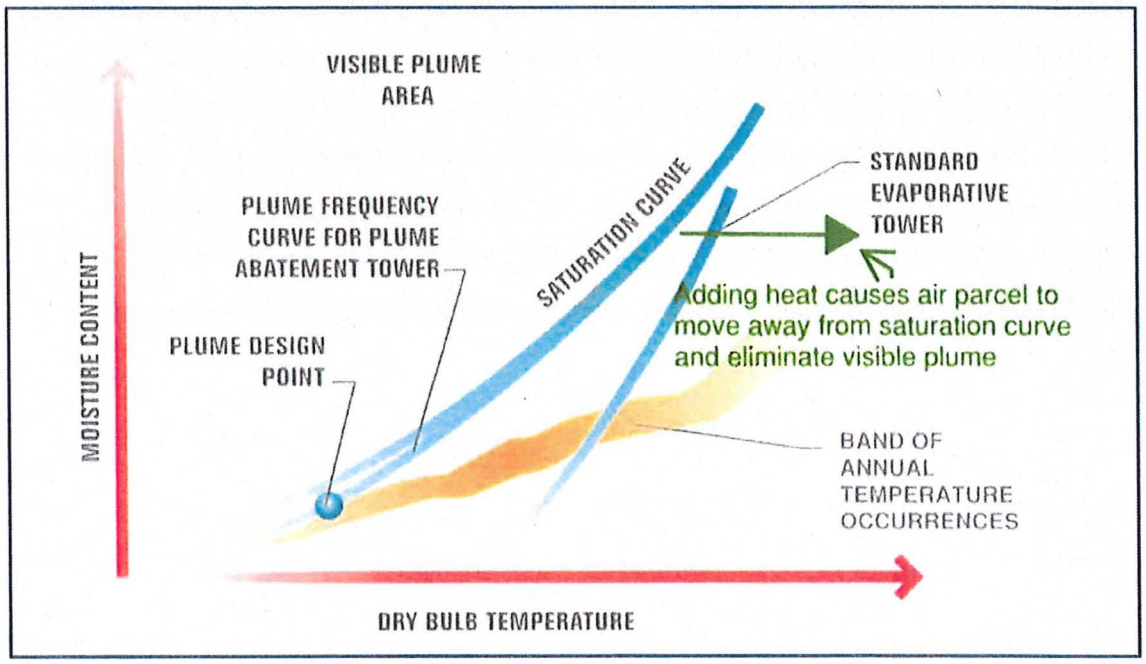


Figure 10-8. Eliminating Visible Plume from a Hybrid Cooling Tower (CTI, 2010)

Hybrid towers do not need to be operated in plume-abated mode at all times. The heat source may be applied to the dry portion of the tower during cooler months when the visible plume is more likely, and the tower may be operated in wet-only mode during other times of the year. This helps reduce the parasitic load on the facility.

Often, the hot water from the condenser may be used as the heat source. When operated in the hybrid mode, with hot water from condensers as the heat source for the dry portion, water enters the tower at the top of the dry portion, where sensible heat transfer lowers the temperature of the circulating water while raising the temperature of the air leaving the tower (thereby eliminating the visible plume); the slightly cooled circulating water then cascades down to the evaporative portion of the cooling tower, where water is further cooled through latent heat transfer (EPRI, 2011). No contact is made between the air and water in the dry portion of the tower; however, there is contact between air and water in the lower, wet portion of the tower (EPRI, 2011).

Saturated air leaving the top of cooling towers is what causes the plume. The "dry section installed in the upper part of the cooling tower reduces the visible plume by heating wet air coming from the [lower] rain zone" (SPX, 2016). Warm air has greater moisture assimilative capacity. Warming the air exiting the wet portion causes the air to be unsaturated, thereby reducing the visible plume. In the mechanical hybrid tower, the dry portion may be installed above or below the fan. When installed below the fan (like the configuration shown in Figure 10-9) the tower is called a Parallel Path Wet/Dry Cooling Tower. When the dry portion is installed above the fan, it is called Series Path Wet/Dry Cooling Tower. Parallel Path Wet/Dry Cooling Towers are presently more prevalent than Series Path Wet/Dry Cooling Towers (CTI 2010).

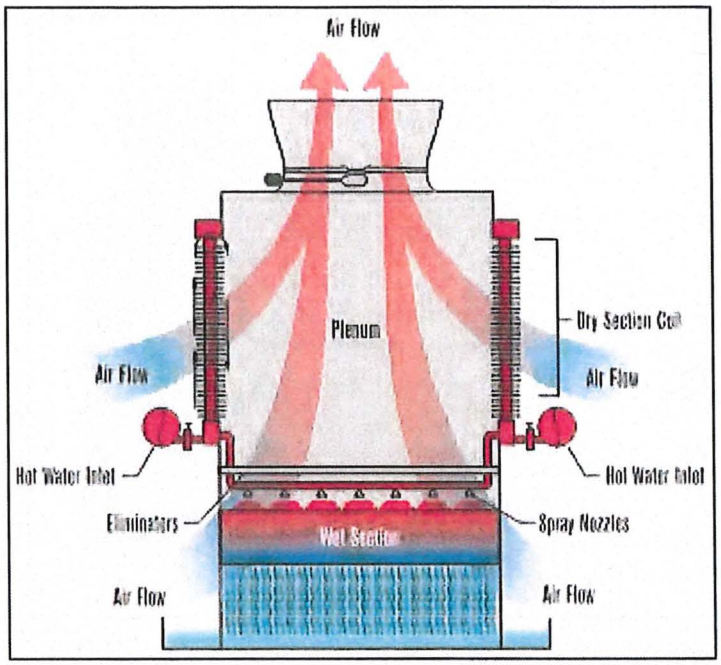


Figure 10-9. Cross-Section Schematic of a Parallel Path Wet/Dry Cooling Tower (CTI, 2010)

The second type of plume-abated tower developed by SPX is called ClearSky™. It blows additional cooler ambient air into the chamber above the wet portion to condense the moisture (see Figure 10-10). The condensate may be collected for use in various facility equipment that requires high quality water. If the condensate is not collected, it would cascade down to the basin to be recirculated. This technology eliminates the visible plume by removing moisture from air leaving the tower. Operation of additional fans during cooler months poses a higher energy penalty than a standard MDCT.

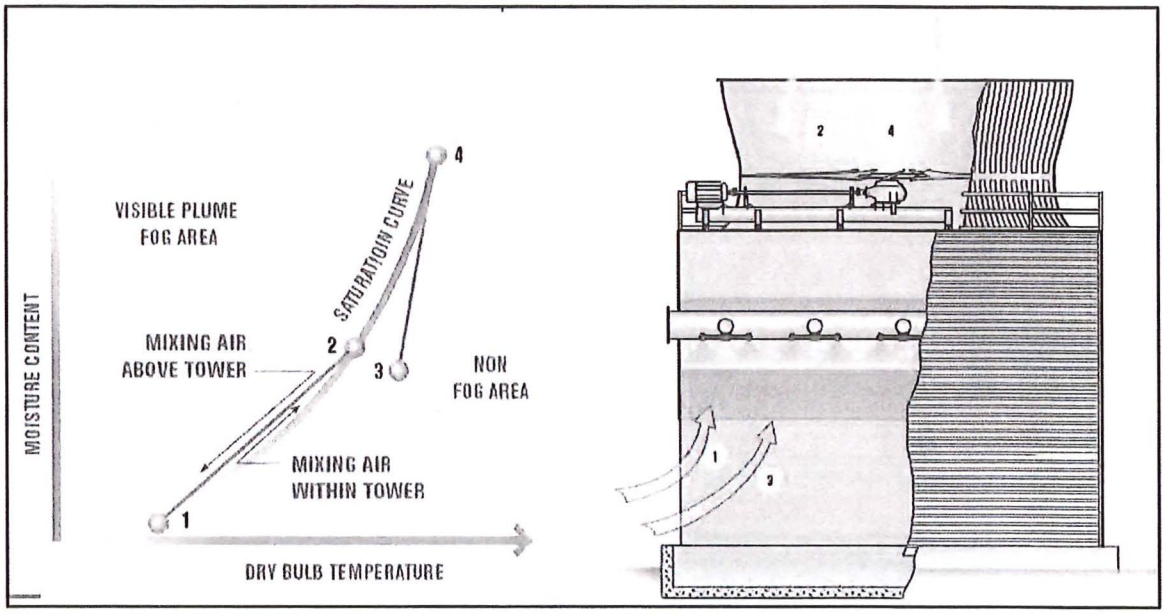


Figure 10-10. Cross-Section Schematic of a ClearSky™ Plume-Abated Cooling Tower by Marley (SPX, 2016)

Feasibility

Plume-abated towers are available and are typically used in areas where the plume can have an adverse impact by way of fogging or icing or for areas where long-range visibility is needed. Due to their design, hybrid towers have a larger base by approximately one to three times and a height of approximately one-and-a-half times that of standard MDCTs. In addition, these towers are restricted to in-line arrangement (i.e., cooling tower arrays must be a single cell wide). Hybrid towers have lower efficiency, a lower summer output, and a higher energy penalty compared to standard MDCTs. According to SPX (2016), this also is the case for its ClearSky™ tower.

With the exception of fan noise, most environmental impacts are less than or similar to MDCTs. Plume-abated towers can be operated in plume-abated mode by actuating the air cooled portion of the tower (in hybrid towers) or the additional fans (in ClearSky™), and when operated as such, there is usually a minimal or no visible plume. There is, however, greater fan noise with the use of plume-abated towers.

Both capital and operating costs are greater compared to MDCTs (EPRI, 2011). Plume-abated towers would have similar challenges to MDCTs, such as limited suitable space and prohibitive site topography, potential major reconstruction of existing equipment and facilities, and space constraints associated with the property. Plume-abated towers will have a larger power loss due to a lower efficiency and greater energy penalty compared to MDCTs.

10.3.3.4 Dry Cooling

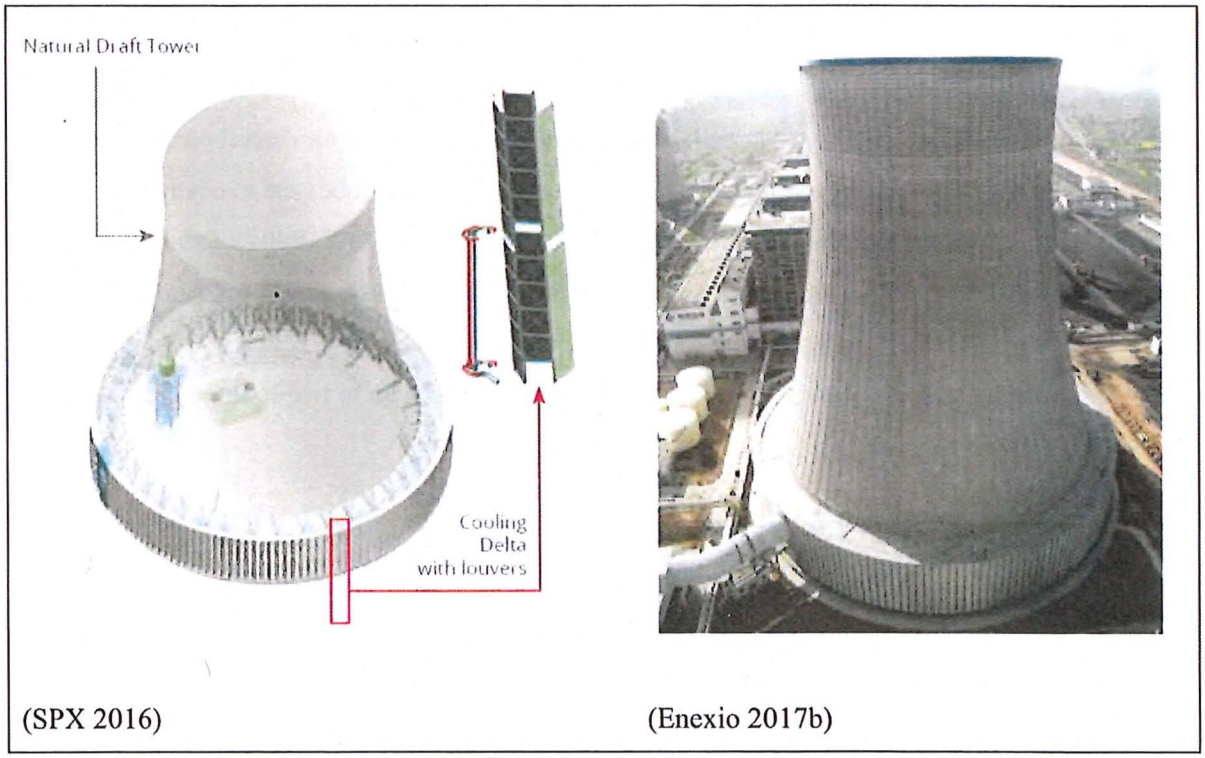
Description

There are two key dry cooling methods: direct dry cooling through use of ACCs and indirect dry cooling.

Dry cooling towers use only sensible heat transfer and can use ambient air directly or indirectly. Through the use of direct dry cooling systems, a dry-surface, finned-tube heat exchanger provides for the non-evaporative transfer of heat to the atmosphere (SPX, 2009). Steam from the turbine is sent directly to the ACC where the steam is condensed inside air-cooled finned tubes; there is no steam surface condenser and there is no contact between the ambient air and the steam and condensate. As shown in Figure 10-11, an ACC can be up to two to three-times the height of MDCTs.

Figure 10-11. Aerial Photograph of an Air Cooled Condenser (Direct Dry Cooling) (Enexio, 2017a)

Indirect dry cooling systems use a combination of a dry cooling tower (natural or mechanical draft) with a steam surface condenser. In these cooling towers, the heated water is pumped to heat exchangers arranged vertically around what looks like a standard wet cooling tower. But as shown in Figure 10-12, no water cascades down through the tower; instead, water flows through the bundles of tubes placed around the tower. Air flow through the tower cools the water within the bundles of tubes (SPX, 2017). There is no contact between air and the circulating water (EPRI, 2011).



(SPX 2016) (Enexio 2017b)

Figure 10-12. Schematic of an Indirect Dry Cooling Tower

Feasibility

ACCs require the largest area of land of all towers because they only utilize sensible heat transfer.[46]

ACCs have the lowest cooling efficiency and lowest summer output of all towers, which results in the greatest energy penalty of all towers (EPRI, 2011). ACCs have a considerable energy requirement to operate the fans. Cooling of ACCs is limited by the dry-bulb temperature, rather than the wet-bulb temperature. Because the dry-bulb temperature is always higher than the wet-bulb temperature, the resulting cold water temperature is higher compared to wet cooling tower water temperatures. Therefore, the energy penalty with dry cooling is significantly higher than with wet cooling towers.

Because dry cooling systems use sensible heat transfer, there is no visible plume or related PM emissions, cascading water noise, water consumption, scale, sediment, or sludge accumulation. Dry cooling systems result in the greatest reduction in water use of all towers. However, they result in the highest fan noise and in the largest land footprint, including potential land use impacts.

Capital and operating costs for dry cooling systems, especially ACCs, are the highest of all towers. Capital costs can be up to four to six times that of MDCTs. ACCs are generally not compatible with existing condensers due to unacceptable turbine back pressure and hydraulic pressure on the condensers (EPRI, 2007). For this reason, installation of ACCs typically requires significant redesign and reconstruction of existing condensers, facility buildings, equipment, and piping. Due to the large energy penalty, ACCs may have impacts on the reliability of the facility and electric transmission distribution system.

[46] Wet cooling towers utilize both sensible and latent heat to transfer heat from water to air. The latent heat of vaporization for water is 970.3 British thermal units (Btu) per Pound mass (lbm) (Lindeburg, 2003). The specific heat of water is 1 Btu/lbm-°F. That is, it takes 970.3 Btu to evaporate a pound of water, and it takes only 1 Btu to raise the temperature of water by 1°F. Wet cooling towers operate by evaporating a small quantity of water and cooling the remaining large quantity of water. The portion that evaporates absorbs energy from the remaining hot water, which then cools. Cooling through evaporation of water using latent heat transfer is more effective than using sensible heat transfer.

10.3.3.5 Condenser Replacement

The above discussion of cooling tower types (NDCT, MDCT, plume-abated towers and dry cooling) was based on reusing the existing condensers. Such a hypothetical closed-cycle cooling tower retrofit would have to accommodate the existing condenser characteristics such as its pressure rating, backpressure impacts, water flow rate, and temperature rise. A plant's condensers and cooling towers need to complement each other; that is, all heat added at the condenser needs to be removed by the cooling tower.

Replacing the existing condensers with new condensers would eliminate those constraints, because the new condenser would be selected to meet the new hypothetical cooling tower performance criteria. However, a condenser replacement for both Unit 1 and Unit 2 would result in significant reconstruction at PBNP and increased outages (resulting in lower grid reliability), higher cost, additional NRC permitting and approvals, and greater disturbance to site and surroundings resulting in greater adverse impacts.

Owing to the longer construction outage and greater adverse impacts that would result from condenser replacement to accommodate different types of cooling towers, this option is considered inferior and will not be evaluated further. Instead, this evaluation assumes that the existing condenser would remain in place and that the cooling tower retrofit would conform to the constraints of the existing condenser. As indicated previously, if CCRS was found to be BTA, the need to modify or replace the existing condensers would be re-evaluated.

10.3.3.6 Selected Cooling Tower Type

The type of cooling tower most appropriate for hypothetical implementation at PBNP is a standard MDCT. Based on the types of cooling towers discussed in this section, as well as PBNP's condenser design, cooling water piping design, and other site considerations (discussed in Sections 10.4 through 10.4.11), NDCTs and dry cooling have been deemed infeasible and impractical at PBNP and eliminated from further evaluation. Because of site constraints, the larger plume-abated MDCTs are considered to be impractical and inferior to standard MDCTs.

As discussed in Section 10.4, the hypothetical CCRS retrofit hypothesized for PBNP has an approach of 10°F and a range of 22°F for both Unit 1 and Unit 2 (see Section 10.2.3). Per SPX (2017), a NDCT cannot be designed for these parameters. The range and approach must be greater for a NDCT as discussed in Section 10.3.3.2. The hot water from the condensers is not sufficiently warm to facilitate a natural draft through the tower. Due to the larger circulating water flow and smaller approach of PBNP, NDCTs are infeasible from a technical perspective.

Due to the large site requirements, incompatibility with the existing steam turbines, significant facility redesign, and reduction in facility and regional electricity reliability, ACCs are considered infeasible from an engineering perspective.

Because plume-abated cooling towers are larger than standard MDCTs, each plume-abated tower would likely need to be split into two smaller towers, which creates additional difficulties and uncertainties with respect to citing multiple towers per unit. Therefore, plume-abated MDCTs are not considered practical.

The following matrix in Table 10-6 provides a summary comparison of the various cooling tower types. The next section will evaluate MDCTs in greater detail and estimate the cost of retrofitting PBNP with a CCRS.

Table 10-6. Comparison Matrix of Cooling Tower Types

Attribute	Cooling Tower Types			
	Standard Mechanical Draft Cooling Tower	Plume-Abated Mechanical Draft Cooling Tower	Natural Draft Cooling Tower	Dry Air Cooled Condensers
	Base Case	Compare to Base Case	Compare to Base Case	Compare to Base Case
Design and Siting Impacts				
Footprint Area	• Base case	• Larger than base case, and cannot be configured as back-to-back therefore challenging to locate at this site	• Larger or smaller footprint than base case • Large, circular areas required	• Largest area required, approximately 2 to 4 times the area required for the base case
Height	• Base case	• Taller than base case, approximately 70 feet	• Highest of all towers • Owing to small range and approach temperatures, greater than 600 feet, which is beyond the typical cooling tower design height.	• Approximately 2 times the height of a MDCT.
Efficiency (the ability to cool, compared to system energy consumption)	• Base case	• Lower than MDCT • Lower summer output	• This type of tower would not be able to produce cold water with sufficiently low temperatures needed by the condenser. Use of NDCT would necessitate the overhaul of the entire cooling system. Use of a NDCT with the existing condensers would result in significant deterioration of generator efficiency. • Suitable/applicable only when both cooling tower range and approach temperature are relatively large	• The existing steam turbines are designed to exhaust into a vacuum less than 25 inches mercury, which dry air cooled systems cannot achieve, making this technology infeasible. • Lowest cooling system efficiency. • Lowest summer electricity output.

	Cooling Tower Types			
	Standard Mechanical Draft Cooling Tower	Plume-Abated Mechanical Draft Cooling Tower	Natural Draft Cooling Tower	Dry Air Cooled Condensers
Attribute	Base Case	Compare to Base Case	Compare to Base Case	Compare to Base Case
Energy Penalty	• Additional pumping, fans, and related appurtenances increase energy penalty	• Higher than base case • Additional pumping, fans, and related appurtenances increase energy penalty	• Lower than base case with respect to parasitic loss. • Significantly higher backpressure energy penalty; potential incompatibility with design criteria.	• This alternative has the highest energy penalty. • Large energy requirement for fans. • Cooling is limited by dry-bulb temperature rather than wet-bulb temperature; dry-bulb temperature always higher than wet-bulb temperature. Therefore, these systems have the highest resulting cold water temperature, with largest energy penalty in the height of the summer.
Environmental Impacts				
Visible Plume	• Potential for plume • Potential ground level fogging and icing • Potential safety impacts at the Plant and proximity to surrounding areas	• Minimal to no visible plume • Lower probability for ground-level fogging and icing	• Visible plume at higher elevation • Reduced ground-level fogging and icing due to height of plume emissions	• No visible plume • No fogging or icing
PM Emissions	• Dependent upon source water TDS, cycles of concentration, and drift eliminator efficiency	• Similar to base case	• Similar to base case	• No PM emissions
Noise Emissions	• Additional fan noise • Cascading water noise	• Potentially higher than base case but not permittable	• No fan noise • Cascading water noise	• Greatest fan noise • No water noise

	Cooling Tower Types			
	Standard Mechanical Draft Cooling Tower	Plume-Abated Mechanical Draft Cooling Tower	Natural Draft Cooling Tower	Dry Air Cooled Condensers
Attribute	Base Case	Compare to Base Case	Compare to Base Case	Compare to Base Case
Water Consumption	• Base case	• Similar to base case	• Slightly less consumptive water use than base case	• No water consumption • Greatest reduction in water use of alternatives
Residual Waste	• Dependent upon water and air quality, basin sizing, and use of chemical additives	• Similar to base case	• Similar to base case	• No scale, sediment, or sludge accumulation
Overall Plant Impacts				
Capital Costs	• Base case	• Higher than base case but not permittable	• Likely higher than base case	• Highest capital costs, approximately 4 to 6 times
Operating Costs	• Base case	• Higher than base case but not permittable	• Lower than base case	• Highest operating costs
Site-Specific Applicability	• Major reconstruction of existing Plant equipment, buildings, storage warehouses • Plume may impact traffic on local access roads, as well as operation of the Point Beach Solar Project.	• Major reconstruction of existing Plant equipment, buildings, laydown areas, and warehouses • Minimal plume impacts	• Infeasible due to small approach temperatures • Large towers may have an adverse visual impact on area • Plume may impact traffic on local roads, as well as operation of the Point Beach Solar Project.	• Infeasible • Incompatible with existing condensers • Insufficient suitable space • Impact plant and regional reliability
Overall Feasibility	• Infeasible from an engineering perspective, given the retrofit connection to the existing intake and discharge piping and structures (see Section 0)	• Infeasible from an engineering perspective, given the retrofit connection to the existing intake and discharge piping and structures (see Section 0)	• Infeasible due to low approach temperatures, as well as from the existing setup of the intake and discharge piping and structures	• Infeasible due to existing condenser characteristics. Given large site requirements and expected high resultant cold water temperatures, this alternative is infeasible from an engineering perspective

Source: EPRI, 2011; CTI, 2003; Maulbetsch and Stallings, 2012

10.4 Description of the Hypothetical Closed-Cycle Cooling Tower—40 CFR 122.21(r)(10)(i)(A)

10.4.1 General Concept

Based on the evaluation performed in Section 10.3, a standard MDCT has been selected to be used for further evaluation and cost estimation.

The general concept at PBNP is to install two 30-cell back-to-back MDCTs (one per unit) north-northwest of the main plant area. The hot and cold water piping between the hypothetical MDCTs and condensers would traverse along the lake shoreline. Cold water pipes from the hypothetical MDCTs would tie into the existing cooling water intake pipes in front of the forebay/transition structure. Service water pumps and circulating water pumps would withdraw water from the cooling tower return. Condenser discharge would continue to flow out to the flume which would then transition to hot water piping that routes water back to the MDCT. For the purposes of this report only, the evaluation assumed that service water would be included in the closed-cycle recirculating system. If closed-cycle cooling were selected as BTA for entrainment, the service water system would need significant additional evaluation prior to determining the actual mode for the service water system. Converting it to closed-cycle could pose potential water quality issue including incompatibilities with circulating water system metallurgy. Leaving it in once-through mode would necessitate significant piping modifications under the turbine building, a potentially longer retrofit-related outage, and construction within the protected area, all of which would translate to additional costs and complexity. This evaluation did not assess the service water system in any significant way. The evaluations and implementation would increase the facility (and social) costs.

A new makeup water intake structure, consisting of a crib, conveyance piping and traveling screens, would be built near the MDCT (north of the existing CWIS). The MDCT would be operated at 5 COC, and blowdown returned to the lake.

The following sections describe specific components and sizing, all of which is used to develop the cost and schedule for this retrofit.

10.4.2 MDCT Design Assumptions

Several design conditions have been assumed with the selection of a hypothetical new standard MDCT; these assumptions are described in the following sections.

10.4.2.1 Circulating Water Flow

This evaluation uses cooling water and service water flow rates in Section 10.2.2 for the below calculations. It assumes that both the circulating and service water flows would be converted and included in the hypothetical CCRS retrofit.

Water evaporation rate in the cooling tower necessary to dissipate the required design heat load has been estimated and is listed in Table 10-7. The evaporation rate is estimated to be approximately 13,278 gpm total for both units (approximately 6,605 gpm for Unit 1 and 6,673 gpm for Unit 2). These values assume a range for both cooling towers of 22°F. The blowdown rate is a function of source water quality and WPDES permit discharge water quality requirements, and is estimated to be 3,316 gpm. The Lake Michigan TDS levels are estimated to range between 154 and 169 parts per million (ppm) (Chapra *et al.*, 2012). Because Lake Michigan is freshwater, this evaluation assumes 5 COC[47]. This concept also assumes that the cooling towers would employ the most efficient drift eliminators presently on the market with a 0.0005 percent efficiency. Total drift from the towers would be approximately 4 gpm. Detailed calculations are provided in Section 12.

[47] The design and actual COC may vary during operation due to changes in water quality.

Table 10-7. Estimated Cooling Tower Water Use at Point Beach Nuclear Plant

Water Use	Unit 1	Unit 2	*Units*
Once-through Condenser Circulating Water Flow Rate	373,584	377,416	gpm
Once-through Service and Screenwash Water Flow Rate	18,160		gpm
Plant Total Once-through Flow Rate	769,160		gpm
Cooling Tower Water Flow Rate	373,584	377,416	gpm
Evaporation Rate	6,605	6,673	gpm
Drift Rate	1.9	1.9	gpm
Blowdown Rate	1,649	1,666	gpm
Makeup Rate[48]	8,256	8,341	gpm
Reduction in Cooling Water Withdrawal Rate	365,328	369,075	gpm

10.4.2.2 Temperatures

The hot water temperature entering the cooling tower is assumed to be approximately 106°F under design conditions, which accounts for a design ambient wet bulb temperature of 74°F and a minimum approach temperature of 10°F (WMO, 2020).[49] The cooling tower range, which is designed to be equal to the ΔT across the condensers, is approximately 22°F (NextEra, 2020). Given the wet bulb temperature of 74°F and the minimum approach temperature of 10°F, the water returning to the existing condenser would be approximately 84°F (during the warmest/most humid period of the year). Service water would continue to withdraw water from the existing forebay and transition structure, which in turn would be fed by the MDCT. For safety reasons, service water inlet temperature cannot exceed 85°F[50] (NextEra, 2015; PBNP, 2019). If closed-cycle cooling were selected as the BTA at PBNP, additional studies would be required to confirm the appropriateness of temperatures in various water streams.

[48] This estimate assumes that there are no other leaks in the system. Makeup rate equals the sum of evaporation, drift, and blowdown.
[49] This is the practical minimum approach temperature.
[50] The highest historic inlet temperature on record is 75°F. The existing 85°F inlet temperature criterion provides 10°F margin of safety. The hypothetical MDCT retrofit would erode that margin to 1°F.

10.4.2.3 Cooling Efficiency

The potential for plume recirculation and interference can exist when towers are not aligned with the prevailing wind direction, and when towers are located downwind from other towers, respectively. Depending on the amount of potential recirculation or interference, it is possible to increase the number of required cells or the power to the fans.

The hypothetical CCRS retrofit assumed for PBNP consists of two cooling towers. For the highest efficiency, cooling towers are typically oriented parallel to the predominant summer wind direction. The hypothetical cooling towers would both be located north of the existing plant, between the existing dry cask storage and the Lake Michigan shoreline, and oriented in a south-southwest (SSW) to north-northeast (NNE) direction (WMO, 2020).

10.4.2.4 Water Treatment Additives

Maintaining and operating a cooling system with a cooling tower at optimum efficiency often includes the use of chemical additives to treat circulating water and service water. These additives are typically used to prevent and control corrosion, scaling, and fouling.

In some instances, additives are dosed at such a concentration so that the chemicals are neutralized (i.e., used up) in the water prior to discharge. For example, acids or bases may be used to control the pH in the discharge water to meet state regulations; these chemicals will not typically be discharged into a receiving waterbody, as they will be consumed in the water through chemical reactions. In other instances, the additives will not be fully neutralized, and the remaining concentration may need to be discharged into the receiving waterbody. The blowdown quality needs to meet effluent limits that would be imposed through PBNP's WPDES permit.

Further evaluation of MDCTs with respect to use of current and potential future water treatment additives would need to be completed prior to any cooling tower retrofit at the Plant. The evaluation would need to confirm the compatibility of any chemicals used with the cooling tower, including the fill material. The fill material of the cooling tower can be susceptible to chemical usage, including clogging and degradation of materials. In addition, chemical additives

in the water could potentially be emitted from the tower, in both the exhaust emissions and drift water droplets.

Whenever the circulating water is chlorinated, the blowdown stream would likely need to be dechlorinated. Use of a dispersant is assumed to remove microbiological slime and disperse unwanted deposits. A scale and corrosion inhibitor is assumed to protect the cooling water system from scale build-up and metallic corrosion.

10.4.3 Cooling Tower Sizing

Based on the design inputs described in Section 10.4.2, two hypothetical standard MDCTs, one for each unit, have been sized by SPX for the cooling system at PBNP. The cooling towers would be similarly sized and each made up of 30 cells. The cells would be organized in a back-to-back arrangement; each cell is assumed to be approximately 53 ft in length, 61 ft in width, and 50 ft in height. Information in Table 10-8 has been used to size the hypothetical new cooling towers for Units 1 and 2.

Table 10-8. Hypothetical MDCT Sizing Information for Unit 1 and Unit 2 at PBNP

Description	*Units*	Unit 1	Unit 2
Tower Type	-	MDCT	MDCT
Number of Cells (total)	-	30	30
Number of Towers	-	1	1
Cells per Tower	-	30	30
CT Type/Arrangement	-	Back-to-Back	Back-to-Back
Cell size (l x w x h)	ft	53 x 61 x 50	53 x 61 x 50
CT Basin Size (l x w x d)	ft	803 x 130 x 6	803 x 130 x 6
Motor Output Power for Fans	bhp	250	250
Total Fan Motor Output Power	hp	7,500	7,500
Total Lift Pump Head	ft	128	128
Water Flow Rate	gpm	373,584	377,416
Design Approach Temperature	°F	10	10
Design Conditions for Summer Duty			
Condenser Temperature Differential	°F	22	22
Design Wet Bulb Temperature	°F	74	74

Description	*Units*	Unit 1	Unit 2
Design Wet Bulb Temperature Percentile	%	1	1
Prevailing Wind Direction	-	SSW	SSW

Source: WMO, 2020; NextEra, 2020; EA, 2008

The MDCTs would be positioned directly above a collection basin, often referred to as the "basin", which would accumulate the cascading water and direct it back to the condenser via the intake piping and structure (assumed to be valved off from Lake Michigan for the hypothetical CCRS scenario; see Section 10.4.6 for further discussion). Each basin is assumed to extend an additional 4 ft from each side of the tower, resulting in a potential length of 803 ft and width of 130 ft for each of the cooling tower basins. The depth of each basin would be approximately 6 ft. The total fan motor output power requirement for each cooling tower would be approximately 7,500 horsepower[51] (hp), assuming one fan for each cell with a motor power requirement of 250 brake horsepower (bhp) for each fan.

The flow rate through each hypothetical MDCT is assumed to be equivalent to the design condenser circulating water flow rate. Each MDCT would have 8 booster pumps to pump water from the basin to the top of the wet deck. Booster pump sizing is provided in Section 12. Under the design web-bulb temperature, the prevailing wind direction is from the SSW, so the preferred cooling tower orientation would be in a parallel orientation with this wind direction (WMO, 2020).

10.4.4 Hypothetical Cooling Tower Location (§ 122.21(r)(10)(i)(B))

The following aspects were considered when identifying potential locations for the hypothetical cooling tower placements; one potential location was then selected for use in the remainder of the feasibility evaluation:

- Cooling tower construction or operation should not interfere with the Plant's operation or safety. Structures or plume should not impact the view of the perimeter of the Protected Area.

[51] 1 hp is equivalent to 745.7 watts; therefore, 7,500 hp is approximately 5.6 MW.

Whenever possible, cooling towers should be located away from switchyards and transmission lines.

- Each location must have existing space available for construction – the footprint of the cooling tower basins, booster pumphouses[52] and sumps/wet wells, construction access, excavation spaces, and spaces to setup equipment were considered under this category. Additionally, the topography of the site should be amenable to construction, or the site should be amenable to re-grading.
- Each location must minimize impacts to nuclear safety-related buildings and equipment at the Plant.
- In order to minimize construction within the Protected Area, to the extent practical, the evaluation attempted to keep large construction activities outside the Protected Area. Cooling towers would be located outside the Protected Area to improve contractor productivity and reduce potential safety/security issues.
- The location must be located to minimize impacts to the Point Beach Solar Project, which plans to include solar arrays on the existing property.
- Each location needs to be downwind of switchyards and transmission corridors, or sufficiently separated from switchyards and transmission corridors to prevent electrical arcing and icing during severe winters.
- Ability to protect key equipment from storm damage and flooding.
- Each location must have existing space available for cooling tower operation – good air circulation is needed for cooling towers to operate efficiently.
- Each location must minimize, to the extent practicable, retrofit-related Plant outages. Plant outages are costly and can affect the reliability of the electric grid.
- Each location must minimize, to the extent practicable, O&M costs – the evaluation attempted to locate the cooling tower and other related new equipment to minimize fuel, labor, and other maintenance costs.

[52] Booster pumps would be used to route water from the wet well to the top of the cooling tower.

- Each location must be within reasonable distance to the existing condensers – a long distance between the condensers and cooling tower increases the cost of construction, and increases head loss through the system that would need to be compensated with larger pumps. Therefore, the distance between condensers and cooling tower was minimized to the extent practicable during the assessment.
- Each location must be close to and able to use the existing intake and discharge piping and structures to the extent possible, and also minimize disturbance to the Plant by using existing pipeline alignments.
- Each location must have pipe or channel routes available between the condensers and the cooling tower – power plants have a myriad of above-ground and underground infrastructure and utilities. Pipe routes that avoid crossing transmission corridors and other densely utilized areas of the site are preferable. Cooling tower locations that allow for practical hot and cold water routes are preferred. The evaluation also attempted to minimize cooling water pipe crossings.
- Each location must facilitate minimal construction-related disturbance to the extent practicable – restoring a construction site is costly. This evaluation attempts to locate and sequence work to minimize areas disturbed.
- Each location must have existing space available for equipment laydown – it is convenient and cost-effective for contractors to have laydown space readily available near construction activities. When there is insufficient space, equipment must be hauled to the construction site as-needed.

This evaluation identifies spaces that meet most of the above requirements, to the extent possible.

10.4.5 Existing Site Conditions

10.4.5.1 Topography

Figure 10-13 shows the topography and flooding potential of the area around PBNP. The property is relatively flat, elevations generally vary between 600 ft and 620 ft throughout much of the property.

10.4.5.2 Load Bearing Stratum

The load bearing stratum at PBNP is between 65 ft and 100 ft below grade (NextEra, 2015). This evaluation assumes that cooling tower basins would be pile-supported, and that the hypothetical pilings would be driven to a depth of 100 ft. Additional geotechnical investigations and borings would need to be completed to evaluate the specific depth to bedrock in the event PBNP were required to construct cooling towers.

10.4.5.3 Site Layout in Proximity to Intake and Discharge Structures

The design and layout of the existing intake and discharge structures, as well as piping to and from the condensers, has been concentrated within a small portion of the Plant. Water enters the intake structure perpendicularly from two underground pipes located at the center of the structure. The water flows west toward the existing screens and pumps. After the pumps, water is directed in pipes south for Unit 1 and north for Unit 2, before turning west again and entering the turbine building. The intake piping is located beneath the Plant road in a corridor between the intake structure and turbine building (see **Error! Reference source not found.**).

Water is routed through the condenser to discharge pipes, which cross the corridor at the southern side of the turbine building for Unit 1 and the northern side of the turbine building for Unit 2. The discharge pipes are routed east toward the intake/discharge structure. The Unit 1 discharge pipe enters the southern wall of the intake/discharge structure and is then routed out to Lake Michigan through a discharge flume angled in an eastern direction. The Unit 2 discharge pipe enters the intake structure from the north and routes the water to a discharge flume angled in a north-northeast direction.

Service water pipes, fire water pipes, diesel generator water loop, and electrical ducts are also co-located with the intake and discharge piping within the corridor between the CWIS and turbine building. This corridor is approximately 50-ft wide and is shown in **Error! Reference source not found.**.

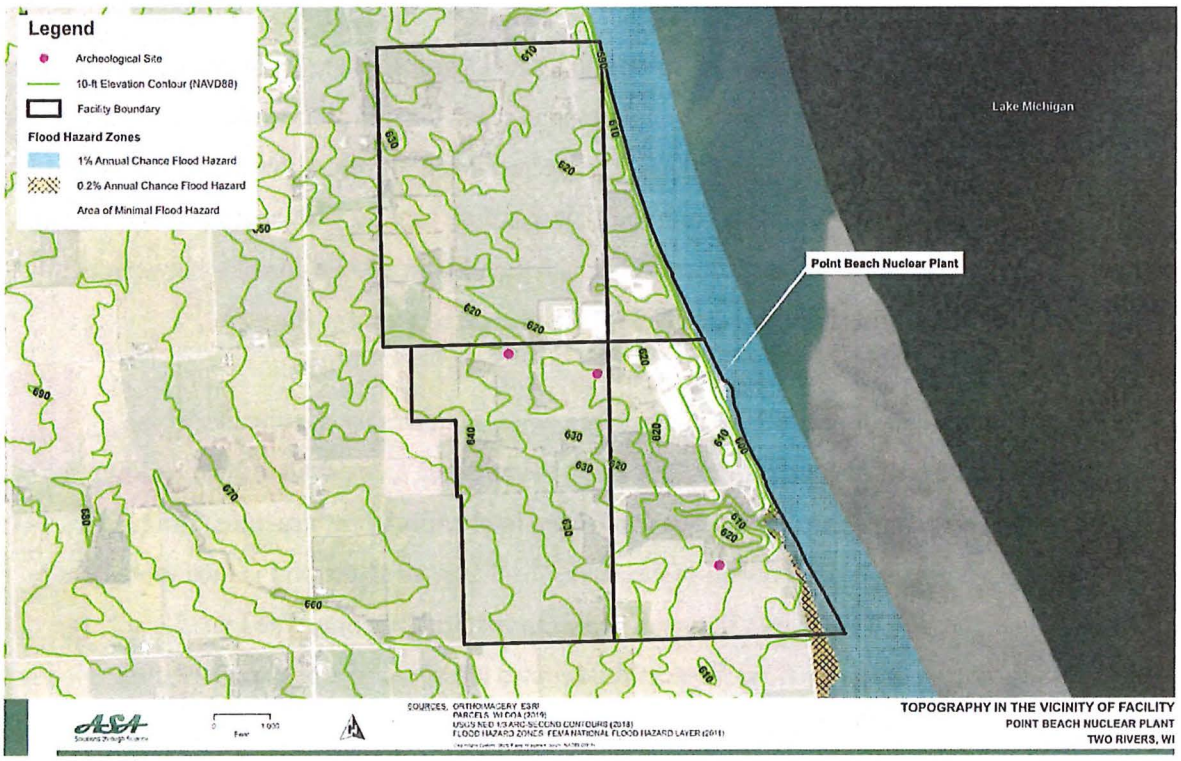


Figure 10-13. Topography Near Point Beach Nuclear Plant

Figure 10-14. Corridor between the CWIS (building on right) and the turbine building (building on left)

10.4.6 Hypothetical Retrofit Connection to Existing System

The hypothetical Location A and alternate locations are discussed in Sections 10.4.8 and 10.4.9. Location A is north of the Plant, and the piping between the existing system and the hypothetical towers is assumed to generally run in a north-south direction. This evaluation considered two hypothetical options to tie the cooling towers to the existing system: from the eastern side of the intake structure within Lake Michigan, and on the western side of the intake structure within the corridor between the intake structure and the turbine building.

Because of the intricate design of the existing intake structure and because the intake piping, structure, and service water pumps are all considered safety-related[53], any modifications to these systems will require both units of the Plant to be shut down. This means that there would be relatively long construction-related outages, which may impact the stability of the grid. This is discussed in more detail in Section 12. The Plant's Ultimate Heat Sink (UHS) is Lake Michigan, and the water for the UHS is brought in through the intake crib and intake piping. A nuclear power plant's UHS main functions are to dissipate residual heat after a reactor shutdown and dissipation of heat after a design basis accident. The UHS is essential to maintaining the units in a safe shutdown condition by providing sufficient cooling water for the safe shutdown and cooldown of the units. Changes to the UHS and other safety-related equipment at nuclear power plants pose safety risks to the public; therefore, these changes would require NRC review and approval.

As both hypothetical connection options involve significant reconstruction and changes to this safety-related equipment, and while both options may be theoretically and conceptually designed in the following sections, both tie-in options are considered infeasible and impractical.

10.4.6.1 Hypothetical Lake Option

In this hypothetical option, the connections to and from the cooling towers are routed to the east of the intake structure and into Lake Michigan. The hot water from the condensers would be

[53] The NRC defines safety-related as applying "to systems, structures, components, procedures, and controls (of a facility or process) that are relied upon to remain functional during and following design-basis events. Their functionality ensures that key regulatory criteria, such as levels of radioactivity released, are met. Examples of safety-related functions include shutting down a nuclear reactor and maintaining it in a safe-shutdown condition" (NRC, 2020).

routed into the discharge flumes, and the water would then be sent from the flumes into pipes northward to the cooling towers. Because the Unit 1 discharge flume is south of the intake pipes and the Unit 2 discharge flume, the hot water from the Unit 1 discharge flume would be routed into a pipe that would be located deep beneath both the intake pipes and the Unit 2 discharge flume. The Unit 2 hot water would be sent into a pipe on the northern side of the discharge flume. The Unit 1 and Unit 2 hot water pipes would combine into a single pipe north of the intake/discharge structure.

On the eastern side of the hot water lines, the cold water return from the cooling towers would be split and the pipes would be routed and connected to the existing intake pipes that are buried and located between the discharge flumes. Both pipes would be routed deep underground below the Unit 2 discharge flume and each one would be connected upward to a different intake pipe from below (inverted siphon). Considering the age of the existing pipes, it is assumed that the section of existing piping where the connections would be made would be replaced entirely.

The existing intake pipes and discharge flumes would be isolated from Lake Michigan by use of gates and valves so that the system could operate as a closed-cycle system. Gates and valves would also be included between all new and existing intake and discharge connections so that the Plant would have the ability to operate as once-through, if needed. The hypothetical cold water and hot water pipes would not be connected directly to the intake structure. Connecting directly to the intake structure would prevent utilizing the existing intake crib as a bypass during emergency or maintenance operations. In this option, the existing intake crib and discharge flumes would be left operable for emergency bypass and maintenance operations.

During winter operations, heated water from the discharge would need to be recirculated at various areas (e.g., existing intake crib, existing intake structure, hypothetical makeup water intake structure and crib) throughout the system to prevent frazil ice formation, which is similar to the existing system where warm water is recirculated to the intake crib.

As with both options, the hypothetical lake option is considered to be infeasible. While pipe connections and construction can be made theoretically, the onsite conditions may not allow for

the described changes. Most of the work to make the connections would need to be made within Lake Michigan, which poses difficulties performing significant reconstruction within and over water, as well as additional permitting requirements.

In addition, the existing intake piping and discharge flumes of the existing system have been designed in such a manner that the equipment and piping are within a very concentrated area near the intake structure. The intake pipes are 14-ft in diameter and are buried between the discharge flumes. In the hypothetical retrofit connection, the hot water pipe from the Unit 1 discharge flume would need to be directed downward and deep enough below the intake pipes to avoid impacts to those pipes. This may introduce hydraulic and silting issues that would need to be solved with additional pumps, making this option more difficult and costly. Similarly, both cold water return pipes would need to be bored underneath the Unit 2 discharge flume and both intake pipes to a depth that would not impact the flume and allow for the cold water return lines to be connected to the intake pipes. The top 13 ft of ground near PBNP is hard/dense (N value of 22); bedrock is between 65 ft and 100 ft. The material between the hard top layer and bedrock has little load bearing capacity and poor material integrity. Therefore, boring through that layer may not be possible and needs further evaluation.

This option, while still involving significant reconstruction of safety-related equipment, is considered to be the least invasive option as all work can be completed outside of the protected area. This option allows the Plant to reuse the existing circulating water pumps; however, further studies would be required to determine if additional pumps would be required; assess how to evacuate deposited soil from inverted siphons; and if the 'soft'[54] layer of material may be bored through.

This hypothetical option is shown for discussion purposes only as a plan view in Figure 10-15 and a cross-section view in Figure 10-16. This hypothetical option has been selected as the least infeasible option and will be moved forward into costing. This evaluation by no means finds this

[54] Per Shaw Nuclear (2008), material between 13 and 56 ft has an N value of 10. N value refers to the number of blows per foot. Per USBR (1998), N values between 4 and 10 are considered to be loose (of low density). N values between 10 and 30 has medium density.

piping option to be feasible; additional detailed studies would be needed to assess construction and operational feasibility if closed-cycle cooling were selected as entrainment BTA at PBNP.

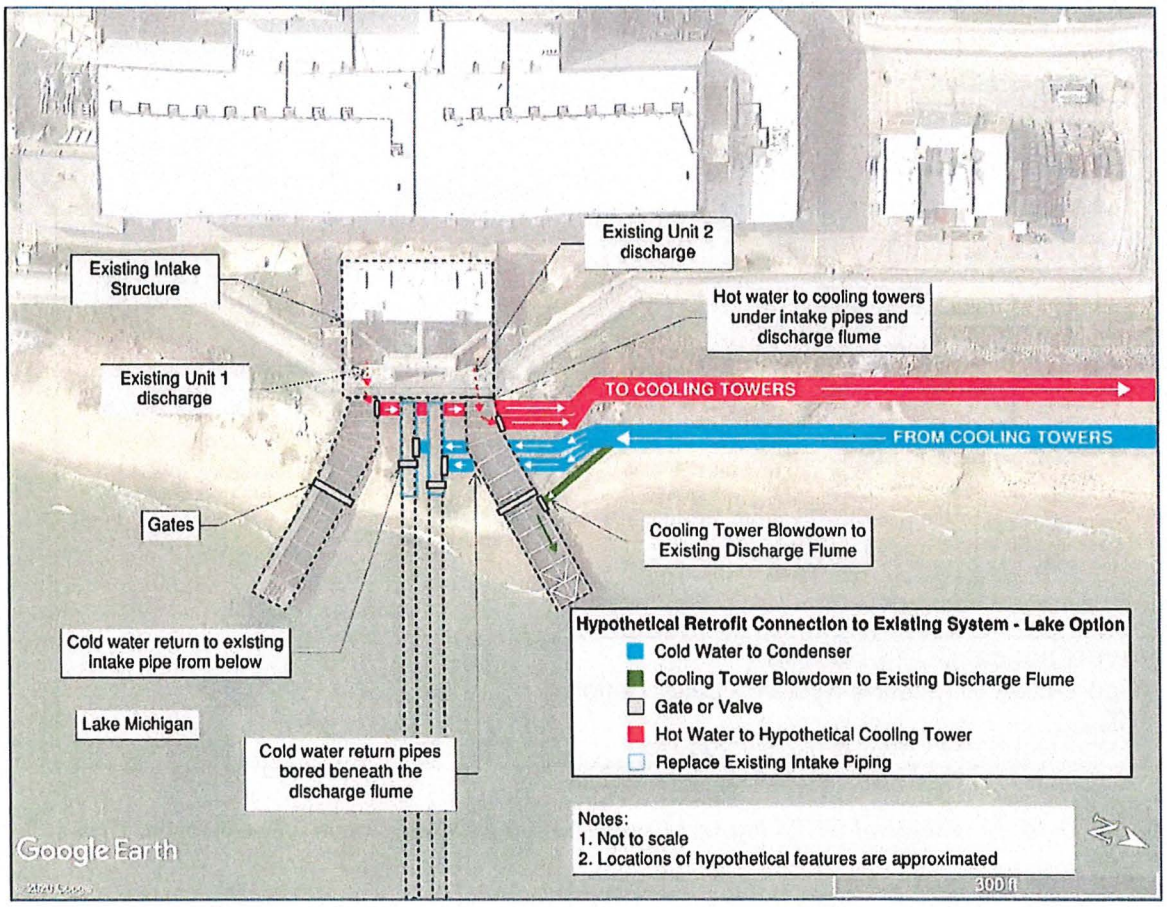


Figure 10-15. Hypothetical CCRS Retrofit Connection to Existing System – Lake Option Plan View

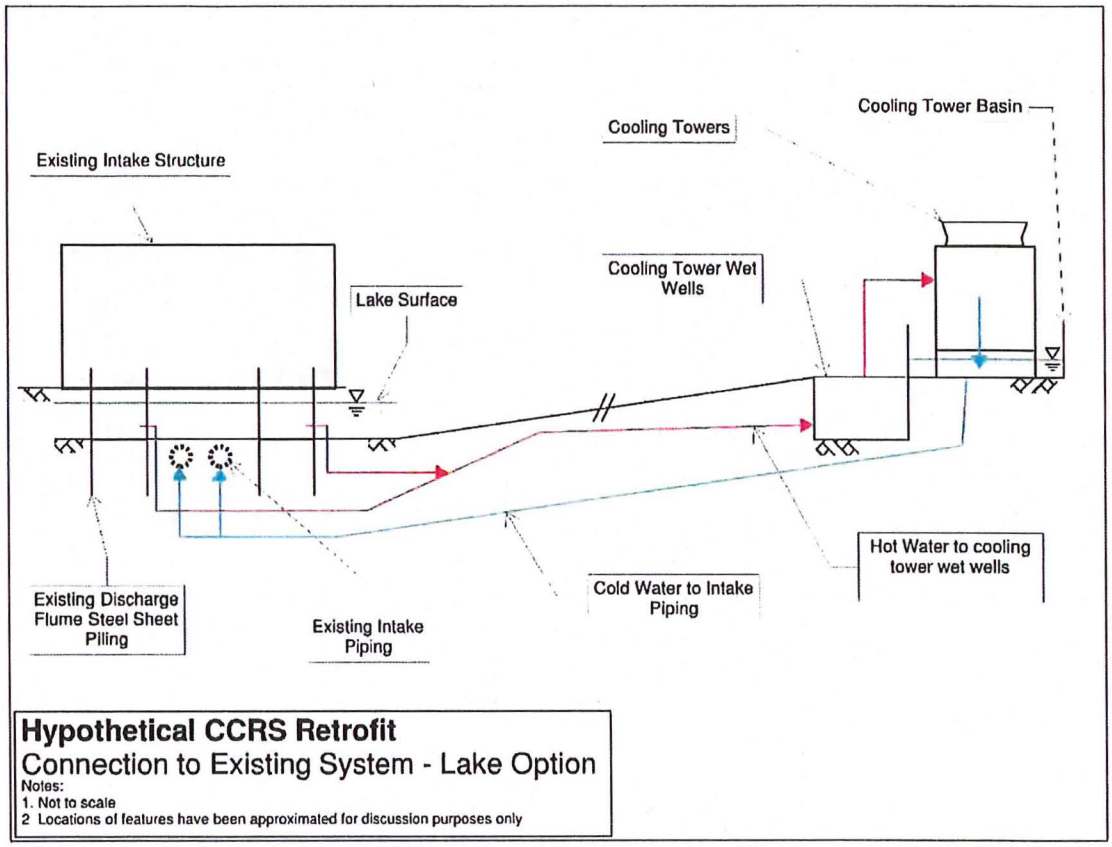


Figure 10-16. Hypothetical CCRS Retrofit Connection to Existing System – Lake Option Cross-Section View

10.4.6.2 Hypothetical Corridor Option

This is a second hypothetical CCRS connection option for the hypothetical cooling towers; however, due to various factors that will be discussed, this option has been deemed highly infeasible and will not be carried into costing.

This option provides connections to and from the hypothetical cooling towers directly to the existing condenser inlet and discharge piping. The pipes to and from the cooling towers would be routed directly to the inlet and discharge pipes via the corridor between the intake structure and the turbine building. Therefore, in this hypothetical option, the existing intake structure would

not be used for hypothetical CCRS operations. It is possible for the existing piping to remain in place for the facility to operate in once-through mode by using a system of valves and other pipe connections; however, for CCRS operations, new circulating water pumps would be required. Hypothetical new circulating water pumps would likely be located near the hypothetical cooling towers, as there is minimal space near the existing intake structure for additional equipment and buildings.

This option includes many difficulties given the significant construction within the corridor between the intake structure and turbine building. This corridor is about 50-ft at the widest point, and this corridor houses many existing pipes and utility ducts that cross between the buildings, such as electric ducts, fire water protection water pipes, and safety-related service water piping that supports UHS operations. All circulating pipes and many of the other pipes in this corridor are encased in concrete, making access for tie-ins extremely challenging.

In this option, all connections and reconstruction would occur on land, so there would be minimal impacts to Lake Michigan, minimal in-water construction, and minimum disturbance to the existing intake piping and discharge flumes; however, there would be significant construction within the protected area, which poses many difficulties at a nuclear power plant. Additionally, if heated water were not to be recirculated to the intake structure and existing intake crib during the winter, some of the piping and structure could get damaged from ice and frazil ice. The intake pipes and structure need to be kept in operation for emergency bypass and maintenance operations.

Due to significant impacts to the existing system within the protected area and the work within such a small corridor, this option has been deemed infeasible and will not be moved forward into costing.

The schematic for this option is shown in Figure 10-17.

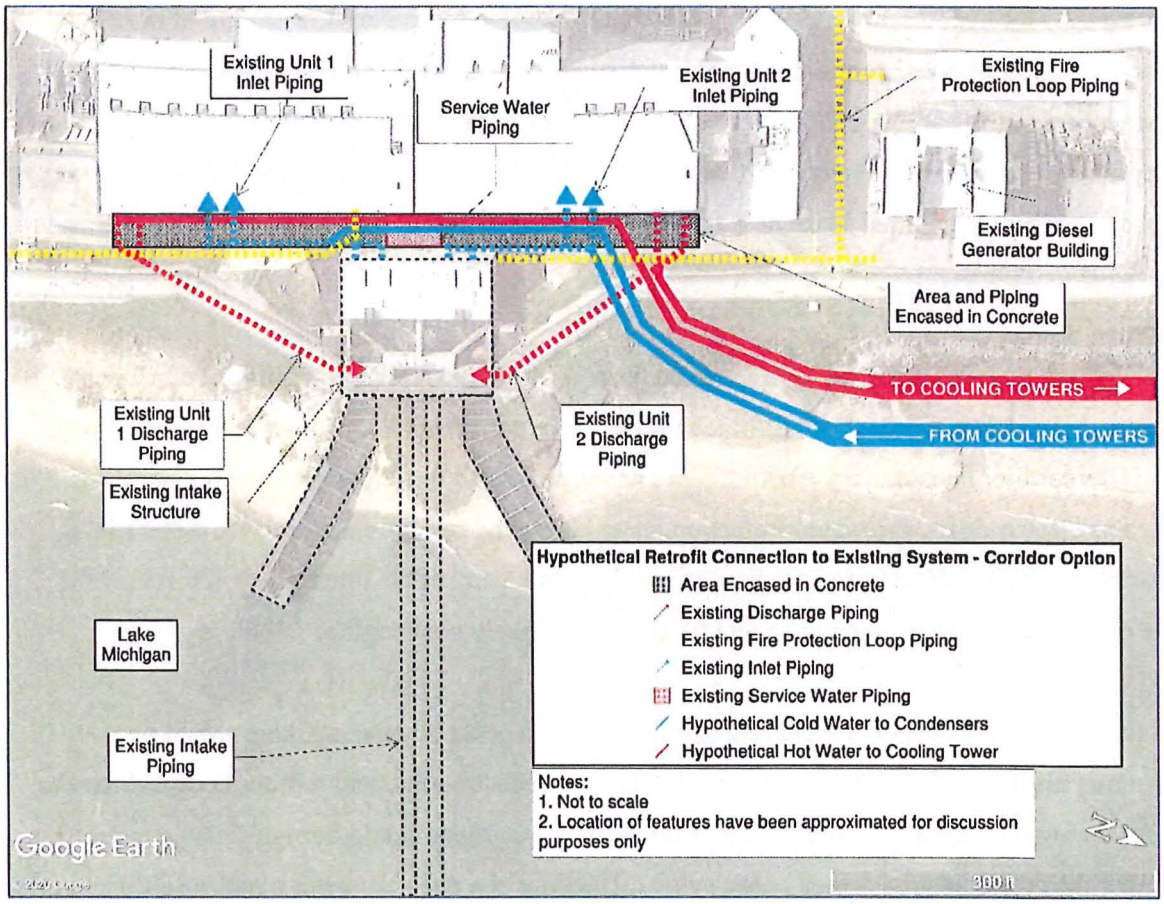


Figure 10-17. Hypothetical CCRS Retrofit Connection to Existing System – Corridor Option

10.4.7 Orientation of the Cooling Tower

Wind speed and direction significantly influence cooling tower performance, as well as the potential effects of facility emissions. While moderate wind speeds are critical for transporting the saturated plume away from the tower and increasing cooling tower performance, excessive wind speeds can diminish cooling tower performance by restricting the plume from rising up and out of the tower. A cooling tower array performs best when its primary (long) axis is oriented in the predominant wind direction because this orientation minimizes the potential for saturated air recirculation. When space and other physical conditions allow, a MDCT should be oriented with the prevailing wind direction that coincides with design wet bulb temperature. Meteorological data from the World Meteorological Organization (WMO Station Number 726450) for Green

Bay, WI was used for this evaluation (WMO, 2020). Wind roses[55], which depict prevailing wind direction and percent frequency of observed wind speeds, for Green Bay, WI, for the different months of the year, are shown on Figure 10-18.

The winter (December, January, and February) wind rose shows that the majority of prevailing winds are from the south-southwest to west directions; wind from these directions occurs approximately 44 percent of the time, respectively (Figure 10-18).

The spring (March, April, and May) wind rose shows that wind has occurred in many directions, but the majority of prevailing winds are from the north-northeast to northeast and south-southeast directions and occurs approximately 20 percent of the time (Figure 10-18).

The summer (June, July, and August) wind rose shows that the majority of prevailing winds are also from the south to west directions, with the predominant direction being from the southwest (Figure 10-18). Wind occurs from these directions approximately 28 percent of the time.

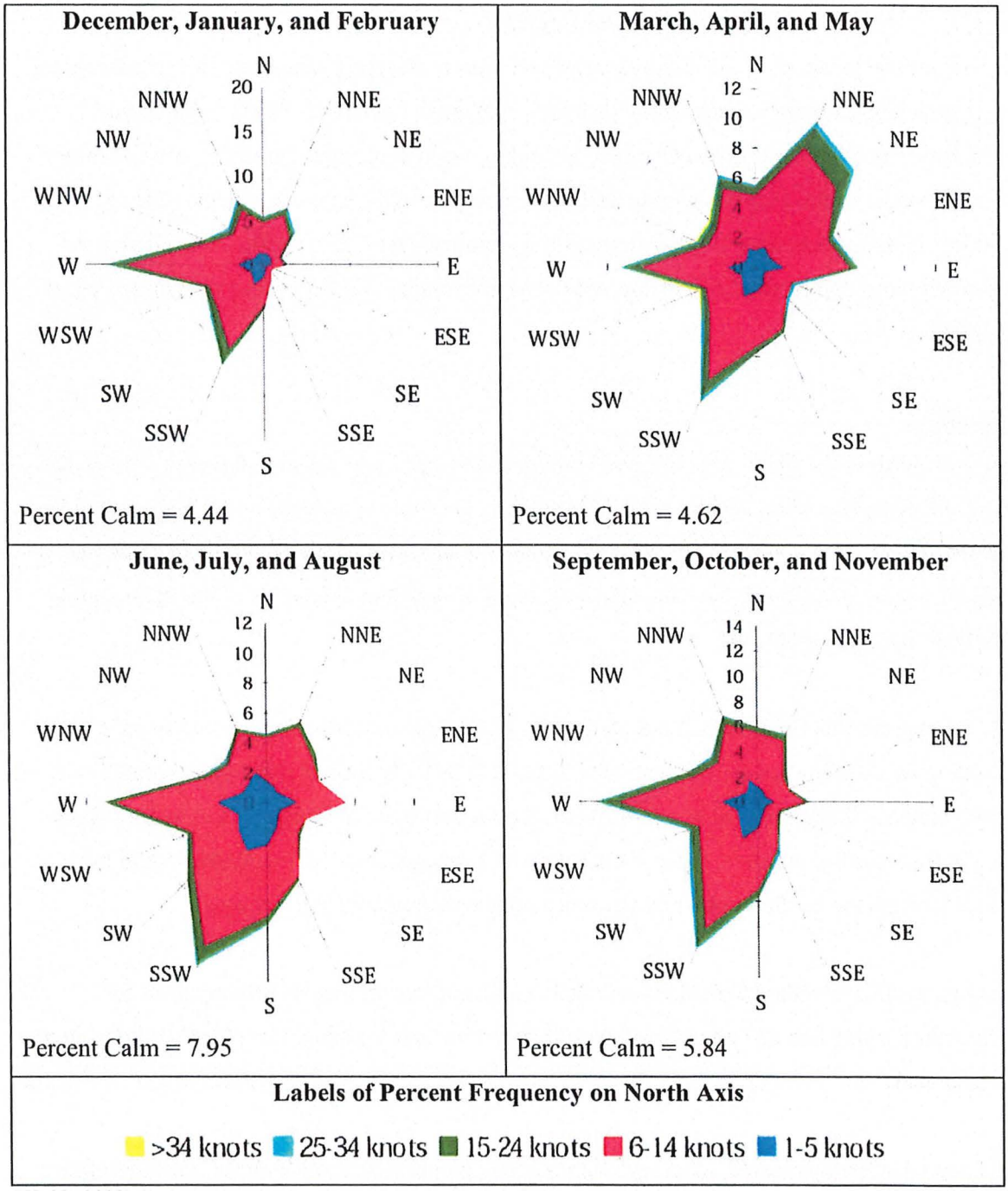
The autumn (September, October, and November) wind rose shows that the majority of the prevailing winds are from the south-southwest and west directions, occurring approximately 12 percent of the time for each of these directions (Figure 10-18).

During all four periods, wind speeds are commonly between 6 and 14 knots[56] (approximately 7 and 16 miles per hour [mph]); however, wind speeds greater than 34 knots (39 mph) have been experienced.

[55] A wind rose is a graphical representation of how prevailing wind direction and percent frequency of wind speed are distributed at a specific location, for a given period of record of data. The wind rose is plotted in a circular format. Straight lines directing towards the center represent the prevailing wind direction; the concentric circles (or dashes on the straight lines) represent the percent frequencies of wind speed, which increase in percent frequency from the center of the wind rose (NRCS, 2016). The percent of time the wind speed is observed as calm is typically provided as a note to the wind rose. Wind speeds may be provided in units of either miles per hour (mph) or in knots.

[56] A knot is a velocity measured in nautical miles per hour, where one nautical mile is equivalent to 1,852 m, or approximately 6,076 ft. To convert from knots to mph, the value in knots should be multiplied by 6,076 feet per hour per knot and then divided by 5,280 feet per mile.

The predominant wind during the design wet bulb temperature condition is from the south-southwest (WMO, 2020); therefore, this will need to be accounted for with respect to the orientation of the hypothetical new cooling towers.



(WMO, 2020)

Figure 10-18. Wind Summary for Green Bay, WI (WMO 726450)

10.4.8 Hypothetical Cooling Tower Location A

Several on-site locations were initially considered prior to selecting an appropriate area for siting the hypothetical cooling towers. Of the locations evaluated, Location A discussed below has been determined the least infeasible based on cooling tower footprints. However, site constraints and difficulties connecting the hypothetical cooling towers to the existing system make any location, including Location A, challenging for a hypothetical CCRS retrofit. The calculations and discussions presented in this report, as well as in Section 12, reflect siting cooling towers at Location A.

Location A

The area north of the Plant, west of Lake Michigan, and east of the existing dry cask storage has been selected as Location A (Figure 10-19). While some space constraints at the Plant and in the surrounding areas may limit the potential locations for additional equipment, this location has been chosen because it may have the least impact on the existing operations of the Plant, and is relatively flat topographically.

The concept for this location includes converting the existing once-through system to a CCRS by installing two cooling towers at Location A, separated by a distance of about one cooling tower length between them, oriented in a SSW to NNE direction, and separating the circulating water system from surface waters to create a closed-cycle system (Figure 10-19). Water would be routed through the cooling towers by booster pumps withdrawing from wet wells.

The hypothetical standard MDCTs would be located on property that is currently used for contractor parking and equipment laydown. This parking and equipment laydown would need to be relocated.

Makeup water pumps would be located within a new pumphouse located onshore north of the Plant (and east of the hypothetical cooling towers by the shore of Lake Michigan) with an offshore intake structure connected via underground intake pipes. Makeup water would be withdrawn from Lake Michigan. Makeup water would be sent to the cold water return from the

hypothetical new MDCTs to the condensers. Blowdown water from the cold water return would be routed to the existing Unit 2 discharge flume and outfall.

There are challenges associated with cooling tower construction and installation at this location, as discussed below.

The following challenges are associated with siting cooling towers at Location A:

- The retrofit concept assumes that the existing circulating water pumps would continue to route water to the condensers. Therefore, the system would need new booster, makeup water, and blowdown pumps. This concept assumes that the existing intake piping and discharge flumes would be hydraulically separated (via gates and/or valves) from Lake Michigan.
- The pipe route for this option assumes that all interconnections would be made east of the existing intake/discharge structure. This configuration would necessitate the new cold water pipes to be routed under the Unit 2 discharge flume, and for the new hot water pipe from Unit 1 to be routed under the existing intake pipes and existing Unit 2 discharge flume. This inverted-siphon configuration would necessitate boring through relatively soft materials, which could transpire to be infeasible during further analysis and design.
- If the inverted-siphon configuration were built, silt and solids could deposit in the low points of the pipe and over time, decrease the cross-section area available for flow. The additional impact in headloss could exacerbate hydraulics at the intake discussed in Section 10.2.5.
- In order to minimize outage time, the evaluation assumes that any hypothetical equipment not impacting existing operations (e.g., hypothetical new MDCTs, hot and cold water return lines to existing system, makeup water intake structure) would be constructed while the Plant is operating.
- This concept involves the use of standard MDCTs, which will produce a plume. The plume may impact the Point Beach Solar Project that is planned for the surrounding property by shading the project from the sun at times.

- Pipe installation under Lake Michigan would need to be implemented from the shoreline or off barges, likely during warmer months. Project implementation and costs would be closely tied to the time of year, and restricted to warmer months.
- Whether the existing intake pipes can be reconnected to the new piping would need further evaluation.
- Other potential locations were considered to be less suitable for the construction of a cooling tower and are discussed in the following subsection.

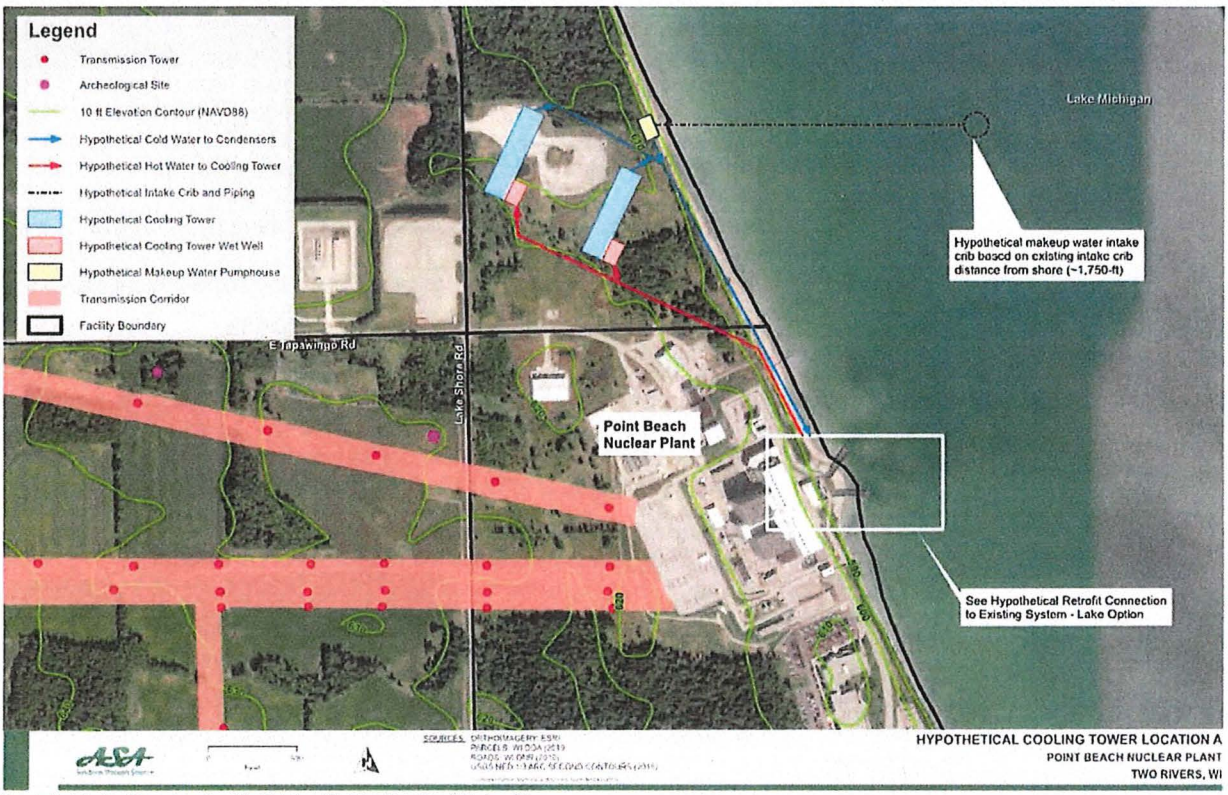


Figure 10-19. Hypothetical Cooling Tower Location A for Unit 1 and Unit 2 at Point Beach Nuclear Plant

10.4.9 Alternate Hypothetical Cooling Tower Locations

The following alternate cooling tower locations (Table 10-9; Figure 10-20) were considered but were found to be inferior to Location A, and therefore eliminated from further consideration for the reasons discussed. Areas that are located underneath transmission corridors have been deemed impractical as construction and operation of a cooling tower under or near transmission lines can pose a safety hazard. These areas have been identified in Figure 10-20.

Table 10-9. Alternate Cooling Tower Locations Considered

Location	Current Use and Challenges with Siting a Cooling Tower
B	Contractor parking and equipment laydown. Area is similar and in proximity to Location A. It is located immediately east of the dry cask storage. This location would necessitate crossing over additional plant roads and would be further away from the hypothetical makeup water crib and intake. Therefore this location is inferior to Location A.
C	Intake and discharge structures. This area is infeasible for locating hypothetical MDCTs.
D	Reactor and turbine buildings. This area is infeasible for locating hypothetical MDCTs.
E	Switchyard. This area is infeasible for locating hypothetical MDCTs.
F	Warehouse and storage buildings. A portion of this land is within the Protected Area. Given size and orientation of the cooling towers needed, this area is not large enough to house either or both towers without impacting the Protected Area and requiring several warehouses to be relocated. This area is not as practical as Location A.
G	Diesel generator building. This area is infeasible for locating hypothetical MDCTs.
H	Diesel fuel oil tanks, domestic water pumphouse, sewage treatment plant. This area is not as feasible for locating cooling towers as compared to Location A.
I	Parking, training buildings, administrative buildings. This area is inferior to Location A.
J	Dry cask storage. This area is infeasible for locating hypothetical MDCTs.
K	Earmarked for solar array. Due to planned development as a solar project, this area is unavailable.
L	Earmarked for solar array. Due to planned development as a solar project, this area is unavailable.
M	Buffer area around the plant.
N	Archaeological sites. Due to archaeological and historical significance, this area is considered infeasible for locating hypothetical MDCTs.
O	Buffer area around the Plant, patches of wetlands, and an intermittent stream.
P	Earmarked for solar array. Due to planned development as a solar project, this area is unavailable.
Q	Firing range, buffer area around the Plant.

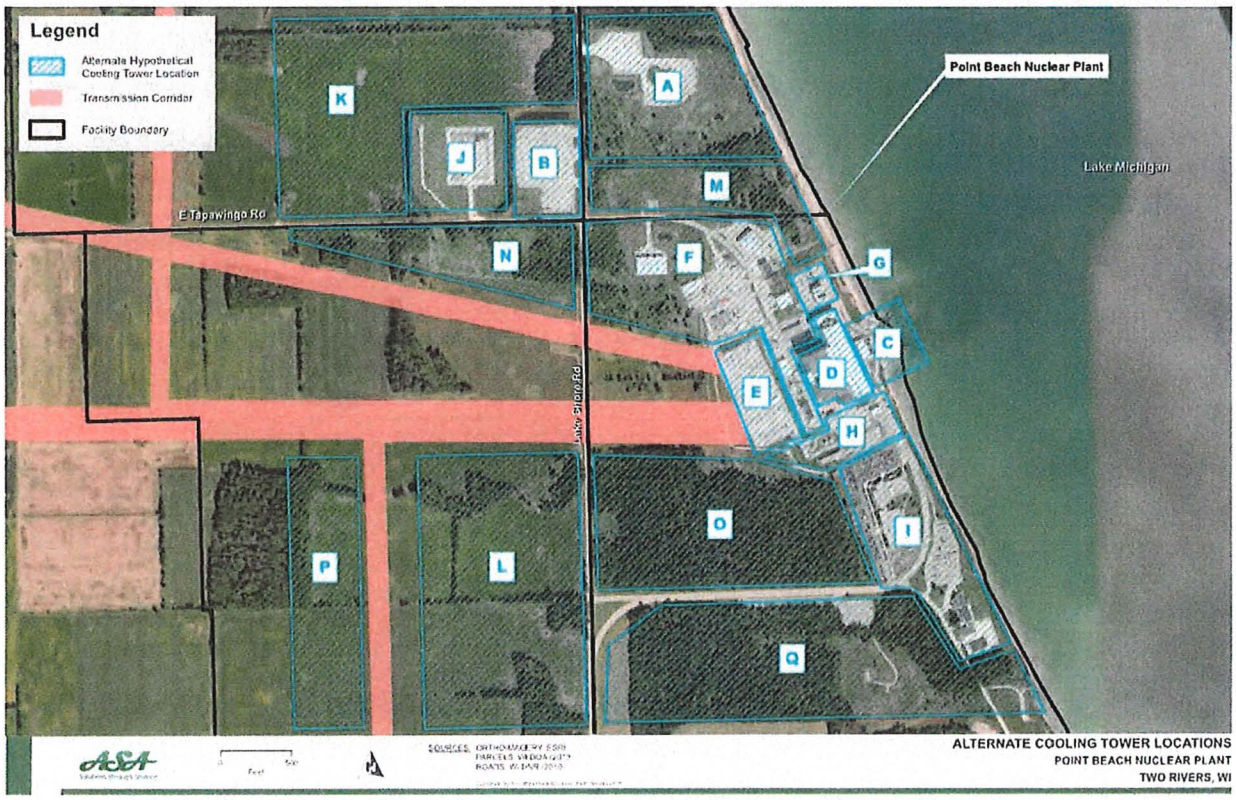


Figure 10-20. Alternate Hypothetical Cooling Tower Locations for Unit 1 and Unit 2 at PBNP

10.4.10 Feasibility Discussion

The feasibility of construction, operation, and retrofitting PBNP with hypothetical MDCTs is discussed below, assuming Location A for the MDCTs and the Lake Option for routing piping.

10.4.10.1 Retrofit Feasibility

A hypothetical retrofit of the existing PBNP cooling system with two MDCTs appears to be challenging, infeasible, and impractical.

The condenser tubes for Unit 1 and Unit 2 are designed for a certain pressure that's appropriate for a once-through system. If the existing cooling water system were retrofitted with a single set of pumps that could route water from each cooling tower basin to the condensers, through the condensers, the hot water pipes, and up to the cooling towers, such pumps would need to develop significant head, which the existing condensers, or the existing cooling water pipes may not be able to withstand. To address this issue directly, a retrofit would require the condensers to be replaced, and the cooling water pipes would need to be reinforced or replaced. This would involve significant work on existing infrastructure that is in and under the generators and other key Plant infrastructure, work within the Protected Area, and longer outage. If such a retrofit were feasible, it would essentially rebuild the Plant at significant cost, time, effort, and permitting (assuming it would be approved by the NRC).

This evaluation, therefore, assumes that two sets of pumps would be used to circulate water through each unit's cooling water system for each hypothetical cooling tower. The existing circulating water pumps would be used to route cold water from the Plant intake structure through the existing condensers, discharge flume, and to the wet well near the cooling towers. The wet well elevation would be adjusted to allow this flow. The MDCT booster pumps will pump water from the wet wells and pump water to the top of the tower wet deck. Water would cascade down into the cold water basin and return to the intake pipes near the front of the intake structure in Lake Michigan to start the cycle again.

This configuration requires intricate design of the hydraulics in order to prevent the wet well from being too deep and requiring significant pumping posing undue parasitic load. Additionally,

the need for the hot and cold water pipes to and from the MDCT to traverse under the existing intake pipes and Unit 2 discharge flume pose further hydraulic challenges and potential silting issues as well.

Several evaluations would need to be performed to assess if the existing intake pipes can be retrofitted.

10.4.10.2 Construction Feasibility

This concept poses several construction challenges. The primary one being the construction of the hot and cold water pipes between the intake/discharge structure and MDCTs, and tying in the pipes to the existing system. Per Shaw Nuclear (2008), material between 0 and 13 ft below ground has an N value of 22; material between 13 and 56 ft has an N value of 10. N value refers to the number of blows per foot. Per USBR (1998), N values between 4 and 10 are considered to be loose (of low density) and N values between 10 and 30 has medium density. Bedrock or load bearing stratum is between 65 and 100 ft deep (NextEra, 2015). The hot and cold water pipes would need to be installed within the loose density layer. Because of the softness of the material, the material could collapse making boring infeasible. If closed-cycle cooling were selected as entrainment BTA, further geotechnical review and studies would be needed to assess if hot and cold water pipes may be bored through existing material. Alternatively, the pipes may be installed using open-cut excavation, at much greater cost and significantly greater impact (if permittable).

Because the pipes need to be installed within the loose density material, the evaluation anticipates that the hot and cold water pipes would need to be pile supported during construction. The piles would need to be driven prior to boring the pipe. Aligning piles and pipe would be extremely challenging. Additionally, a significant length of the hot and cold water pipelines would require underwater construction. The engineering team is unaware of this combination of construction techniques being used in construction at a nuclear power plant.

This concept assumes that the cold water pipes would need to be installed under the Unit 2 flume, and that the Unit 1 hot water pipes would need to be installed under the existing cooling

water pipes and Unit 2 discharge flume. Whether the construction is performed within a large coffer dam with open excavation, or directional boring, achieving the level of precision and providing for the level of safety needed for the circulating water pipes would be extremely challenging.

Based on the construction challenges including in-water construction, boring underneath the existing discharge flume and intake pipes and in soft material, the construction of cooling towers at Location A and their connection to the existing system is deemed challenging, impractical, and infeasible.

10.4.10.3 Operational Feasibility

The concept assumed for the hot and cold water pipes would result in an inverted-siphon in the pipes under the intake pipes and the Unit 2 discharge flume. Solids/silt in the circulating water would settle in that sagged section, causing the pipe to lose capacity over time. Suctioning out deposited solids would be challenging.

This concept assumes that a smaller crib and smaller intake structure (than the existing crib and CWIS) would be built to withdraw and route makeup water. Ice control is a major consideration at PBNP, as the Plant presently routes warm water to the intake to prevent/control for ice and frazil ice. Because of its small size there'd be little margin for error for the makeup water crib, and therefore ice control at the makeup water crib would be even more delicate and challenging.

The evaluation assumed that the existing crib and piping would remain in-place to be used as needed (during emergencies), but isolated from the closed-cycle system. Based on historic operations, PBNP needs to recirculate two circulating water pumps (one per unit) to control for ice at the existing crib. Discharging the entire blowdown to the existing crib (and a portion to the new make-up water crib), even if taken from the hot side, would not be adequate for ice control. Modifying the hypothetical closed-cycle system to route more hot water to the cribs would complicate the design and operation, and cause the construction and operations to be costlier. The lack of sufficient hot water during winter could make this system infeasible during winter months.

The hypothetical MDCTs would be designed for the 99th percentile upper wet bulb temperature, which means that one percent of the time annually (approximately 88 hours), on average, but concentrated during the warmest times of the year, the towers would not be able to cool the full circulating water load. Electricity demand is highest during such days. PBNP would not be able to generate at full capacity when the cooling tower is not fully available, incurring a cost penalty, and also reducing the reliability of the grid when electricity is most needed.

Operation of standard MDCTs would involve the addition of pumps, fans, and related equipment, which would consume energy. These parasitic losses would reduce the amount of electricity the Plant could supply to the grid. Parasitic losses are presented in Section 12.

10.4.10.4 Facility Operational Feasibility Due to Technology Retrofit

Operating PBNP cooling and service water system with a closed-cycle recirculating system would cause the cold water temperature during the warmest and most humid periods of the year to increase to 84°F, and could exceed this temperature one percent of the time on average. The service water system is designed to receive cold water no warmer than 85°F. The service water system is designed with a 10°F margin of safety. Converting to closed-cycle would reduce the margin to 1°F.

Whenever the cooling towers cannot cool the full condenser load (for approximately 88 hours during the warmest and most humid periods in the summer), the Plant would not be able to generate at full capacity to supply full power to PBNP during those periods. Additionally, the parasitic load on the system would be highest during the warmest periods when the greatest number of fans would need to operate to facilitate cooling or to reduce the visible plume. These periods would also coincide with peak demand days for energy usage.

10.4.10.5 Overall Feasibility of Cooling Towers (§ 122.21(r)(10)(i)(D))

Several reasons make the construction and operation of cooling towers at PBNP impractical; these include the high parasitic load and reduction in facility reliability, and the potential plume impact on the future solar arrays planned for the surrounding areas.

However, the complex modifications required for the tie-in and the hot and cold water piping installation challenges make the construction of this system, and the loss of safety margin on the service water system make this retrofit infeasible.

10.4.11 Permitting Requirements

Construction and operation of a cooling tower at PBNP could trigger additional federal, state, and local permitting efforts. These include:

- NRC Review and Coordination
- US Army Corps of Engineers (USACE) review and permitting
- Wisconsin Department of Natural Resources (WDNR) – Water Quality Bureau
- WDNR – Air Permitting modification
- WDNR Modification to Storm Water Pollution Prevention Plan
- WPDES General Permit for Construction Stormwater
- WPDES Construction Dewatering Discharge to Surface Waters Permit
- WDNR - Division of Fish, Wildlife, and Parks
- Public Service Commission of Wisconsin (PSC)
- Manitowoc County approvals

10.4.12 Hypothetical Schedule

The hypothetical cooling tower retrofit project schedule is shown in Table 10-10. Depending on NRC review and coordination, and permit approval timelines for other agencies, the schedule could be substantially longer than presented here.

Table 10-10. Hypothetical Cooling Tower Implementation Schedule at PBNP

Task Completion Month	Year	Implementation Item
Dec	2020	Submit 316(b) application
Jun	2021	Permit expiration
Jun	2021	Permit Issuance / Final BTA determination
Dec	2021	Engineering Contract
Sep	2022	Engineering evaluations. Pipeline alignments and construction methods. Demolition plans. Infrastructure relocation plans. Regulatory coordination.
Mar	2023	30 percent design
Sep	2023	Site investigations - geotechnical borings, soil and topographic surveys. Prepare and submit permit applications
Mar	2024	60 percent design
Sep	2024	Procure long-lead contracts. 95 percent design. Receive long-lead permit approvals.
Mar	2025	Bid construction work. Select contractor. General conditions. Receive long-lead permit approvals. Apply for and receive local permits.
Dec	2025	Construct cooling tower basins, cooling tower wet wells, pipelines outside PA. Construct new makeup water crib and conveyance piping.
Mar	2026	Install cooling towers. Install makeup, booster, blowdown pumps.
Nov	2026	Excavate/bore along shoreline to interconnect hot/cold pipes from cooling towers to intake/discharge pipes. Modifications to existing intake pipes and transition structure. Install blowdown pipeline. Hydrostatic testing. [Generation outage assumed of two months]
May	2027	Site restoration
	2038	Fill replacement

This evaluation anticipates a 2-month tie-in outage.

10.4.13 Cooling Tower Costs (§ 122.21(r)(10)(iii))

10.4.13.1 Capital Costs

Based on the existing conditions, the conceptual-level design presented, and assumptions stated, the AACE Class 4[57] estimate for retrofitting the once-through cooling systems for Units 1 and 2 with cooling towers is presented in this section. The construction cost estimates utilize union wage rates for Green Bay, WI, budgetary equipment pricing obtained from major equipment suppliers, and construction standard pricing (using RS Means data). Capital costs are presented in 2020 U.S. dollars. Contingency, which includes cost components that were not explicitly costed in the engineers' conceptual design, was included at 20 percent of all project costs. Owner's costs (project management and planning by the owner, permit application reviews, project site supervision and bill payment by owner) was included as 10 percent of all project costs.

The Class 4 estimate for the capital costs for labor and materials for the implementation of two standard MDCTs at PBNP would be approximately $630 million (Table 10-11), if all work were implemented in 2020, and includes the following components:

- Existing infrastructure demolition costs;
- Equipment costs, including cooling tower structural components and fill, cooling tower booster pumps;
- Cooling tower basin and wet well construction;
- Construct/bore new hot and cold water pipelines along the shore and under Lake Michigan, including under existing circulating water pipes and Unit 2 discharge flume;
- Earth moving and civil work; site restoration;
- Piping and electrical work;
- Blowdown system;
- Makeup water system, including the new crib and intake;

[57] A Class 4 estimate is typically used for study and feasibility purposes only, with a project percent completion between 1 percent and 15 percent; the accuracy may be between -30 percent and +50 percent of the estimated cost (AACE, 2016).

- Engineering and design of retrofit with the existing Plant and condensers;
- Permitting the cooling towers, makeup water system, and intake modifications; and
- Non-water quality environmental and other impacts mitigation.

The evaluation has attempted to minimize disruptions to generation and schedule construction efforts to minimize outages. The evaluation expects that construction of the cooling towers, makeup water system, and hot and cold piping from the tower down to the Plant would occur while the plant is in operation. The tie in to the existing system would require significant modifications to the intake piping and discharge flumes, which would necessitate an outage to both units. The cooling tower tie-in and modifications to the existing system would be aligned to occur with a scheduled maintenance outage in an attempt to minimize Plant outages. Service water would need to be continuously available, even if it is via a bypassed route or alternate source.

Table 10-11. Cooling Tower Capital Costs at PBNP (2020 $ Millions)

Cost Component	2020 $M
Construction Direct Costs	
Demolition	$15.59
Civil / Sitework	$151.53
Mechanical	$104.13
Structural	$31.61
Electrical and I&C	$12.59
Subtotal Construction Direct Costs	$315.45
Construction Indirect Costs	
Contractor Site Supervision	$11.37
General Conditions	$34.23
General Administration & Profit	$54.16
Subtotal Construction Indirect Costs	$99.76
Total Construction Cost	**$415.21**
Design Engineering and Construction Management	$50.47
Permitting	$9.51
Project Management (Engineering)	$1.80
Owner's Costs	**$47.70**
Contingency	**$104.94**
TOTAL CAPITAL COST	**$629.62**

10.4.13.2 Operations & Maintenance Costs

O&M costs for the MDCTs are estimated at approximately **$5.29** million per year (if incurred in 2020), and include labor, chemicals[58], solids removal, parts replacement for makeup and booster

[58] This evaluation assumes that a dispersant and a corrosion/scale inhibitor would be added continuously at a low dose.

pumps, and cooling tower fans. The electricity to operate pumps and fans would cost about another $24.25 million per year. It is also assumed blowdown would be dechlorinated whenever the circulating water is chlorinated. In addition, circulating water is assumed to be treated to reduce corrosion and scaling within the system. O&M Cost breakouts for 100% and average utilization rates are provided in Table 10-12.[59]

Table 10-12. Cooling Tower Annual Operations & Maintenance Costs at PBNP (2020 $ Millions)

O&M Cost Component	Annual O&M $M (100% CUR)	Annual O&M $M (Average CUR)
Chemicals for Cooling Water	$0.27	$0.25
Solids Removal[60]	$0.02	$0.02
Parts Replacement and Maintenance	$5.00	$5.00
Electricity for Pumps and Fans[61] and loss due to Backpressure Energy Penalty	$24.25 [62]	$23.23[63]
Total	**$29.54**	**$28.5**

Note: CUR = Capacity Utilization Rate

10.4.13.3 Environmental Mitigation Costs (from 122.21(r)(12))

The design already incorporates potentially feasible impact mitigation measures listed below. No additional environmental mitigation efforts or costs are estimated because additional measures are not expected to be technically feasible.

[59] During the final quality assurance review, it was noted that the generation data for Units 1 and 2 were reversed for part of the data record. The actual Unit 1 CUR for the period Jan 1, 2015, through Dec 31, 2019, was 94.6 percent (as opposed to 93.9 percent used above). The actual Unit 2 CUR for the same period was 94.7 percent (as opposed to 95.5 percent used above). Given the 0.8 percent higher value for Unit 1 and 0.8 percent lower value for Unit 2, the overall impact on PBNP operations and maintenance costs remain the same. Therefore, the reports were not updated in their entirety.

[60] Primarily cooling tower solids removal. This could be conducted every few years, but costs are presented as annual.

[61] Electricity used for operating fans and pumps is assumed to be generated by the Plant.

[62] The costs assume a total of approximately 306,523 MWhr consumed annually for the pumps and fans; and 153,981 MWhr/year as backpressure energy penalty

[63] When PBNP is operating at full capacity, Unit 1 and Unit 2 can lose up to 8.8 MW each due to backpressure energy penalty alone, which would add up to approximately 153,981 MWhr per year. Backpressure would be impacted during warmest months when the Plant would be operating near-continuously. Therefore, backpressure energy penalty would be approximately the same under both full or project utilization rates.

- Reduce additional energy consumption by assuming the implementation of the most energy efficient equipment.
- Route warm water to the new makeup water crib and intake structure to control ice and frazil ice.
- Minimize impact on the Protected Area.
- Minimize excavation and disturbance to the Plant by repurposing the intake and discharge canals to be parts of the hypothetical closed cycle cooling system.

10.4.13.4 Facility-Level Compliance Cost (Annual and NPV)

Considering operations through 2050 for Unit 1 and 2053 for Unit 2, the evaluation assumed that the Unit 1 cooling tower fill would be replaced once in 2038.
Per the schedule presented in Section 10.4.12, the cooling towers would be operational by May 2027.

Table 10-13 through Table 10-16 provide a series of cost layouts. Table 10-13 overlays the capital costs presented in Table 10-11 on the project schedule presented in Table 10-10; column 4 assumes that the entire project would be executed in 2020; column 5 escalates the costs in column 4 to the applicable year; and column 6 gives the present value of each task in 2020 dollars.

Table 10-14 presents O&M costs excluding electricity costs assuming that the Plant would be operated continuously: costs if incurred in 2020 (column 2); costs in a given year (column 3); and the present value of each year's costs in 2020 dollars (column 4). Table 10-15 presents electricity costs for continuous operation (100 percent CUR) of fans and pumps. Table 10-16 present O&M costs, including electricity costs, assuming that the Plant would be operated at its average CUR from January 2015 through December 2019.

Table 10-13. Capital Cost Outlay for Cooling Tower Installation at PBNP (2020 $ Millions)

Task Completion Date	Project Year	Implementation Item	Cost if Implemented in (2020 $M)	Costs in Given Year ($M)	Present Value (2020 $M)
Dec-20	-0.5	Submit 316(b) application	$-	$-	$-
Jun-21	0	Permit expiration	$-	$-	$-
Jun-21	0	Permit Issuance / Final BTA determination	$-	$-	$-
Dec-21	0.5	Engineering Contract	$0.63	$0.65	$0.60
Sep-22	1.25	Engineering evaluations. Pipeline alignments and construction methods. Demolition plans. Infrastructure relocation plans. Regulatory coordination.	$14.20	$15.07	$12.80
Mar-23	1.75	30 percent design	$21.34	$23.32	$18.26
Sep-23	2.25	Site investigations - geotechnical borings, soil and topographic surveys. Prepare and submit permit applications	$15.41	$16.84	$13.18
Mar-24	2.75	60 percent design	$18.02	$20.28	$14.63
Sep-24	3.25	Procure long-lead contracts. 95 percent design. Receive long-lead permit approvals.	$31.80	$35.79	$25.82
Mar-25	3.75	Bid construction work. Select contractor. General conditions. Receive long-lead permit approvals. Apply for and receive local permits.	$49.86	$57.81	$38.44
Dec-25	4.5	Construct cooling tower basins, cooling tower wet wells, pipelines outside Protected Area. Construct new makeup water crib and conveyance piping.	$184.01	$213.32	$141.87
Mar-26	4.7	Install cooling towers. Install makeup, booster, blowdown pumps.	$95.11	$113.57	$69.61
Nov-26	5.4	Excavate/bore along shoreline to interconnect hot/cold pipes from cooling towers to intake/discharge	$190.71	$227.72	$139.58

Task Completion Date	Project Year	Implementation Item	Cost if Implemented in (2020 $M)	Costs in Given Year ($M)	Present Value (2020 $M)
		pipes. Modifications to existing intake pipes and transition structure. Install blowdown pipeline. Hydrostatic testing. [two month outage]			
May-27	5.9	Site restoration	$8.53	$10.49	$5.92
2038		Fill Replacement	$25.50	$43.41	$10.00

Table 10-14. Cooling Tower Operation & Maintenance Costs at PBNP (excluding electricity costs and assuming full utilization of the Plant) (2020 Costs, Escalated Costs in a Given Year & Present Value of Costs)

	Unit 1			Unit 2		
Year	O&M Costs if Incurred in 2020 ($M)	O&M Costs in a Given Year ($M)	Present Value of O&M Cost (2020 $M)	O&M Costs if Incurred in 2020 ($M)	O&M Costs in a Given Year ($M)	Present Value of O&M Cost (2020 $M)
2026	$0.44	$0.53	$0.32	$0.44	$0.53	$0.32
2027	$2.64	$3.25	$1.84	$2.64	$3.25	$1.84
2028	$2.64	$3.35	$1.74	$2.64	$3.35	$1.74
2029	$2.64	$3.45	$1.65	$2.64	$3.45	$1.66
2030	$2.64	$3.55	$1.57	$2.64	$3.55	$1.57
2031	$2.64	$3.66	$1.49	$2.64	$3.66	$1.49
2032	$2.64	$3.77	$1.42	$2.64	$3.77	$1.42
2033	$2.64	$3.88	$1.34	$2.64	$3.88	$1.34
2034	$2.64	$4.00	$1.28	$2.64	$4.00	$1.28
2035	$2.64	$4.12	$1.21	$2.64	$4.12	$1.21
2036	$2.64	$4.24	$1.15	$2.64	$4.24	$1.15
2037	$2.64	$4.37	$1.09	$2.64	$4.37	$1.09
2038	$2.64	$4.50	$1.04	$2.64	$4.50	$1.04
2039	$2.64	$4.63	$0.98	$2.64	$4.64	$0.98
2040	$2.64	$4.77	$0.93	$2.64	$4.78	$0.93
2041	$2.64	$4.92	$0.89	$2.64	$4.92	$0.89
2042	$2.64	$5.06	$0.84	$2.64	$5.07	$0.84

	Unit 1			Unit 2		
Year	O&M Costs if Incurred in 2020 ($M)	O&M Costs in a Given Year ($M)	Present Value of O&M Cost (2020 $M)	O&M Costs if Incurred in 2020 ($M)	O&M Costs in a Given Year ($M)	Present Value of O&M Cost (2020 $M)
2043	$2.64	$5.22	$0.80	$2.64	$5.22	$0.80
2044	$2.64	$5.37	$0.76	$2.64	$5.37	$0.76
2045	$2.64	$5.53	$0.72	$2.64	$5.54	$0.72
2046	$2.64	$5.70	$0.68	$2.64	$5.70	$0.68
2047	$2.64	$5.87	$0.65	$2.64	$5.87	$0.65
2048	$2.64	$6.05	$0.62	$2.64	$6.05	$0.62
2049	$2.64	$6.23	$0.58	$2.64	$6.23	$0.58
2050	$2.20	$5.35	$0.46	$2.64	$6.42	$0.56
2051				$2.64	$6.61	$0.53
2052				$2.64	$6.81	$0.50
2053				$0.66	$1.75	$0.12

Table 10-15. Cost of Electricity for Operating a Cooling Tower and Assuming Full Utilization of the Plant (2020 Costs, Escalated Costs in a Given Year, and Present Value of Costs)

	Unit 1			Unit 2		
Year	O&M Costs if Incurred in 2020 ($M)	O&M Costs in a Given Year ($M)	Present Value of O&M Cost (2020 $M)	O&M Costs if Incurred in 2020 ($M)	O&M Costs in a Given Year ($M)	Present Value of O&M Cost (2020 $M)
2026	$2.01	$2.40	$1.47	$2.03	$2.42	$1.49
2027	$12.07	$14.85	$8.39	$12.18	$14.98	$8.46
2028	$12.07	$15.29	$7.96	$12.18	$15.43	$8.03
2029	$12.07	$15.75	$7.56	$12.18	$15.89	$7.63
2030	$12.07	$16.22	$7.17	$12.18	$16.37	$7.24
2031	$12.07	$16.71	$6.81	$12.18	$16.86	$6.87
2032	$12.07	$17.21	$6.47	$12.18	$17.36	$6.52
2033	$12.07	$17.73	$6.14	$12.18	$17.89	$6.19
2034	$12.07	$18.26	$5.83	$12.18	$18.42	$5.88
2035	$12.07	$18.81	$5.53	$12.18	$18.97	$5.58

	Unit 1			Unit 2		
Year	O&M Costs if Incurred in 2020 ($M)	O&M Costs in a Given Year ($M)	Present Value of O&M Cost (2020 $M)	O&M Costs if Incurred in 2020 ($M)	O&M Costs in a Given Year ($M)	Present Value of O&M Cost (2020 $M)
2036	$12.07	$19.37	$5.25	$12.18	$19.54	$5.30
2037	$12.07	$19.95	$4.99	$12.18	$20.13	$5.03
2038	$12.07	$20.55	$4.73	$12.18	$20.73	$4.77
2039	$12.07	$21.17	$4.49	$12.18	$21.36	$4.53
2040	$12.07	$21.80	$4.26	$12.18	$22.00	$4.30
2041	$12.07	$22.46	$4.05	$12.18	$22.66	$4.08
2042	$12.07	$23.13	$3.84	$12.18	$23.34	$3.88
2043	$12.07	$23.82	$3.65	$12.18	$24.04	$3.68
2044	$12.07	$24.54	$3.46	$12.18	$24.76	$3.49
2045	$12.07	$25.27	$3.29	$12.18	$25.50	$3.32
2046	$12.07	$26.03	$3.12	$12.18	$26.27	$3.15
2047	$12.07	$26.81	$2.96	$12.18	$27.05	$2.99
2048	$12.07	$27.62	$2.81	$12.18	$27.86	$2.84
2049	$12.07	$28.45	$2.67	$12.18	$28.70	$2.69
2050	$10.06	$24.42	$2.11	$12.18	$29.56	$2.56
2051				$12.18	$30.45	$2.43
2052				$12.18	$31.36	$2.30
2053				$3.04	$8.08	$0.55

Table 10-16. Cooling Tower Operation & Maintenance Costs at Point Beach Nuclear Plant (including electricity) assuming the Projected Utilization of PBNP (2020 Costs, Escalated Costs in a Given Year, and Present Value of Costs)

	Unit 1			Unit 2		
Year	O&M Costs if Incurred in 2020 ($M)	O&M Costs in a Given Year ($M)	Present Value of O&M Cost (2020 $M)	O&M Costs if Incurred in 2020 ($M)	O&M Costs in a Given Year ($M)	Present Value of O&M Cost (2020 $M)
2026	$2.36	$2.82	$1.73	$2.39	$2.85	$1.75
2027	$14.15	$17.41	$9.83	$14.34	$17.64	$9.97
2028	$14.15	$17.93	$9.34	$14.34	$18.17	$9.46
2029	$14.15	$18.47	$8.86	$14.34	$18.72	$8.98
2030	$14.15	$19.02	$8.41	$14.34	$19.28	$8.53
2031	$14.15	$19.59	$7.99	$14.34	$19.86	$8.09
2032	$14.15	$20.18	$7.58	$14.34	$20.45	$7.68
2033	$14.15	$20.79	$7.20	$14.34	$21.06	$7.29
2034	$14.15	$21.41	$6.83	$14.34	$21.70	$6.92
2035	$14.15	$22.05	$6.49	$14.34	$22.35	$6.57
2036	$14.15	$22.71	$6.16	$14.34	$23.02	$6.24
2037	$14.15	$23.39	$5.85	$14.34	$23.71	$5.92
2038	$14.15	$24.10	$5.55	$14.34	$24.42	$5.62
2039	$14.15	$24.82	$5.27	$14.34	$25.15	$5.34
2040	$14.15	$25.56	$5.00	$14.34	$25.91	$5.07
2041	$14.15	$26.33	$4.75	$14.34	$26.68	$4.81
2042	$14.15	$27.12	$4.51	$14.34	$27.48	$4.57
2043	$14.15	$27.93	$4.28	$14.34	$28.31	$4.34
2044	$14.15	$28.77	$4.06	$14.34	$29.16	$4.12
2045	$14.15	$29.63	$3.86	$14.34	$30.03	$3.91
2046	$14.15	$30.52	$3.66	$14.34	$30.93	$3.71
2047	$14.15	$31.44	$3.47	$14.34	$31.86	$3.52
2048	$14.15	$32.38	$3.30	$14.34	$32.82	$3.34
2049	$14.15	$33.35	$3.13	$14.34	$33.80	$3.17
2050	$11.79	$28.63	$2.48	$14.34	$34.82	$3.01
2051				$14.34	$35.86	$2.86

	Unit 1			Unit 2		
Year	O&M Costs if Incurred in 2020 ($M)	O&M Costs in a Given Year ($M)	Present Value of O&M Cost (2020 $M)	O&M Costs if Incurred in 2020 ($M)	O&M Costs in a Given Year ($M)	Present Value of O&M Cost (2020 $M)
2052				$14.34	$36.94	$2.71
2053				$3.59	$9.51	$0.64

10.4.14 Uncertainty

Key uncertainties associated with this evaluation are listed below:

- While the hypothetical CCRS retrofit is infeasible, the evaluation has included conceptual designs, scheduling, and costing assuming such a retrofit would be permittable from all agencies and viable from Plant, engineering, and hydraulic perspectives. This is done to provide a facility cost estimate that will support a social cost estimate.
- The ability to bore pipe through low integrity soil needs further evaluation.
- The hypothetical MDCTs included in this evaluation have been designed for a cold water temperature of 84°F returning to the existing system; eroding the margin of safety for the safety-related service water system from 10°F to 1°F. Because the service water system is assumed to be fed by the MDCT, the water returning to the service water system must meet the temperature requirements of this system. The water in the service water system cannot exceed 85°F for safety reasons. Potential fluctuations in daytime temperature were not evaluated.
- The hypothetical CCRS retrofit assumes that there would be no associated potential security or nuclear safety-related implications. If there are security or nuclear safety-related implications that could not be addressed, further evaluations would be required in an attempt to mitigate for such implications.
- The site for the hypothetical cooling tower is assumed to be available, and not already earmarked for other site improvement projects.

- The impacts from the cooling tower plumes on the planned Point Beach Solar Project have not been evaluated. Additional studies would be required to determine the impacts from the plumes on the solar arrays.
- Existing uses at the location and impacted equipment may be relocated, and the distances between the cooling towers and existing Plant equipment meet minimum separation distances.
- The existing intake pipes withdraw water from Lake Michigan (via the crib) and the existing discharge flumes discharge circulating water back to Lake Michigan. As such, intake pipes and discharge flumes are hydraulically connected to Lake Michigan. The retrofit assumes that intake piping and discharge flumes may be hydraulically isolated from the surface waterbody using valves (but may be hydraulically reconnected as needed). This is critical to the CCRS retrofit. If this is unallowable, then the entire retrofit may be infeasible.
- The existing intake structure, intake crib, and discharge flumes have been designed to avoid ice by recirculating warm water. Impacts to the existing intake structure, existing intake crib, existing discharge flumes, and the hypothetical new makeup water intake crib, piping, and structure have not been evaluated. If heated water is not available to prevent ice formation at these structures, the retrofit may be infeasible.
- Key intake/discharge retrofit elements and tie-in outage would be completed prior to the winter. If both units need to be taken offline during winter, loss of warm water recirculation could cause ice, and jeopardize service water flow and the intake structure itself.
- Except for dechlorination, the blowdown would not need to be treated prior to discharge. Existing discharges that were combined with the once-through circulating water may need to be evaluated against WPDES permit limits and evaluated for possible discharge routes and treatment prior to discharge.
- The evaluation anticipates that much of the existing Plant infrastructure, equipment, and piping would continue to be used in the closed-cycle system. If the condition of these items is unsuitable for continued use or if the items are found to be incompatible with the

hypothetical CCRS retrofit, then those items would need to be replaced at higher cost and longer construction and outage durations, assuming replacement of the item(s) is feasible.

10.5 Fine-Mesh Screen Retrofit (§122.21(r)(10)(i))

This section will discuss the potential approaches to retrofitting the Point Beach Nuclear Plant (PBNP) CWIS with fine-mesh screens (FMS) in order to reduce rates of entrainment. While the Final Rule only requires a reduction in entrainment and not entrainment mortality, the reduction in entrainment mortality is a major contributor to the overall benefit of an entrainment control technology estimated as part of the Benefits Valuation Study (§ 122.21(r)(11)). Therefore, what the Final Rule calls "conversion", or exclusion of entrainable organisms by FMS, should also consider the potential that the organism may not survive the exclusion event[64]. This important goal complicates the consideration of FMS because it necessitates quantitative estimation of biological performance given a variety of site-specific factors (e.g., hydraulic behavior at the intake, the taxa and life stages of entrained organisms, the candidate approach to FMS, etc.).

Per the Final Rule, FMS are those with openings of 2 mm or less. The rule does not make clear distinctions between two alternative FMS technologies: 1) narrow-slot wedgewire screens; and 2) use of FMS on MTWS (FM MTWS). For this reason, this section will consider both technologies as potential means to address entrainment BTA at PBNP.

While the two technologies have important differences, both rely on the exclusion of otherwise entrainable organisms, typically eggs and larvae, in a fashion that attempts to ensure their continued survival within the source waterbody. As noted in the Final Rule's Technical Development Document (TDD; EPA, 2014), the nature of the interaction between the screen and the organism is very likely to affect both rates of exclusion and rates of post-exclusion survival. For example, at a high through-screen velocity (TSV), organisms may be held to the screen and

[64] Throughout this section and in Section 11, FMS effectiveness will be considered relative to the exclusion, survival, and live return to the source water. NextEra believes that there is a growing consensus that a substantial fraction of entrained organisms are likely to survive passage through the plant under some conditions. At PBNP, the increase in temperature across the condensers is sufficiently high (22°F) that no entrainment survival has been assumed.

either extruded through it or damaged by it prior to being washed off.[65] More importantly, application of FMS, without expanding the screen area, will reduce the open area available for water passage, increasing the TSV and raising the potential for unacceptable head loss across the screen and related adverse hydraulic effects within the CWIS, cooling and service water systems. FMS are also likely to be subject to increased rates of debris retention and biofouling, both of which would contribute to hydraulic, station reliability and safety concerns.

As will be discussed below, the two FMS technologies are subject to very different performance constraints including how they could comply with the IM BTA portions of the rule. Neither technology has been commonly applied at the intake flows needed at PBNP or at nuclear facilities in particular. There are few CWIS that employ FM MTWS and, therefore, the design parameters (e.g., target TSV) are not well established. These issues require careful consideration during the conceptual design of potential FMS retrofit to ensure that the system evaluated is reliable, biologically effective, and properly costed. The potential necessity to expand the CWIS to accommodate FMS is of great importance in estimating capital costs. For these reasons, the following sections will introduce the two technologies and will discuss approaches to their conceptual design.

It is important to note that in the preamble to the Final Rule[66], EPA wrote:

> *"Converting traveling screens from coarse mesh to fine mesh often requires adding more screens in order to maintain the same flow, since the open area of a fine mesh screen is less than the open area of a coarse mesh screen. Adding more screens is one way to maintain that flow. [Footnote: A facility could also increase its intake velocity.] EPA estimates that as many as 17 percent of existing intakes could not be enlarged to accommodate a 2 mm mesh, and as many as 55 percent of existing intakes could not accommodate a 0.5 mm slot size under conditions of low-intake velocities. For these reasons, fine mesh screens are available for some locations, but they are not the best performing technology and are not an available technology for the industry as a whole for IM&E."*

As noted below, the TDD for the 2014 Rule (EPA, 2014) assumed, as the basis for cost estimation for the rulemaking, that the CWIS would have to be expanded to allow for a TSV of less than 0.5 ft/s. EPA also indicated that a facility could increase its intake velocity to

[65] The duration of the organisms' association with the screen has been found to be positively correlated with increased mortality (EPRI, 2010).
[66] Federal Register. Vol. 79, p. 48335. August 15, 2014.

accommodate FMS but did not provide an alternative TSV to 0.5 ft/s[67]. The relevance of this finding for PBNP will be carefully considered in the following discussion of both narrow-slot wedgewire screens and FM MTWS.

10.5.1 Narrow-slot Wedgewire Screens

10.5.1.1 Constraints on the Cooling Water Intake Structure

As described in Section 10.2.5, the CWIS at PBNP is subject to a number of constraints that complicate its potential retrofit with FMS. These constraints are carefully considered in the evaluation of FMS either as wedgewire screens or fine mesh modified traveling water screens (FM MTWS).

10.5.1.2 Description of Hypothetical Wedgewire Arrangement

Narrow-slot wedgewire screens represent a potential approach to entrainment BTA at PBNP under the Final Rule. This technology typically has a design intake velocity of 0.5 ft/s or less when used at power-plant intakes. This velocity is consistent with the velocity EPA used as the basis for cost estimation for the rulemaking as noted above. With a velocity of 0.5 ft/s or less, these screens would achieve impingement mortality BTA, under Impingement Mortality Compliance Alternative 2 (see 40 CFR 125.94(c)(2)).

Cylindrical wedgewire screens have been used at two large facilities on the Great Lakes (James H. Campbell Power Plant and Oak Creek Power Plant/Elm Road Generating Station). These two facilities use screens with 9.5 mm slots, representing BTA for impingement. Cylindrical wedgewire screens narrow-slot openings have been successfully used at a very limited number of facilities and those with intake flows that are a small fraction of the PBNP CWIS. Narrow-slot cylindrical wedgewire screens have not been used at any nuclear facilities in the USA. As discussed below, environmental conditions with Lake Michigan present a myriad of issues that need to be addressed in order for a successful wedgewire screen installation and operation.

[67] The TDD also assumed that traveling water screens with TSV in excess of 3.0 ft/s would not be able to achieve the IM BTA standard with MTWS alone but would require either expansion to reduce the TSV or application of wedgewire screens (see Section 8.2.2.1 or EPA, 2014). While NextEra believes that this threshold is uncertain, EPA's concern represents another constraint on application of FMS to MTWS.

A conceptual wedgewire screen arrangement was developed for PBNP. This alternative uses screens with 1.75 mm slot openings. This slot size had been considered informally as BTA for PBNP when USEPA (2004) considered fine slot wedgewire for PBNP as part of the estimation of the national implementation costs of the 316(b) Phase II rule. This exercise did not affect PBNP under 316(b) except to the extent it established a potential cost for consideration of the Phase II rule's "cost-cost" test[68], an application that did not result in direct suggestion that the technology should be the basis of 316(b) compliance at the site. In 2008, as part of discussions regarding the WPDES permit renewal, agency fisheries staff suggested that 1.75 mm wedgewire could be an appropriate BTA approach at PBNP. NextEra (then FPL Energy) rebutted this suggestion in a report in 2009 (AKRF, 2009). As described below, NextEra now understands the constraints on wedgewire screens to be far more severe than discussed in AKRF (2009).

Finer slot sizes are available but space requirements, biofouling, icing, and debris loading concerns, as discussed later in this section, are more severe with smaller slots. Therefore, 1.75 mm slot openings are considered as a means of evaluating the overall feasibility of narrow-slot wedgewire screens, as well as comparing them to FM MTWS as described below. The 1.75 mm slot screens will, however, exclude a lower proportion of organisms than either wedgewire or a traveling water screen equipped with smaller mesh openings.

A total of twenty-seven (27)[69], 84-inch diameter wedgewire tee-screens with 1.75-mm slot widths would be necessary to screen the PBNP intake flow (769,160 gpm) with an average intake velocity of less than 0.42 ft/s. This velocity was selected for design to allow for plugging of up to 15% of the screen surface area without exceeding a 0.5 ft/s through-screen velocity. Three additional screens are included in the design to balance the flow through each of the five header pipes.

[68] The cost-cost test allowed an applicant to consider EPA's site-specific estimates of the cost of compliance and propose that the actual costs would be far higher. That procedure was lost with the remand of the 2004 rule and was not included in the 2014 rule.

[69] This design includes five (5) more screens than presented in 2009. The new design permits plugging of up to 15% of the screen area without exceeding a 0.5 ft/s through-screen velocity.

The screens would be mounted to five, 9-foot diameter header pipes located lakeward of the existing offshore intake. These pipes would connect to a large plenum constructed around the existing offshore intake. The plenum would be constructed using earth-filled double sheet pile walls with a concrete cap. These walls would support a work deck and the screen cleaning equipment. The top of the platform would be located above the maximum wave height and the screen cleaning equipment placed in weather tight enclosures to reduce the probability of damage during large storm events. An approximately 1,750 ft long, 20 ft wide pier would be used to access the offshore plenum and screen cleaning equipment. Power to the screen cleaning system would be routed along this pier. A plan of the wedgewire layout is provided on Figure 10-21.

The wedgewire arrangement presented in this study differs from the arrangement presented in 2009 (AKRF, 2009). These differences are a result of increased testing and operational experience with cylindrical wedgewire screens. The major differences include; emergency bypass gates to allow the screens to be bypassed if they cannot maintain adequate flow, an automated brush-actuated cleaning system to remove debris and reduce biofouling of the screens, and an access pier with service deck to house the screen cleaning equipment and emergency bypass controls. These three features are considered essential for any narrow-slow wedgewire option at PBNP.

The hypothetical wedgewire layout is intended for illustrative purposes only because, as described below, there are many uncertainties and barriers that need to be addressed when determining the feasibility of wedgewire screens at PBNP. In fact, as described below, the constraints at PBNP make wedgewire screens of any form infeasible.

10.5.1.3 Feasibility Discussion

Use of wedgewire screens for cooling water withdrawals has some precedent in the United States but the installed systems are either relatively small (i.e., capacity of approximately 10 MGD) or their slot width is considerably larger than 2 mm, or both. NextEra is aware of no precedent for an intake system with intake flows approaching PBNP's that uses narrow-slot wedgewire screens

under the conditions in Lake Michigan. This lack of precedent indicates that there is a high degree of uncertainty and concern regarding the performance and reliability of such systems.

The major concerns that need to be considered when determining the feasibility of a narrow-slot wedgewire screen installation at PBNP include: head loss, presence of sweeping currents, debris accumulation, sediments, icing, and biofouling. These issues are discussed in the sections below.

Head losses

Head losses associated with wedgewire screen installations are related to head losses through the screen openings, screen assembly, and piping. With a through-slot velocity of less than 0.5 ft/s the head loss through the screen wires would be less than an inch with clean screens. The losses through the screen assembly would be less than 1 ft and the losses through the intake piping would be approximately 1 ft. Overall, a wedgewire screen assembly would reduce water levels in the forebay and the circulating water pumps by approximately 2 ft (assuming a good hydraulic design, debris loading and fouling would not be a significant problem). These head losses are inevitable given the nature of the technology and the resulting hydraulic forces.

As introduced above, the cooling water system at PBNP is constrained relative to the water level that is allowable in the pump bays. Below a critical water level and in order to preserve adequate margins of safety, pumping must be reduced, preventing full generation at the plant. In addition, normal operation of the pumps occurs at a water level that is relatively close to this critical low water level. Additional potential head losses through the cooling water supply system are, therefore, a critical design consideration for both forms of FMS.

These water level constraints are documented in PBNP's internal operating procedures for Forebay and Pump Bay Level Alarm Setpoints (designated PBF-2124 and included as Appendix 10-B) which indicates that water levels in the forebay and/or pump bays cannot be less than elevation -11.5 ft (relative to the station's datum) and a low level alarm should be set no less than elevation -11.0 ft. These represent critical water level conditions that jeopardize the plant's operation. The potential that normal operating conditions with FMS and/or a rapid clogging event could result in insufficient water in the pump bays is of paramount concern to PBNP.

The lowest recorded water level in Lake Michigan was at elevation 576.02 ft (-4.88' station datum), recorded in January 2013[70]. Under existing conditions, there is approximately 4.3 ft of head loss through the intake pipes and clean TWS with both units operating at full flow and both intake pipes in operation. The head loss increases to 6.0 ft with one circulating water pump per unit and one intake pipe in operation. During low lake levels these two operating conditions would have resulted in pump bay water levels of approximately -9.2 ft and -10.9 ft, respectively, as shown in Table 10-17. With the addition of wedgewire screens the water levels in the pump bay would be reduced to elevations of approximately -11.2 ft and -12.9 ft, during low lake levels, assuming no debris buildup, icing or biofouling. The head losses through the PBNP intake with wedgewire screens both clean and with 6 inches of additional head loss are shown in Table 10-17. As can be seen from this table even relatively modest amounts of debris and biofouling of the wedgewire screens and intake piping would increase the head loss through the system, resulting in water levels below an elevation of -11.5 ft which violates PBF-2124.

Table 10-17: Estimated Pump Bay Water Levels with 1.75 mm Slot Wedgewire Screens

Conditions	Clean Screen Head Loss (ft)	Pump Bay Water Elevation (ft)
Normal Operations (2 intake pipes and 4 CW pumps Operating)		
Existing Conditions	-4.3	-9.2
Existing Conditions with Six Inches of Additional Head Loss[1]	-4.8	-9.7
1.75 mm Slot Wedgewire Screens	-6.3	-11.2[2]
1.75 mm Slot Wedgewire Screens with Six Inches of Additional Head Loss[1]	-6.8	-11.7[3]
Worse Case Operations (1 intake pipe and 2 CW pumps, 1 per unit)		
Existing Conditions	-6.0	-10.9
Existing Conditions with Six Inches of Additional Head Loss[1]	-6.5	-11.4[2]
1.75 mm Slot Wedgewire Screens	-8.0	-12.9[3]
1.75 mm Slot Wedgewire Screens with Six Inches of Additional Head Loss[1]	-8.5	13.4[3]

[70] While this value is the lowest recorded, it is not an outlier. Several other observations are within a few hundreds of a foot of that value and long-term annual mean within approximately 2.8 feet.

1. Six inches of additional head loss corresponds to 58% screen blockage for the traveling water screens under normal operations. For wedgewire screens, biofouling and blockage may occur at several points in the system making calculation of a unique percentage of blockage impossible.
2. Yellow Cells are below the Low Level Alarm
3. Red Cells are below the Low Level Alarm and are in violation of PBF-2124

A frazil ice event, as described below, would result in a very rapid and substantial decline in water level. The inability to meet nuclear safety requirements during all expected water levels and operating conditions severely limits the feasibility of narrow-slot wedgewire screens at PBNP.

Navigation

The conceptual wedgewire installation presented in Figure 10-21 falls completely within the existing security zone and it is therefore expected to have a negligible impact on navigation.

Sweeping Currents and Debris

A sweeping current is recommended with wedgewire screens to effectively transport organisms and debris past the screens. Based on laboratory evaluations, velocities as low as 0.25 ft/s are capable of carrying debris removed from the screens a sufficient distance to avoid re-impingement following cleaning. Any non-motile organisms, including eggs and larvae, that encounter the screens will be drawn to the screens in the absence of a sufficient sweeping current to move them off and away from the screens. While not essential to reduce entrainment, a sweeping velocity is necessary to improve the impingement performance and post-exclusion survival benefit of wedgewire screens, particularly with less motile organisms and life stages that cannot actively swim away from the screens.

Sweeping currents are also needed to move debris past the screens. Without sufficient currents, debris will accumulate around the screens, eventually overwhelming the screen cleaning system, leading to increased head losses. This could lead to screen failure, pump cavitation and an overall reduction in station reliability.

In Lake Michigan, longshore currents are typically the driving force behind sweeping flows. At PBNP the longshore currents are predominantly north to south. The magnitude of these currents was not investigated as part of this analysis. A more detailed hydrologic and hydraulic analysis

of the currents at PBNP would be necessary to better estimate the magnitude of sweeping currents past the screens prior to a BTA determination utilizing narrow-slot wedgewire screens being made.

Dredging and Sediment

Sediment buildup in and around the screens is a common concern at wedgewire screen installations. Unchecked, sediment deposition can lead to screens becoming buried. As discussed earlier, longshore currents are expected to be the predominant current past the screens. Longshore currents are ocean currents that move parallel to shore and are responsible for the movement of sediment along the coast. A more detailed hydrologic and hydraulic analysis of the currents at PBNP would be necessary to better estimate the sediment transport characteristics at the proposed wedgewire deployment location prior to a BTA determination utilizing narrow-slot wedgewire screens being made.

Biofouling

Zebra mussels (*Dreissena polymorpha*) and quagga mussels (*Dreissena bugensis*) are two common biofouling organisms found in Lake Michigan. Biofouling is currently controlled by the use of chemical biocides. Chemical biocide dosing of wedgewire screens would require adding a biocide to the exterior surface of the screens, where it could enter the surrounding waterbody. This option is not expected to be a permissible means of controlling biofouling because of the potential for harmful chemicals in the surrounding waterbody. This measure would also involve substantial additional infrastructure at the wedgewire array to supply the chemical biocides.

Wedgewire screens made out of copper alloys are commonly used to reduce biofouling. Copper alloys prevent bio-fouling by forming a thin film of copper-oxides, a biocide, at the water-metal interface. Once developed, this film reduces the rate of copper reduction of the screens and therefore the amount of copper present in the discharge. However, cleaning of the screens would remove a portion of this film releasing copper oxides from the screens and increase the amount of copper in the discharge water. The amount of copper released by these screens has not been estimated but needs to be considered before copper alloy screens can be considered at PBNP.

Copper alloy screens are typically twice the cost of stainless steel screens and have a shorter service life.

Recent developments in wedgewire screen cleaning systems, such as brush-cleaned screens that physically brush along the internal and external components of the screen surface have shown potential for preventing bio-growth on the surface of the screen in freshwater environments with high biofouling potential. A brush cleaning system would not prevent bio-growth on internal screen components and distribution piping.

New super slick coatings have been used to reduce the attachment strength of biofouling agents on boat hulls and show potential for use as a coating for internal screen components and pipes. There is very limited data on their use for this application and additional testing would be required to determine their effectiveness on the bio-fouling community at PBNP.

Icing

Frazil ice occurs in Lake Michigan during the winter. Frazil ice crystals adhere and accumulate on the screens increasing in size until they begin to bridge the gaps between screen members. The frazil ice begins to extrude through the screening members and continues until the ice forms plugs in the gaps between the screen wires and the internal screen baffles. This clogging can occur over a period of minutes to hours and may not be noticed until after the screens are already more than 50% plugged. Rapid plugging of wide-slot cylindrical wedgewire screens have resulted in operational issues and screen failures at several facilities with wide-slot (e.g., 3/8 inch or 9.5 mm) wedgewire screens. The Manitowoc Public Utilities Raw Water Intake #2, located approximately 17 miles south of PBNP has wide-slot cylindrical wedgewire screens installed in approximately 25 ft to 30 ft of water, similar to the depth of the crib at PBNP. Frazil ice blockage of this intake has resulted in a loss of cooling water flow requiring the unit to shut down. We Energies' Oak Creek Station, located approximately 100 miles south of PBNP, uses wide-slot wedgewire screens in approximately 45 ft of water. These screens have suffered at least two frazil ice related failures since their initial installation.

Frazil ice is a concern with the existing offshore intake at PBNP and will be a greater concern with narrow-slot wedgewire screens. Warm water is currently recirculated back to the offshore

intake during the winter to prevent icing. Wedgewire screens withdraw water from a broader area; therefore, the exiting warm water recirculation system is not expected to be effective leaving the screens prone to frazil ice buildup during the winter.

Brush cleaned screens operating continuously when frazil ice conditions have been present show the potential to prevent the buildup of ice on the outside of the screens. This is however based on anecdotal evidence and would not reduce ice buildup on the internal screen components.

If an effective method to control frazil ice cannot be determined at PBNP, the wedgewire screens could be bypassed during the winter. Bypassing the screens is not expected to impact the overall reduction in entrainment because entrainable life stages are not present during icing conditions.

If year-round protection is needed, moving the wedgewire screens farther offshore, beyond the frazil ice zone could be considered. In the Great Lakes, the mixing depth can reach 30 meters (~100 ft) with a 7 m/sec (13.6 knots) wind speed (Daly and Ettema, 2006). At PBNP this depth occurs approximately 5 miles offshore. Extending the intake pipes this far offshore would increase the losses in the intake pipes by approximately 4.5 ft to 5.5 ft, lowering water levels in the forebay well below the minimum operating water level. Moving the intake below the frazil ice level is therefore not considered a feasible alternative.

Organism Attraction

The wedgewire screen arrays, bulkhead wall and access pier would result in a large artificial structure leading from the shoreline to the screens. This structure would provide habitat that attracts a variety of species. The higher abundance of organisms within close proximity of the screens may result in more organisms being susceptible to entrainment. For example, as discussed in Section 11.2.1.2, the intake crib provides attractive habitat for *Gammarus* sp. and densities of these species in entrainment samples are 34 to 88 times those found in ambient samples. The screen arrays, bulkhead wall, and access pier may also provide attractive habitat for these species and increase entrainment even with wedgewire screens.

10.5.1.4 Summary of Feasibility

There are many uncertainties and constraints that make the use of wedgewire screens infeasible at PBNP. Head loss through the screens and intake piping would increase by approximately 2 ft

under best case, clean-screen conditions. This would result in forebay water levels below the low water alarm elevation of -11.0 ft during low water periods with clean screens. Water levels would be lower if effects of debris and biofouling of the screens and new intake piping are considered. The screens would also be subject to frazil ice during the winter, which would require them to be bypassed to prevent a rapid decrease in water forebay water level.

These are both critical issues that would impact screen, cooling water and service water reliability. The reduced reliability of these systems would have significant nuclear safety considerations. The inability to maintain the screens under expected operating conditions is a fatal flaw that would preclude the use of wedgewire screens at PBNP. Other issues such as sweeping currents, biofouling, and habitat formation are more tractable problems but still represent important challenges and uncertainties. Therefore, narrow-slot wedgewire screens are considered to be infeasible at PBNP.

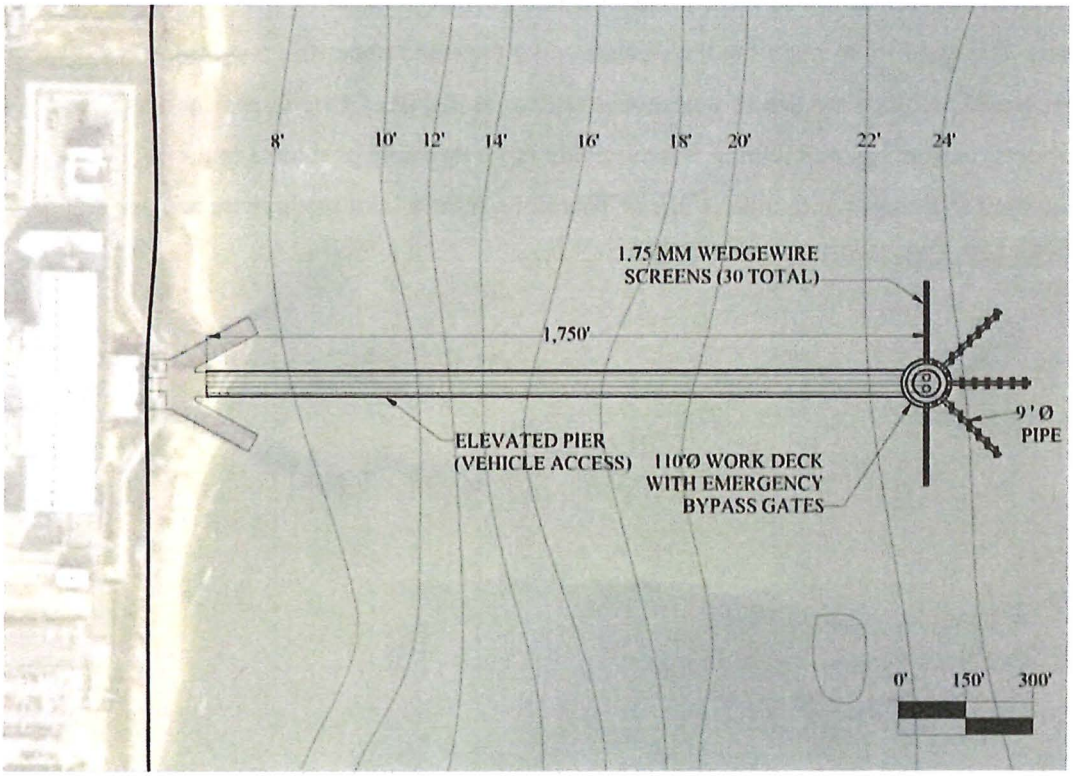


Figure 10-21: 1.75 mm Wedgewire Screen at the PBNP Intake

10.5.2 Fine-mesh Modified Traveling Water Screens and an Organism Return System

This section will consider the application of FM MTWS at PBNP. The potential for FMS to be incorporated with MTWS, including the need to expand the intake screens, is of primary importance to this analysis and will be discussed in the remainder of this section.

10.5.2.1 Technology Overview

By decreasing the mesh size on MTWS from coarse (i.e., standard 3/8-in mesh, equivalent to 9.5 mm) to fine (e.g., 2 mm or less), the biological performance and reliability of the resulting system must be considered.

FMS can be applied to MTWS as either overlay panels on the existing coarse mesh screens (i.e., overlays) or full-time fine-mesh. These screens rely on a three-step process to reduce entrainment mortality:

1. Exclusion of the organisms by the screen;
2. Survival of the excluded organism and removal from the screen; and
3. Live return of the organisms to the source water.

In reality, none of these three processes is likely to be perfectly effective. For example, by-pass of the screens either through gaps around the screens or by extrusion through the FMS has been observed in installed systems. Similarly, the rate of survival of excluded organisms has been observed to be less than 100 percent and, in some cases, quite low (see EPA, 2014b). Unfortunately, prediction of the rates of exclusion, survival, and live return is very difficult and there is not a consensus regarding design parameters to estimate and maximize the rates.

With installation of finer mesh sizes within an existing CWIS, the open area available for water passage decreases resulting in increased TSV and head loss across the screen. Undue head loss has the potential to affect screen integrity and to result in hydraulic issues in the cooling system such as pump cavitation, especially during periods of low water levels and/or high debris loading. The smaller opening size of finer meshes increases debris retention and the potential for screen blockage, biofouling, and/or blinding of the screens. These phenomena may rapidly worsen, resulting in accelerating head loss and cooling system failure. Conditions that affect

system reliability are highly variable in time and across facilities making design challenging and motivating pilot testing of FMS systems.

FMS are currently installed at two nuclear facilities in the USA, Prairie Island Nuclear Station on the Upper Mississippi River in Minnesota and Brunswick Nuclear Generating Station on the Cape Fear River Estuary in North Carolina.

Prairie Island Nuclear Station has eight, 10-ft wide MTWS with seasonally deployed 0.5 mm mesh screens. These screens are located in a screen house located at the mouth of a large intake canal. From April through August, the coarse-mesh panels are replaced by fine-mesh panels to reduce the number of fish eggs and larvae entrained. The remainder of the year, a 9.5 mm coarse-mesh is used. At a flow of 800 cfs (517 MGD) and low water levels, the traveling water screens' approach velocity is 0.5 ft/s. At the maximum intake flow (1,500 cfs; 970 MGD), the velocity approaching the traveling water screens is less than 1.0 ft/s. The velocity through the fine-mesh panels is approximately 3.1 ft/s. The fine-mesh panels are easily damaged requiring approximately 12.5% of the panels to be replaced every year. A second screen house located at the end of the intake canal is equipped with trash racks, standard TWS and the circulating and cooling water pumps for the station. This CWIS provides secondary screening to remove any debris that makes it past the FMS or originates within the canal.

Brunswick Nuclear Generating Station has eight, 10-ft wide fish-friendly traveling water screens with 1.0-mm mesh panels overlaid on 9.5-mm mesh. These screens are located at the end of an intake canal that is pre-screened at a diversion structure with ⅜-inch by ⅜-inch mesh fixed-panel screens. Each traveling water screen has 50 baskets; all 50 baskets have 9.5-mm mesh and 42 of 50 baskets have 1.0-mm Nitex mesh overlays as well. At a full flow of approximately 2,411 cfs (1,558 MGD), and mean low tide level, the velocity approaching the circulating water traveling water screens is 1.2 ft/s with a through-screen velocity of approximately 3.1 ft/s. When first installed all 50 panels on each screen had 1-mm overlays and the screens suffered numerous emergency failures due to mechanical issues. In order to improve reliability, the plant removed the 1-mm overlays from eight of the 50 panels. Plant personnel have indicated that growth of shellfish is less on the overlay mesh screens compared to the coarse-mesh screens.

For the conceptual design and costing exercise presented below, the design parameters at Prairie Island Station were generally adopted. This was done both because the parameters are documented and because a redundant set of coarse-mesh screens would be necessary to screen the flow at PBNP in the event of FMS failure. Importantly, by approximately matching those conditions (e.g., TSV), it is possible to adopt the biological performance data for taxa relevant to PBNP measured at Prairie Island.

10.5.2.2 Key Design Parameters

While considering application of FMS in the context of MTWS, there are three factors of great importance: a) the wire type and opening size of the FMS; b) the choice between application of FMS overlays on a regular coarse mesh or use of full time FMS as the only screen or with a redundant coarse-mesh (a choice which affects the screen open area and TSV); and c) the target TSV based on the first two factors and total area of the screen. These factors will be considered in the rest of this section. Other aspects of the design (e.g., the potential means of expanding the screens, whether to include two screens in series as has been done at Prairie Island or the potential for seasonal deployment[71]), should also be considered. The listed three factors are fundamental to any conceptual design and will be key determinants of estimated cost, biological effectiveness, and reliability.

Mesh Type and Size

Consideration of smaller mesh size involves several trade-offs. The wire size used for a selected mesh opening can vary, but are typically 0.59 mm (.023 inch) in diameter for 2.0 mm mesh, 0.43 mm (0.017 inch) for 1.0 mm mesh and 0.31 mm (0.012 inch) for 0.5 mm mesh. A backing mesh with larger wires can be used to support the fine wires which are not as strong as the thicker wires. This backing mesh provides some level of debris protection if the fine-mesh wires break. Larger diameter wires or the use of a backing mesh results in more robust screens, but the combination of wires results in a smaller open area that results in an increased TSV. The mesh size itself is a tradeoff between excluding smaller organisms versus reducing the screen open area with its attending issues of reduced reliability and biological performance due to increased

[71] Seasonal deployment of FMS is used at Prairie Island because the bulk of entrainment occurs from April through August. Such seasonal deployment reduces operations and maintenance costs.

TSV. An illustration of the effect of decreasing mesh size and different wire meshes on the open area of a clean screen and resulting TSV is provided in Table 10-18. The distinction between full-time and overlay application of FMS is discussed in the next section.

Table 10-18: Change in Screen Open Area[72] and Effects on TSV

Mesh	Fine–mesh wire Diameter (inches)	Approximate Open Area	TSV Relative to Standard Coarse-Mesh
Coarse-mesh (9.5 mm)	NA	55.8%	1.0
Standalone Fine-mesh with No Backing Mesh			
2.0 mm[1]	0.023	48.9%	1.1
1.0 mm[1]	0.017	39.5%	1.4
0.5 mm[1]	0.012	38.5%	1.4
Fine-mesh with a Backing Mesh			
2.0 mm[1,2]	0.023	41.5%	1.3
1.0 mm[1,2]	0.017	33.8%	1.6
0.5 mm[1,2]	0.012	28.6%	2.0
Fine-mesh Overlaying Standard Coarse-mesh			
2.0 mm[1,3]	0.023	28.6%	1.9
1.0 mm[1,3]	0.017	23.1%	2.4
0.5 mm[1,3]	0.012	22.5%	2.5

1. Based on a generic MTWS with an 80% framing open area.
2. Assumes fine-mesh placed with the identified wire size over a 1-inch square backing mesh with an 85% open area.
3. Assumes used in conjunction with MTWS with 3/8-inch mesh and a 90% open area for fine-mesh panel support framing.

The general goal in assessing FMS is to exclude as many entrainable organisms as possible under conditions that would allow their survival and return to the source water. This suggests comparing the size of the organisms[73] entrained to the mesh size and selecting the mesh that maximizes these two goals (i.e., exclusion[74] and post-exclusion survival). Unfortunately,

[72] Open areas percentages assume that the screen is completely clean. Debris and biofouling would reduce the open area and increase the TSV.
[73] With this in mind, various length data were collected on a broad subset of entrained organisms at PBNP and supplemented with length data from available literature. Estimation of the rates of exclusion is discussed in Section 11.
[74] At PBNP, approximately 53% of fish have a smallest dimension of less than 2 mm.

quantitative prediction of these two factors for the range of entrained organisms is not supported by the available literature. For example, while certain organism dimensions have been found to be predictive of the rate of exclusion relative to mesh size (see Section 11), such an approach was found to over-predict exclusion rates when compared to empirical data. More importantly, as discussed below, no reliable quantitative relationship between the rate of post-exclusion survival and TSV is available. This is particularly true given the variation in survival rates by taxa and life stage in the context of the range of organisms subject to entrainment.

Overlays or Dedicated FMS?

Selection of FMS as overlay panels to a coarse-mesh MTWS or dedicated FMS must be informed by three factors:

- The potential for the dedicated FMS to fail or require removal for servicing at a high enough frequency that the cooling system performance is jeopardized by passage of debris;
- Reduction of the open area with a FMS overlay such that a TSV critical to biological performance and/or cooling system reliability is exceeded exacerbating the need for intake expansion (see Table 10-18); and
- The potential for seasonal deployment of FMS to target a specific entrainment period and/or removal of FMS during known periods of high debris loading.

Fine-mesh material uses thinner wires than coarse mesh screens to maintain a reasonable open area. The thinner wires are more prone to failure as a result of erosion, debris impact and debris load. These wires can also be easily damaged by fouled spraywash nozzles. A single partially fouled nozzle combined with continuous rotation has the ability to quickly damage a large number of fine-mesh screen panels. Therefore, damaged FMS may fail to exclude entrainable organisms and may allow entry of debris large enough to plug the condensers. FMS are typically used in conjunction with a redundant mesh to reduce debris entry if the FMS fails. Configurations using redundant meshes include; fine-mesh overlaying of 3/8 inch or similar MTWS, fine-mesh with a 1-inch square backing mesh or FM MTWS in series with redundant TWS.

The finer wires associated with FMS are more prone to failure during heavy debris loading situations and would fail at a lower differential pressure than a comparable coarse-mesh screen. A thicker woven wire mesh would be needed to screen debris if the fine-mesh failed. FMS with a 1-inch backer mesh was not selected because if the fine-mesh failed, debris larger than the condenser tube diameter would be able to enter the circulating water system. This could lead to the condenser plugging, reducing the ability to cool the units and ultimately unit shutdowns. For this reason, it has been concluded that robust coarse mesh must be operated in series with the hypothetical FM MTWS to allow for debris control when FM MTWS fail or require service.[75] Therefore, application of dedicated FM MTWS alone, without a backup screen, was determined to be infeasible.

Entrainment rates at PBNP are seasonal in nature, with most of the entrainment occurring from April through September. For that reason, seasonal deployment of FMS is considered for PBNP. Finally, as discussed below, while overlays require a greater expansion of the CWIS, application of either mode of FMS requires some expansion to maintain the desired TSV. As a conceptual approach, the simplest means of achieving organism exclusion and reliable debris control at PBNP would likely be based on a system similar to the Prairie Island configuration:

- Installations of dedicated FMS system, upstream of the existing coarse-mesh TWS.
- The new FMS system would be designed to achieve a desired TSV of 3.1 ft/s or less and would exclude and return otherwise entrainable organisms at rates assumed to be similar to those at Prairie Island. The new screens would require separate debris and fish/organism handling systems and nearly continuous rotation.
- The FMS would be removed or replaced with coarse-mesh panels outside of the entrainment season. The screen would be rotated on an as needed basis outside of the entrainment season[76].

[75] The CWIS at Prairie Island uses a form of screen redundancy based on two sets of traveling water screens in series. The upstream set has seasonally installed FMS alone which are deployed for 5 months a year while the downstream screens located in the original CWIS are normal coarse mesh. Debris control is achieved by the downstream set of coarse mesh screens when the FMS are either not deployed or have failed. Such a system would require expansion of the screens and is subject to the same constraints at PBNP as those considered below. Importantly, only the new fine-mesh screens would include fish-friendly modifications, employing fish handling and return systems as well as debris wash and disposal systems consistent with the rule's definition of MTWS.
[76] Such a FM MTWS would be compliant with the IM BTA requirements of 40 CFR 125.94(c)(5) – MTWS and organism return in order to achieve the exclusion and return of entrainable organisms. Such a system would be

- The existing coarse-mesh TWS would remain in the existing CWIS to remove debris during periods of FMS failure or service.

Through-screen Velocity

In its discussion of FM MTWS, EPA (2014b) summarizes the performance of some of the installed FMS systems and discusses issues associated with the performance and conceptual design of FMS systems. As summarized in the next few paragraphs, EPA (2014) makes several important observations:

- Application of FMS "converts" some normally entrainable organisms to ones that are impinged on the finer mesh.
- The converts may be subject to mortality on the FMS and the rate of mortality depends on the taxa and TSV.
- In its costing exercise, EPA (2014) assumed that the TSV would be reduced to 0.5 fps but the motives for this threshold appear to be targeted at both entrainment and impingement BTA.

Despite adopting a target TSV of 0.5 fps for FMS for the costing exercise, EPA (2014) does not endorse a specific TSV as a general design basis.

EPA (2014) notes that "*if the [otherwise entrained] organisms can withstand the initial impingement on the fine mesh screen, the majority of organisms survive after passing through a fish return*" [p. 2-19]. In a discussion of the general phenomenon of impingement, the agency notes that: "*Fine mesh screens may prevent entrainment, but may also lead to increased mortality of impinged organisms (specifically eggs and larvae that would otherwise have been entrained).*" [p. 6-23]. EPA further notes that: "*For fine mesh traveling screens, impingement of converts increases as mesh size is reduced, with survival of the converts being dependent upon species and intake velocity.*" [p. 6-48]. When discussing reduced intake velocity EPA notes, "*Reducing the intake velocity generally does not similarly reduce entrainment.*" [pg. 6-67].

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redundant for the IM BTA standard due to the off-shore position, Acoustic Deterrence System (ADS), and seasonal flow reduction.

EPA (2014) concludes that: *"[Intake] Velocity increases beyond a certain range would be unacceptable because they might increase impingement of other organisms and would increase the mortality of eggs and larvae captured on the fine mesh screen panels."* [p. 6-45]. EPA (2014) stated that: *"Intakes with high screen velocities (greater than 3.0 fps) are assumed to be unable to meet IM requirement with Ristroph traveling screens alone and are assigned either new larger intakes or wedgewire screens."* [p. 8-9].[77] To avoid these undesirable effects, EPA (2014) *"assumed the new larger intake would have a through-screen velocity of 0.5 fps when estimating the screen area factor and technology costs for a new larger intake."* [p. 6-45].

NextEra notes that EPA selected the use of 0.5 ft/s TSV for a new larger intake only with regards to meeting the IM requirements of the Final Rule based on velocity alone. In the discussion of new larger intakes in the TDD (EPA 2014) EPA clarifies this point and adds; *"As a result, the intake will not be required to include a fish handling and return system or the full suite of modified Ristroph traveling screen features."* [p.8-16]. EPA's motives for using a 0.5 ft/s TSV with new larger intakes designed with FMS are somewhat ambiguous.[78] What is clear is that EPA (2014) did not consider FM MTWS when developing costing modules and only assumed an intake would be expanded if the TSV was greater than 3.0 ft/s. Further, as quoted above, EPA, in the preamble to the rule, concludes that a high proportion of facilities would find screen expansion to allow low intake velocities (approximately 0.5 ft/s) while employing FMS to be infeasible.[79]

EPA is not clear on an appropriate design velocity to use when assessing the feasibility of FM MTWS. Based on discussion in the TDD, EPA (see page 8-21), a TSV of 2.5 ft/s represents the maximum TSV for use in determining if expansion is necessary with FM MTWS. This velocity is less than the 3.1 ft/s velocity at Prairie Island. NextEra selected a design TSV of 3.1 ft/s as the

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[77] EPA (2014) [p. 8-21]: *"EPA notes that at proposal this value was set at 2.5 fps based on recommendations from a technology vendor (see DCN 12-6657). However, a re-evaluation showed that this threshold was more applicable to fine mesh screens.*

[78] EPA further confounds the issue by discussing the use of Cost Module 3 for estimating the costs for expanding an existing intake structure as part of a FMS retrofit. EPA clearly states at p 8-6 of the TDD (EPA 2014) that; *"...Module 3 was modified so that the traveling screens were sized based on a through-screen velocity of 0.5 fps and coarse (3/8-in) mesh instead of fine mesh screens."*

[79] EPA (2014) [p. 6-48] also quotes the representative of a screen vendor with the following: *"0.5 mm fine mesh requires low screen velocities (i.e., approximately 0.5 fps)..."*. Unfortunately, from the context of the statement, it is not clear if that supported requirement is to maintain biological performance, screen stability, cooling system reliability, or all three.

maximum velocity when evaluating the feasibility of FMS at PBNP, to be consistent with the Prairie Island design. This TSV also results in a significantly smaller intake than one designed with a 0.5 ft/s TSV.

Under Section 122.21(r)(10)(i) of the Final Rule, the expected biological efficacy of a technology is not considered when determining the technical feasibility of an entrainment control technology. TSV and intake expansion would be considered when evaluating the impracticality or infeasibility of different fine-mesh technology arrangements based on site-specific constraints.

While there is a consensus that high TSV is likely to increase the mortality of excluded organisms, the literature does not provide concrete guidelines on supportable maximum TSVs. EPRI (2010) performed a literature review of FMS studies including their settings, available information regarding the physical configuration of the CWIS, the species and life stages considered, and any data on post-exclusion survival. The various studies performed at Prairie Island are included in that summary.

The intake velocities, as represented by the screen approach velocities, differed substantially between the studies referenced by EPRI (2010) (i.e., 0.75 ft/s vs. 2.5 ft/s). In general, the studies showed a broad range of survival depending upon the taxa measured. NextEra does not consider this comparison in the studies to be definitive in supporting the lower intake velocity.

EPRI (2010) also reported on laboratory assessments of post-exclusion survival for a number of freshwater species. Screen approach velocity was variable in this study and, for larger entrainable organisms of 12 mm or more length[80] of some taxa, survival was substantial at higher approach velocities (e.g., 2 ft/s, roughly corresponding to a TSV of 4 ft/s). For smaller organisms, survival of the taxa tested was very poor regardless of intake velocity. Unfortunately, this study does not provide NextEra with a target TSV for the following reasons:

- The study employed a set of freshwater fish that can be reared in the laboratory, many of which are not relevant to PBNP.
- Consideration of approach velocity and TSV were not a focus of the study design and a quantitative relationship between survival and TSV is not supported.

[80] Development of musculature and other structures associated with maturation beyond a certain size was concluded to make the excluded organism resistant to damage on the screen.

This study does, however, indicate that survival of larger entrainable sized organisms (greater than 12 mm total length) may be substantial at approach velocities in excess of those at the existing PBNP CWIS (i.e., maximum of 1.2 ft/s). The EPRI study does not support a finding that earlier life stages would have meaningful survival rates at roughly 1.3 to 2.5 times the existing TSV following application of FMS within the existing CWIS.

As discussed with the two other key design parameters, the operating Prairie Island FMS system provides a biologically effective, workable FMS configuration for use at nuclear generating facilities. It also allows for use of empirical data on exclusion and survival rates that are predicated on a known set of conditions and a set of taxa and life stages that are relevant to PBNP. Use of this model system and the attending performance data obviates the need to extrapolate exclusion and survival rates from one set of conditions and organisms to another without any quantitative basis for doing so. Therefore, NextEra will consider that hypothetical FMS should be designed to achieve similar hydraulic (~3.1 ft/s TSV) and exclusion (0.5 mm mesh) characteristics as the Prairie Island FMS installation. This target TSV was selected because it has been demonstrated at a nuclear facility and has biological performance data for organisms entrained at PBNP. This velocity is higher than the maximum TSV considered by EPA (and some other FM MTWS), resulting in a smaller footprint for an expanded CWIS. The 0.5 mm mesh size would retain the greatest number of organisms and is therefore expected to have the greatest biological benefit.

As presented in Table 10-18, NextEra notes that depending on the configuration and mesh size, placement of FMS overlays on new MTWS, although providing redundant screening would substantially increase the current TSV. Similarly, to achieve a target TSV of 3.1 ft/s, using typical FMS with full-time 0.5 mm mesh over 1-inch square backing mesh or 0.5 mm mesh overlaying coarse-mesh would require more screening area than 0.5 mm screens without a backing mesh (Table 10-19). Redundant coarse-mesh MTWS are needed with fine-mesh without a backing mesh to reduce debris entry if the FMS fails. These estimates are consistent with findings in the Final Rule's preamble.

Table 10-19: CWIS Expansion Necessary to Achieve a 3.1 ft/s or less TSV[81] with Through-flow MTWS

Mesh	Approximate Open Area	TSV if Installed in the Existing CWIS (ft/s)	Screens Necessary for 3.1 ft/s
Existing TWS	55.8%	2.0	N/A
Standalone Fine-mesh with No Backing Mesh[1]			
2.0 mm^2	48.9%	N/A	6
1.0 mm^2	39.5%	N/A	8
0.5 mm^2	38.5%	N/A	8
Fine-mesh with a Backing Mesh			
2.0 $mm^{2,3}$	41.5%	N/A	7
1.0 $mm^{2,3}$	33.8%	N/A	9
0.5 $mm^{2,3}$	28.6%	N/A	11
Fine-mesh Overlaying Standard Coarse-mesh			
2.0 $mm^{3,4}$	28.6%	3.9	10
1.0 $mm^{3,4}$	23.1%	4.8	13
0.5 $mm^{3,4}$	22.5%	4.9	13

1. Assumes coarse-mesh screens in series would be required.
2. Based on a generic MTWS with an 80% framing open area.
3. Assumes fine-mesh placed with the identified wire size over a 1-inch square backing mesh with an 85% open area.
4. Assumes used in conjunction with MTWS with 3/8-inch mesh and a 90% open area for fine-mesh panel support framing.

[81] Open areas percentages assume that the screen is completely clean. Debris and biofouling would reduce the open area and increase the TSV.

Consideration of FMS Overlays at PBNP

While the scenario selected for assessment of monetized costs and benefits has clear advantages in that it has been demonstrated to be reliable and effective, a brief review of a far simpler approach, application of FMS overlays to coarse-mesh MTWS in the existing CWIS is likely to provide useful perspective on the selected scenario. At PBNP, application of FMS overlays could be achieved at relatively low capital costs when compared to an expanded intake option. Only 2.0 mm fine-mesh was considered for use as an overlay because there is some evidence in the literature that larger fish, such as those that would be excluded by 2.0 mm, may survive even at relatively high TSV (EPRI, 2010).[82] Despite these potential positive factors, there are several issues that indicate that 2.0 mm overlays would be infeasible and poorly effective at PBNP. These issues are discussed only in relation to 2.0 mm overlays as the open area of meshes finer than 2.0 mm will further increase TSV and attending biological performance and reliability issues. Overlay of 2.0 mm FMS on the existing screens would exacerbate operational issues and mitigate the expected biological benefit associated with increased organism retention:

- Application of 2.0 mm FMS on coarse-mesh MTWS represents a nearly 96% reduction in mesh opening size (90.3 mm^2 vs. 4 mm^2). The decrease in mesh size would collect more debris, leaving the screens more susceptible to problems with blockage.
- Overlaying coarse-mesh MTWS in the existing CWIS with 2.0 mm fine-mesh would decrease the screen open area from approximately 56% to approximately 29%. The clean-screen TSV would nearly double (Table 10-18). The increase in TSV will increase the head loss across the screen by approximately three inches under "clean screen" conditions. At 50 percent plugged the screens with a 2.0 mm overlay would experience approximately 18 inches of additional head loss relative to the existing screens. Critically, the resulting screen system would be more at risk to rapid increases in head loss as smaller debris that would otherwise pass through the existing coarse-mesh screens would be retained on the fine-mesh screens that already have a reduced open area. The

[82] NextEra notes that a lead investigator on that effort has indicated that the effects of TSV on organism survival was not a focus of the study and conclusions that larger organisms are insensitive to TSV should be made with caution. He also noted that laboratory studies, while useful for evaluating the injury and mortality associated with fish interacting with the screens and the underlying mechanisms of mortality, tend to overestimate survival because test organisms are healthy and have not been exposed to environmental conditions that may contribute to mortality (e.g., variations in water quality and temperature, debris loading, predation).

inability to bypass the FMS and providing debris control during high head loss events put the screens and cooling and service water systems at unacceptable risk.

- Overlaying coarse-mesh MTWS in the existing CWIS would not provide a means to bypass the fine-mesh in the event of heavy debris loading and a reduction in water level at the circulating and service water pumps.
- The rate of exclusion of otherwise entrainable fish is estimated to be low with 2.0 mm mesh. Only 53% of fish entrained at PBNP, based on the 2017 entrainment study would be excluded with a 2 mm mesh and, therefore, 47 percent of entrained fish are predicted to pass through the 2 mm screens (see Section 11). The rate of exclusion with 0.5 mm mesh would be 100 percent, based on the 2017 entrainment study. These entrainment rates do not account for invertebrates, which were not modelled
- The rate of post-exclusion survival is essentially unknown for this combination of taxa, life stages, mesh size, and TSV. While it can be expected that the rate of survival of excluded organisms will be lower at TSVs of 3.9 ft/s, relative to 3.1 ft/s, there is no sound basis to estimate the change.
- The screen system at Prairie Island, which was selected as the design basis for PBNP, is designed to provide screening redundancy and achieve TSV at the FMS that facilitates exclusion and post-exclusion survival. Departure from this model introduces high degrees of uncertainty in the estimated reliability of the system and its biological performance.

Based on these factors, application of 2.0 mm and other fine-mesh overlays on coarse-mesh MTWS in the existing CWISs was eliminated from further consideration. The potential social costs and social benefits were not estimated due to the extreme uncertainty in the design of the hypothetical system and any resulting estimates.

NextEra wants to emphasize that it could not replace the existing TWS with MTWS designed for 2.0 mm or any other overlays as entrainment BTA, without careful consideration of how increases in rate and magnitude of head loss across partially plugged screens would affect station reliability and nuclear safety. NextEra also notes that rates of exclusion and post-exclusion survival are highly uncertain and, for most organisms, are likely to be low. For these reasons,

NextEra believes that 2.0 mm or any other overlays are essentially infeasible and cannot represent entrainment BTA.

10.5.2.3 Selected FMS Scenario

In summary, in assessing the feasibility, costs, and performance of a hypothetical retrofit of PBNP's CWIS with FMS, NextEra has assumed the following screen configuration consistent with the intake at Prairie Island:

- The FMS would have 0.5 mm mesh. This mesh size is selected to maximize the exclusion of entrainable organisms as well as allow use of the data on the rates of exclusion and rates of post-exclusion survival measured at Prairie Island. The latter factor is critical to enabling sound estimates of biological effectiveness and monetized social benefits.
- The target TSV for the FMS would be 3.1 ft/s or less. Again, use of this design parameter is consistent with the demonstrated system at Prairie Island. Of course, this target TSV is more than six-fold higher than the value assumed by EPA (2014b) in its costing exercise and would result in a hypothetical expanded intake of approximately one-sixth the size considered by EPA. NextEra believes that this assumption is a sound one given the precedent available at Prairie Island. Use of this design parameter also allows application of measured biological performance data, greatly reducing the uncertainty in estimation of the monetized benefits.
- FMS would be placed in a new intake structure located in front of the existing CWIS, requiring construction in the vicinity of the existing intake pipes followed by splicing them to a new screen structure.
- FMS would be deployed in front of the exiting TWS from April through September and would be removed or replaced with coarse-mesh the remainder of the year.
- The new FMS would be designed for standalone fine-mesh and not overlaying a redundant mesh, reducing the TSV (and cost of the system) but also increasing the rate of FMS failure. The existing coarse-mesh TWS would act as backups for debris control in the event of FMS failure. Outside of the entrainment season either seasonal coarse-mesh or the existing TWS would be used for debris control. IM BTA is expected to be based on the existing design and location of the offshore intake (Compliance Alternative 6),

negating the need to rotate the new screens continuously outside of the entrainment season.

- FMS with backing was rejected as the only screen material in the existing screen bays due the potential for FMS failure with no ability to bypass the FMS or provide redundant debris screening during a clogging or screen failure event. The higher TSV is also likely to reduce biological effectiveness.
- The new set of fine-mesh MTWS would be through-flow screens which are similar to the existing TWS and those installed at Prairie Island.

The effect of both the selected FM alternative and the rejected alternative with 2.0 mm overlay panels is provided in Table 10-20. Both options result in similar levels of head loss with clean screens. With the screens 50% plugged the expanded intake alternate is expected to result in approximately 6-inch higher water levels in the pump bays. Additionally, the selected alternative has the added benefit that during periods of low lake levels or during high debris periods the FMS can be bypassed, reducing the risk of violating the water level conditions in PBF-2124.

Table 10-20: Estimated Pump Bay Water Levels with 2.0 mm MTWS

Conditions	Head Loss (ft)	Pump Bay Water Elevation (ft)
Normal Operations (2 intake pipes and 4 CW pumps Operating)		
Existing Conditions – Clean Screens	-4.3	-9.2
Existing Conditions with 50% Screen Blockage	-4.7	-9.6
2 mm Overlay on MTWS	-4.6	-9.4
2 mm Overlay on MTWS with 50% Screen Blockage	-6.1	-11.0[1]
Expanded Intake with FMS	-4.7	-9.6
Expanded Intake with FMS with 50% Screen Blockage	-5.6	-10.5
Worse Case Operations (1 intake pipe and 2 CW pumps, 1 per unit)		
Existing Conditions – Clean Screens	-6.0	-10.9
Existing Conditions with 50% Screen Blockage	-6.5	-11.4[1]
2 mm Overlay on MTWS	-6.3	-11.2[1]
2 mm Overlay on MTWS with 50% Screen Blockage	-8.2	-13.0[2]

Conditions	Head Loss (ft)	Pump Bay Water Elevation (ft)
Expanded Intake with FMS	-6.5	-11.3[1]
Expanded Intake with FMS with 50% Screen Blockage	-7.5	-12.4[2]

1. Yellow Cells are below the Low Level Alarm
2. Red Cells are below the Low Low Level Alarm and are in violation of PBF-2124

Design

The expanded screen house for PBNP would include eight, through-flow screens with 0.5 mm mesh (see Figure 10-22). The eight FMS would use 10-ft wide baskets and an invert at elevation -28.5 ft, resulting in the same screen approach area as the existing screens. This results in an actual TSV of 2.9 ft/s, 0.2 ft/s less than the target velocity of 3.1 ft/s, when the fine-mesh panels are installed. Assuming clean screens the water level in the pump bays was calculated to be at elevation -9.7 ft, with four CW pumps and both intake pipes operating, and elevation -11.5 ft with only one intake pipe and one CW pump per unit operating. These water levels are approximately 6 inches lower than existing conditions, reducing the operating margin of safety. The operating scenario with one intake pipe operating and one pump per unit operating results in a water level in violation of PBF-2124. However, this operating scenario typically occurs during the winter, when the fine-mesh panels would not be installed.

In addition to the FMS the expanded screen house would also include an access road, work deck, emergency bypass gates, warm water recirculation valves, trash racks with rakes, a lifting crane to install and remove the FMS and new screen wash pumps. The expanded screen house would tie into the existing intake pipes, approximately 200 ft upstream of the existing traveling water screens as presented in Figure 10-22. The 14-ft diameter corrugated intake pipes are nearly 50 years old and their condition is not known and are expected to need substantial reinforcing at their connection to the expanded screen house.

The new 170 ft wide by 210 ft long screen house would be divided into ten bays, eight screen bays and two emergency bypass bays. The emergency bypass openings would be used during periods of heavy debris loading, if water levels in the existing forebay approach the minimum allowable level. Opening these bays will reduce the risk of a loss of cooling water event and relieve pressure on the FMS, reducing the risk of screen failure. Debris that bypass the FMS will be collected on the existing TWS.

Large open plenums upstream and downstream of new FMS are intended to provide uniform hydraulic conditions approaching and exiting the screens. Poor screen hydraulics can lead to uneven velocity distribution increasing the through-screen velocity and excess wear in the screen components and motors. The plenum downstream of the screens would extend to the existing screen house, to reduce head losses associated with entering and exiting the existing 14 ft diameter pipes. A full hydraulic design of the expanded intake would be needed prior to finalizing the design and costs for a computational model study of this alternative are included in the overall cost estimate.

The existing warm water discharges and recirculation systems would be modified to accept the expanded screen house. The discharge flumes would extend along the outer walls of the screen house, before turning outward to direct the warm water plumes away from the intake pipes. Large 14 ft diameter butterfly valves will be used to direct a portion of the warm water into the new screen house to prevent ice formation during the winter. This is similar to the existing frazil ice prevention method.

Otherwise entrainable fish removed by the low-pressure spray washes from the FMS would flow into a new organism return line. This new line would run south over the extended discharge flume. This location is expected to reduce interaction with the thermal plume while still being outside of the intake's zone of influence. While this measure may limit the potential for non-volitional re-impingement of larger fish[83], entrainable fish, on the other hand, are not generally motile and would risk re-entrainment at the intake crib. This potential is not considered in estimating monetized benefits of FM MTWS. Separate high-pressure sprays would be used to remove debris, which would then be conveyed through a separate trough and deposited into a roll-off dumpster for offsite disposal.

[83] As noted in Section 6, the majority of impinged fish at PBNP are fragile, as defined by the Final Rule, and are not expected to survive impingement and return.

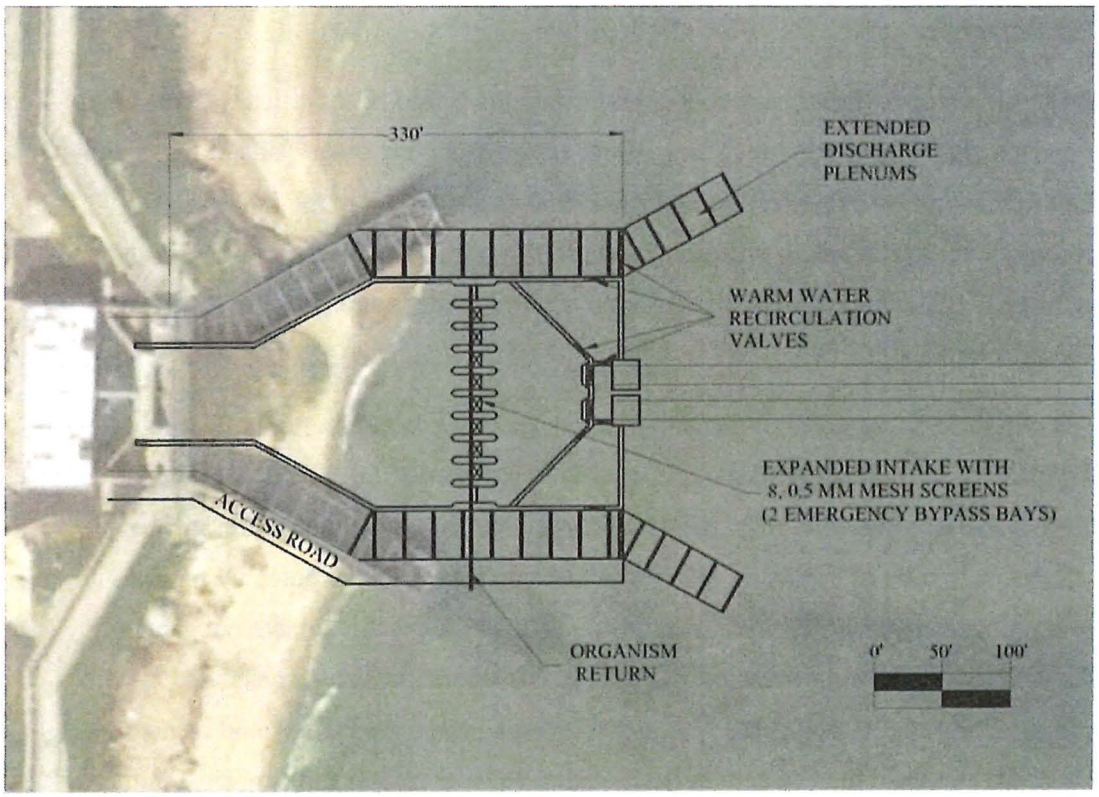


Figure 10-22: Conceptual Design for an Expanded Intake Designed for FMS with a 2.9 ft/s Through-screen Velocity – Plan

Construction

Prior to the construction of the expanded intake, the intake pipes would be inspected to determine their structural stability. Once the inspection and any repairs or reinforcements are completed, the area around the intake pipes would be dredged, exposing the pipes in the vicinity of the expanded intake. A 20 ft section of the pipes upstream of the expanded intake would be reinforced with concrete. This reinforced section would include water stops, anchor points and driven piles allowing it to be tied into a large cofferdam that would be constructed around the construction area. Once concrete encasements are completed the intake pipe butterfly valves in the existing forebay will be closed and the northern warm water deicing valves opened. Both units would be shut down through the remainder of construction[84]. Blind flanges would be affixed to the concrete encasements isolating the construction area from the remainder of the intake pipes and Lake Michigan. This stage of construction will be conducted using divers and barge-based equipment.

The large cofferdam and a temporary access road would be constructed in parallel with the modifications to the intake pipes. The temporary access road would be constructed along the south shoreline of the lake. This access road would provide shore-based access to the active construction area without the need to pass through the PBNP protected zone[85]. The cofferdam would allow most of the work on the expanded intake to be conducted in the dry. This cofferdam would extend from the shoreline south of the intake pipes, out around the construction area, and tie back into the shoreline just to the south of the northern discharge flume. Leaving the north discharge flume open to the lake would allow service water to be withdrawn from the lake during the construction. A temporary service water discharge pipe would be routed through the north discharge flume. The cofferdam would remain open to the lake until the intake pipes within the construction area are isolated from the lake.

Once the cofferdam is complete and the active construction area dewatered, construction can start on the expanded intake. The first step would be to remove approximately 330 ft of each intake pipe extending from the existing screen house to the entrance of the expanded CWIS. The

[84] This construction scenario is presented as an example but would result in an unacceptably prolonged outage for both units. As noted below, an alternative design would allow for a shorter outage by constructing the new intakes in two stages allow for maintenance of the intake pipes farther into the construction project.
[85] An alternative approach based on passing through the protected area could also be considered.

entire expanded CWIS would be constructed out of reinforced concrete. Modifications to the southern discharge flume would also occur at this time. After completion of the main structure, a permanent access road would be completed, providing vehicle access to the top of the structure. The work deck, FMS, organism return, screen wash pumps, screen lifting crane, bar racks and rake would be installed during this stage of construction.

The area around the expanded intake would be backfilled and the cofferdam removed. The new intake structure would be flooded either by opening the recirculation valves or using a pump to fill it. With the hydrostatic pressure between the lake and intake equalized, the blind flanges and wall separating the existing screen house and expanded CWIS would be removed. Circulating water could now pass through the intake pipes allowing the PBNP to come back online.

With the southern discharge flume operational, the northern discharge flume would be modified. After these modifications are completed the emergency bypass gates would be closed and all the flow would be directed through the CWIS intended to support the FM MTWS.

Retrofitting PBNP with an expanded intake with FMS as described above is expected to take approximately 67 months from design to completion. Active construction would take approximately 21 months, with both units being shut down for approximately 14 months.

The design presented in this study was selected to limit the footprint of the expanded intake and reduce the overall construction effort. This arrangement results in a 14-month long construction related shutdown, which is not considered viable at PBNP. Alternative methods to construct the intake to reduce the shutdown duration were considered in order for the FMS option to remain feasible. After considering several different construction and design alternatives, widening the structure and constructing it in three parts; north, south and center would allow most of the construction activities to take place with the station operating. A shutdown of approximately 7 months would still be needed to remove a portion of the existing intake tunnels, construct the center portion and tie the new structure into the existing circulating water system. The change in design and construction is estimated to result in a 25-month active construction window. The overall schedule adjusted to reduce the shutdown duration including detailed design and engineering, permitting, and construction is provided on Figure 10-23.

Changes in design and construction as estimated would also result in a 20% premium on the overall construction costs. Cost multipliers were added to the construction cost of this alternative and a 7-month shutdown was used for estimating social costs, in order to maintain the feasibility of the expanded intake option.

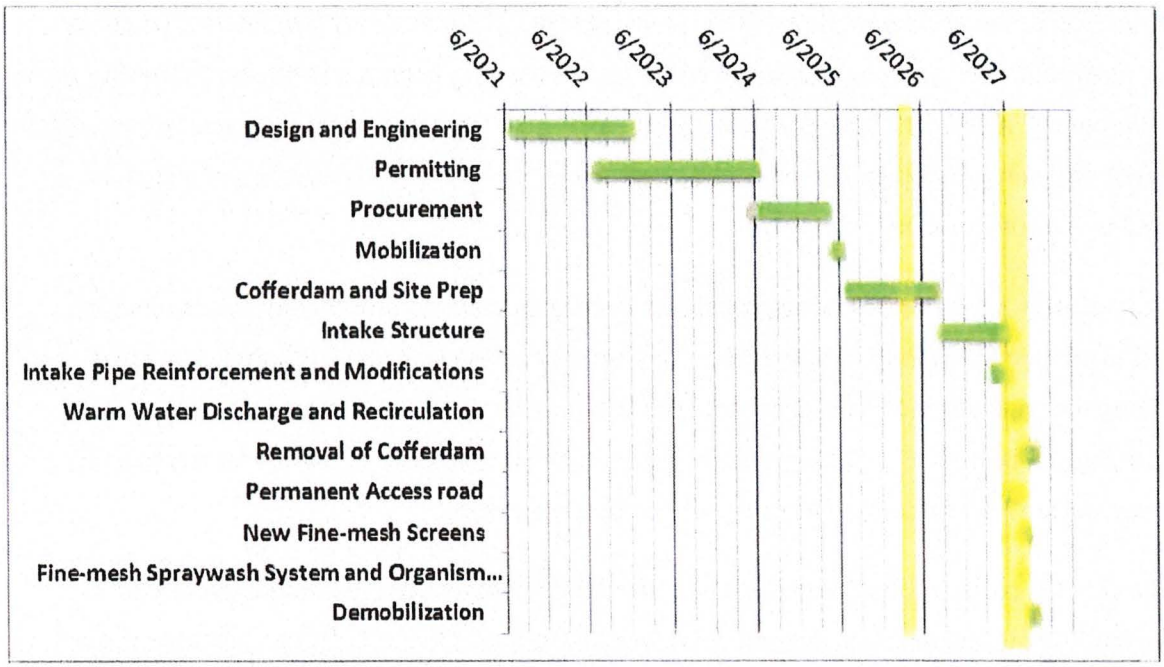


Figure 10-23: Construction Sequence for an Expanded Intake Designed for FMS with a 2.9 ft/s TSV (the yellow shaded section represents the 7-month construction related shutdown)

Operation and Maintenance (O&M)

Operation and maintenance procedures for the new screens in an expanded CWIS is based on information on the maintenance strategies for the FMS installed at Prairie Island which are operated in a similar fashion as anticipated by this potential option at PBNP. The new screens would be rotated and cleaned continuously or near continuously for the 6 months (April through September) when the FM is installed. Coarse-mesh was assumed for the remaining six months (October through March). During this time the new screens would be rotated at low speed for approximately 2 hours per day to remove debris. Continuous rotation is not necessary because the design and location of the existing intake is expected to meet Compliance Alternative 6. This

would require approximately 1,372 MWh per year to operate the new screens, and spray wash pumps.

The FM panels use small diameter wires that are more prone to damage from debris and fouled spray wash nozzles than coarse-mesh. As a result, additional effort to inspect and maintain the FM are required including replacing approximately 15% of the fine-mesh material annually. Inspection of the screens is estimated to take an average of 1 hour per screen per day when the FM is installed and 30 minutes per day when the FM panels are replaced with coarse-mesh. An additional 40 hours per screen per year is also included to account for repairs to the FM and other minor screen repairs. Regular repairs and overhauls of the new screens were assumed to cost 10% of the costs of a new screen.

The organism return should be inspected and cleaned regularly to prevent any debris plugging and to remove bio-growth. These inspections are expected to take up to 10 minutes per day during the 6 months the FM is installed. The fish trough would not be inspected when the coarse-mesh is installed. The existing deicing system is assumed to be sufficient to warm the spray wash water and prevent freezing of the organism return.

The existing coarse-mesh TWS would be rotated for approximately 10 minutes per day to prevent fouling and maintain them in operational condition. Operation of the existing screens and spraywash is expected to require approximately 6.5 MWh per year. If the FMS need to be bypassed, the existing TWS would rotate under a similar schedule to current operations. Annual maintenance including overhauling the existing screens was estimated to be 20% of the screen cost per year, plus an additional 10 minutes per screen per day.

With both the FMS and existing TWS in place, the water levels at the circulating water pumps would be approximately 0.6 ft lower than current conditions with clean screens and 0.9 ft lower if the FMS are 50% plugged, during normal operations. These increases in head loss are not expected to impact circulating and service water pump operations during low water periods. The emergency bypass gates may need to be opened during low water periods when operating one intake tunnel and one CW pump per unit or during high debris periods. Hydraulic modeling of the intake with the expanded CWIS is necessary to ensure balanced flow through the screens and to determine the effect of debris loading on head loss across the screens and station operations.

Permitting

Installation of the FMS option would require construction and dredging activities within Lake Michigan. These construction activities would trigger the need for federal, state, and local permits. The organism return discharge would be considered a new outfall and would need to be permitted accordingly under the NPDES program. The cost for these permits was taken as 0.02% of the direct capital costs estimated for this project. Sixteen to 24 months were anticipated for the application process, assuming all applications are submitted and reviewed concurrently.

PBNP is subject to additional safety and security measures as required by the Nuclear Regulatory Commission (NRC). Any technologies selected to meet § 316(b) requirements should not compromise the safety or security requirements established by the NRC. This assessment did not consider the 10 CFR 50.59 analysis (NRC 2001) required by the NRC. The 10 CFR 50.59 analysis requires a detailed assessment of proposed design changes on nuclear safety and security. This analysis will have to be completed before any decisions are finalized. At this point, conducting such an analysis would be premature. Costs to conduct the 10 CFR 50.59 analysis were assumed to be 1% of the direct capital costs estimated for this alternative. This cost was added to the overall permitting cost.

10.5.2.4 Uncertainty and Additional Studies

Many of the design concepts and O&M costs are based on the Prairie Island fine-mesh expanded intake which uses seasonal fine-mesh (and coarse-mesh) screens for approximately five months of the year and coarse-mesh MTWS only for the rest of the year. It is possible that O&M characteristics at PBNP would be different from Prairie Island because of the difference in environmental setting, debris loading, nuclear safety requirements, etc. In many respects, the system evaluated would be a first-in-kind, and as such several additional evaluations and studies are needed prior to designing, constructing or installing this system at PBNP.

Debris Handling and Clogging Study – There is limited data on the ability to maintain FMS under the debris loading conditions at PBNP. A pilot study should be conducted at PBNP to determine if fine-mesh screens can be installed under the debris conditions at the site. This study would not evaluate the biological performance of the screen, but would

identify the size and quantity of debris that would be collected on FMS at the site. Costs for this possible study are estimated to be approximately $150,000 for a 1 year fine-mesh deployment, assuming fine-mesh panels can be added to one of the existing screens. The cost may be substantially more if an alternative study arrangement is needed.

Study to Evaluate Screen Impact on Cooling Water Pump Performance – Head loss across the screens will impact the water level at the circulating water pumps for both units. The increase in head loss with the selected option is expected to be approximately 6 inches under clean conditions. Potential operational issues associated with reduced water levels on the pumps and nuclear safety would need to be identified prior to moving forward with any retrofit option; therefore, a pump intake model would be necessary. This pump intake model would be used as part of the 10 CFR 50.59 analysis to ensure that the expanded intake with FMS does not impact the safety or security requirements established by the NRC. Both physical and numerical model studies are expected to be needed. These studies are expected to cost approximately $350,000 and are included in the overall cost estimate for this option. The estimated study cost does not include the fees associated with the necessary NRC review.

Study to Evaluate the Screen Hydraulics – A uniform screen approach velocity is necessary to ensure balanced flow through the new screens. Unbalanced flow can lead to areas of high TSV, head loss, and debris loading. This would increase the torque on the screens, accelerate wear, and may lead to premature failure of the screens. The intake models used to investigate any impacts to the pump performance would be expanded for use in optimizing the flow distribution through the screens. Modifying the pump models and completing a physical model study is expected to cost approximately $50,000.

Organism Return Hydraulic Study – The organism return design presented in this study is conceptual in nature. A detailed engineering analysis including a hydraulic study of the return over the range of expected lake levels would be needed to refine the design of the organism return. These studies are expected to cost approximately $30,000 and are included in the overall cost estimate.

Pre-construction studies – Additional studies including topographic, wetland delineation, geotechnical, and seismic investigations would be needed to determine the

final layout and design the expanded CWIS. Cost for individual studies were not estimated as part of the preliminary designs but were accounted for as part of the indirect costs.

10.5.2.5 Compliance Costs

Feasibility level costs consistent with AACE Class 4 cost estimates were developed for the FMS option designed for a 3.1 ft/s or less through-screen velocity. These costs are intended to be used to facilitate a BTA determination. This estimate is composed of order-of-magnitude costs for direct, indirect, annual and periodic O&M, energy penalty, and compliance study costs.

The capital and O&M costs were multiplied by cost factors to account for additional burdens as a result of added security and safety requirements associated with nuclear facilities, like PBNP. A 1.2 multiplier was applied to all labor for productivity (loss) for work outside the protected area. (e.g. if it takes 1-man-hr to do something at a fossil facility, it takes 1.2-man-hrs at a nuclear facility). This accounts for additional staff/supervision requirements. An additional 1.3 multiplier was applied on wages, because only a subset of contractors are badged/able to work at nuclear stations. All activities associated with the expanded intake are assumed to occur outside of the protected area[86]. Accounting for both factors results in an overall adjustment factor of 1.56. This factor was applied to labor during both construction and operation of the expanded intake.

The direct, indirect, annual and periodic O&M, energy penalty and compliance study costs to expand the intake and add FMS designed for a 2.9 ft/s through-screen velocity are presented in Table 10-21. These costs account for modifications needed to reduce construction related shutdowns. The O&M costs in Table 10-21 include the costs for both the new screens with FM and coarse-mesh and the existing TWS.

The estimated annual operating costs associated with maintaining the current operation of the existing TWS, in lieu of installing FMS are presented in Table 10-22. Operating costs for the

[86] NextEra notes that much of the construction associated with the CWIS would be immediately adjacent to the protected area, suggesting that periodic entry for construction activities may be necessary. This potential has been neglected in estimating costs, potentially resulting in an underestimate of facility costs.

existing TWS were estimated as part of this study to allow for the development of incremental operating costs associated with the expanded intake.

The capital and O&M costs for the expanded intake, shown in Table 10-23, are the incremental cost difference between the design and operation of the existing CWIS representing IM BTA via Compliance Alternative 6 and the expanded intake with FMS. These costs represent the additional compliance cost that NextEra will incur if FMS are selected as BTA for entrainment.

Table 10-21 Expanded intake with New FMS with a 2.9 ft/s Through-screen Velocity

Capital Costs	Estimated Cost
Indirect Design and Permitting Costs	
Pre-construction Engineering Studies (indirect costs)	$13,514,000
Permitting	$2,703,000
Hydraulic and Pilot Studies	$570,000
Total Indirect Project Costs (2020$)	***$16,787,000***
Direct Construction Costs	
Mobilization	$8,190,000
Cofferdam and Site Prep	$36,549,000
Intake Pipe Reinforcement and Modifications	$2,764,000
Intake Structure	$24,417,000
New Fine-mesh Screens	$5,818,000
Fine-mesh Spraywash System and Organism Return	$1,153,000
Warm Water Discharge and Recirculation	$8,474,000
Permanent Access Road	$2,726,000
Direct Costs (2020$)	*$90,091,000*
Taxes and Depreciation (6.5% of Materials)	$1,583,000

Capital Costs	Estimated Cost
Distributable Costs (15%)	$13,514,000
Overhead and Profit (10%)	$9,009,000
Subtotal	*$114,197,000*
Allowance for Indeterminates/Contingencies (20%)	$22,839,000
NextEra Administrative (10%)	$11,420,000
Total Direct Project Costs (2020$)	***$148,456,000***
Construction Activities and Impacts	
Permitting (months)	16-24
Active Construction Duration (months)	25
Outage (months per unit)	7
Total Annual and Periodic Costs	
Annual Labor and Equipment[1]	$499,000
Regular Service and Overhauls[2]	$650,000
Annual Energy[3] (MWh)	1,379

1. Inspect and maintain 8 FMS and 8 TWS, including replacement of 15 percent of the fine-mesh material annually.
2. Annualized cost to rebuild each FMS every 10 years and TWS every 20 years.
3. Continuous rotation of the new MTWS for 6 months and for 2 hours per day for 6 months. Existing TWS are rotated for 10 minutes per day.

Table 10-22 Annual Costs to Operate and Maintain the Eight Existing TWS

Total Annual and Periodic Costs	
Annual Labor and Equipment[1]	$227,000
Regular Service and Overhauls[2]	$145,000
Annual Energy[3] (MWh)	78

1. Inspect and maintain the 8 TWS
2. Annualized cost to rebuild each TWS every 20 years.
3. Screens and spraywash system operated an average of 2 hours per day.

Table 10-23 Compliance Cost Summary for an Expanded Intake with New FMS with 2.9 ft/s Through-screen Velocity and an Organism Return

Capital Costs	Estimated Cost	Years Incurred
Total Indirect Project Costs (2020$)	$16,787,000	2022-2024
Total Direct Project Costs (2020$)	$148,456,000	2025-2027
Total Capital Costs (2020$)	**$165,243,000**	
Construction Shutdown	7 months	2027
Incremental Annual Costs[1]		
Annual Labor and Equipment	$272,000	2027- Retirement
Regular Service and Overhauls	$505,000	2027- Retirement
Annual Energy (MWh)	1,301	2027- Retirement

1. Difference in annual costs between maintaining current operations of the existing TWS and the expanded intake with FMS

10.6 Alternate Cooling Water Sources (§ 122.21(r)(10)(i)(C))

PBNP uses Lake Michigan for source water. The Final Rule requires the facility to evaluate alternate water sources to reduce the surface water withdrawal rate. This evaluation considered the use of groundwater and treated wastewater as described below, and further reuse of existing water sources.

10.6.1 Description of Plant Water Uses

Lake Michigan supplies most of the water used at PBNP. The majority is withdrawn for cooling purposes with a very small portion used for steam generation after treatment as well as for fire protection. The only other source of water at the Plant is groundwater withdrawn from wells for potable water and the sanitation system. No municipal water is used at PBNP (Wisconsin Electric Power Company 2007).

10.6.1.1 On-Site Water Reuse

On-site water use primarily consists of circulating water, service/process water, and screen backwash water. Water reuse on site would include reusing water from existing Plant uses in support of condenser cooling water. Intake screen backwash water is not suitable for reuse, as it is intended to remove debris from the screens. Potable water uses must be kept available for Plant personnel use. Process water must be kept available, as it is essential to make demineralized water for steam system makeup and secondarily for washing operations and fire protection (NextEra, 2015).

As water from the CWIS is already used for the cooling water system and other auxiliary equipment cooling purposes and potable and process waters are kept for personnel use, the only viable source of water reuse on the site is from the well water used for circulating water pump seal cooling water. When this flowrate is compared to the design circulating water flow, the quantity of water is less than one percent of the design circulating water flow. As a result, reuse of this water is not considered a candidate for further evaluation.

During winter months, each unit shuts down one of its two circulating water pumps, and routes a maximum of 234,000 gpm of condenser discharge (warm) water to the intake crib to control ice

and frazil ice. Warm water recirculation and reduced pumping results in 20 percent flow reduction on an annual basis. No further water reuse options are available at PBNP.

10.6.2 The Approach for Evaluation Alternate Water Sources

The below evaluation has been performed in two steps. The first step is to shortlist additional sizable alternate water sources located within a reasonable distance. The second step involves a further evaluation of shortlisted sources.

In the first step, the daily flow rate of any alternate water source within a specific radius is compared to the Plant's DIF (Table 10-24). Due to permitting challenges such as highway crossings, numerous rights-of-way required over private properties, and prohibitive construction costs, alternate water sources greater than a radial distance of five miles from the Plant are not considered to be practicable.

Table 10-24. Radial Distance for Alternate Water Sources at Point Beach Nuclear Plant

Distance from Facility	Percent of Facility's DIF	Approximate Minimum Target Flow Rate for Further Evaluation (MGD)
<1 Mile	5%	55
1-2 Miles	10%	111
2-3 Miles	15%	166
3-4 Miles	20%	222
4-5 Miles	25%	277
Point Beach Nuclear Plant's DIF = 1,107.6 MGD		

For shortlisted alternate water sources, the evaluation will include an approximate pipeline alignment from the alternate source to the Plant, and assess the source for:

- Reliability of supply
- Water quality compatibility with the Plant's uses
- Additional necessary treatment and approximate costs
- Cost of conveying water from the source to the Plant

- The relative effort to negotiate rights-of-way on each property parcel crossed
- The impact of discharge, including permitting issues.

Groundwater sources with sufficient well yields to serve as a viable source will be further evaluated for the following:

- Water quality compatibility with Plant's equipment
- Groundwater and Lake Michigan water compatibility
- Groundwater discharge options and the potential impacts of comingling groundwater and Lake Michigan water
- Potential need for additional chemical use
- Cursory evaluation of the impact of groundwater on the biota in Lake Michigan, and
- The impact of groundwater extraction on the aquifer, other wells, and other groundwater uses.

10.6.2.1 Treated Grey Water Sources

PBNP operates an onsite sewage treatment plant as part of the sanitary system for the Plant (Table 10-25). The onsite sewage treatment plant discharges to Lake Michigan and has a design flow of approximately 0.1 MGD, which is far less than one percent of the Plant's DIF. Based on the WDNR's listing of municipal wastewater WPDES permittees (WDNR, 2019), information related to the development of the NE Lakeshore TMDL (WDNR, 2020b; WDNR, 2020c), and the 2040 Manitowoc-Two Rivers-Mishicot Sewer Service Area Plan (BLRPC, 2016), no additional publicly or privately-owned wastewater treatment plants (WWTPs) are located within a five-mile radius of the Plant (Figure 10-24). The nearest off-site WWTP, the Francis Creek Wastewater Treatment Facility, is approximately eight miles southwest of PBNP and has a design flow of 0.095 MGD, which is less than one percent of the Plant's DIF. Therefore, grey water is not feasible as an alternate source of supplemental cooling water at PBNP and will not be evaluated further.

Table 10-25. Grey Water Alternate Water Source Evaluation

Grey Water Source	Distance From Plant (Miles)	Maximum Design Flow (MGD)	Percent of Plant DIF (%)	Candidate for Further Evaluation
PBNP Sewage Treatment Plant	Onsite	0.006	<1	No
Point Beach Nuclear Plant's DIF = 1,107.6 MGD				

Source: PBNP Water Balance.

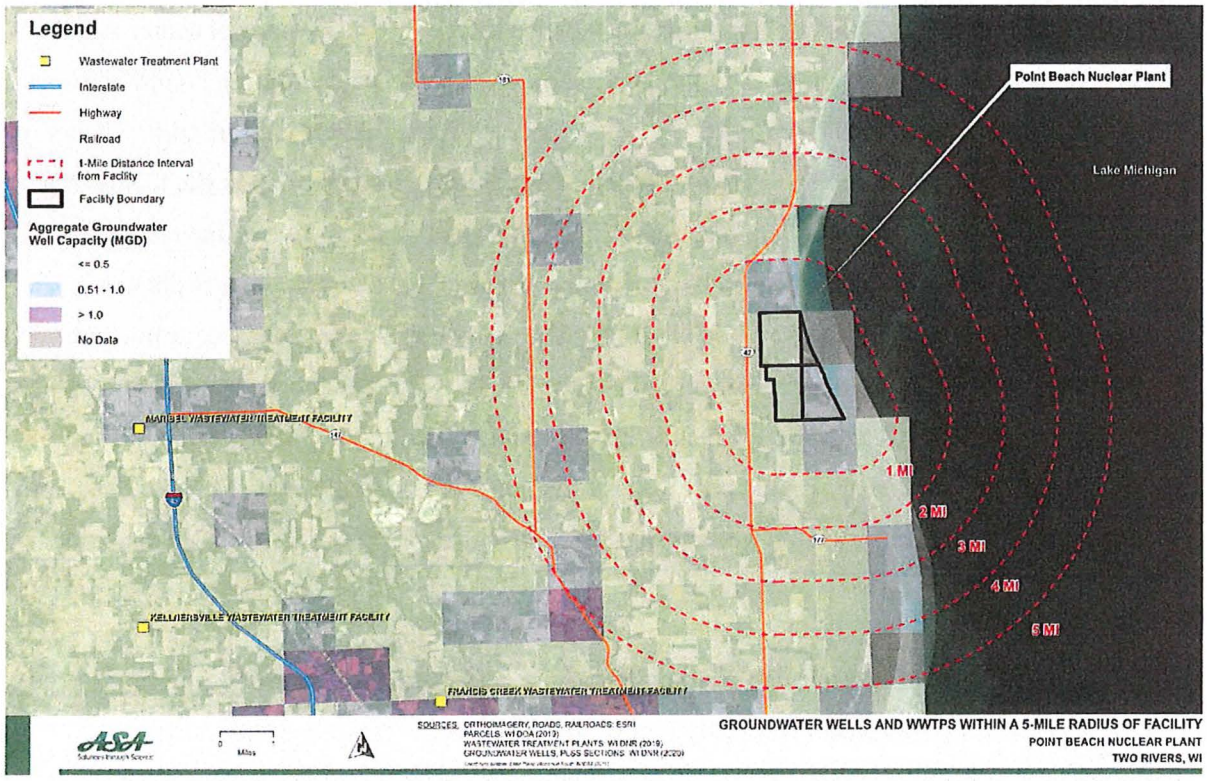


Figure 10-24. Aggregate Groundwater Well Capacity and Wastewater Treatment Plants within a Five Mile Radius of Point Beach Nuclear Plant

10.6.2.2 Groundwater Sources

The following sections describe the groundwater availability for PBNP and off-site wells within a five-mile radius of the Plant.

Onsite Wells

PBNP has five existing onsite groundwater wells that supply water to the Plant for potable and sanitary purposes. The main well has a pump capacity of 65 gpm and draws from the Silurian aquifer at a depth of 257 ft (PBNP 2004). A well at the north gate, which was installed during original construction of the plant, provides limited domestic water to a storage building (PBNP 2004). Two wells with 20-gpm pumps were installed at the site boundary control center and the lakeside training complex during 1983, however the well at the lakeside training complex is currently inactive (PBNP 2004). A well that was constructed at the Energy Information Center in 1998 has a maximum withdrawal rate of 0.6 gpm (PBNP 2004). Six previous onsite residences each previously had wells with pumping capacities of 10 gpm, however five of the residences have since been removed and their wells abandoned. The well for the remaining residence is used periodically by Plant security (PBNP 2004). The main well, site boundary control center well, and Energy Information Center well combined give PBNP a groundwater pumping capacity of 85.6 gpm (0.12 MGD), which is less than one percent of the Plant's DIF. All onsite groundwater wells together provide only a small fraction of circulating water. Therefore, groundwater from existing onsite wells is not considered a viable option for further evaluation.

Off-site Wells

Groundwater provides much of the surrounding region with potable supplies. No public groundwater wells are located within five miles of PBNP, however wells for private use are present in the vicinity of the Plant (NextEra, 2015b). The WDNR Groundwater Retrieval Network Well Inventory (WDNR, 2020a) provides data on individual wells in each county including an approximate location based on the Public Land Survey System (PLSS) township, range, and section where each is located. A total of 83 PLSS sections were within or partially intersected the five-mile radius drawn from the PBNP boundary (Figure 10-24). Of 543 wells located within these sections, pumping rates were available for 516 wells with rates varying from 2 to 500 gpm. The aggregate pump capacity of the 516 wells for which data were available was 22.5 MGD, or approximately two percent of the Plant's DIF. Given that the total maximum yield

within five miles of PBNP did not meet the flow threshold criteria outlined in Table 10-24 for any mile radial distance, groundwater from off-site wells is not considered a viable option for further evaluation.

10.6.3 Ranney Wells

A Ranney well consists of a caisson driven into the ground and aquifer, and adjacent to a surface waterbody. Water may seep into the caisson through the main body or via additional lateral well screens built out radially into the aquifer. The aquifer and the water in the caisson is expected to be fed by the surface waterbody. The facility would pump water out of the caisson; given the close proximity between the caisson and the surface water, the facility would effectively be withdrawing from the surface waterbody. Sand and gravel in the aquifer would 'filter' the water and disperse the induced velocity, effectively preventing impingement and entrainment. See Figure 10-25.

Ranney wells need to be constructed in highly permeable soils with infiltration rates between 10-100 inches per hour. Infiltration rate of Manitowoc soil is approximately 0.1 inches per hour (USGS, 2005; USGS, 1973). See Figure 10-26. As part of a groundwater exploration program that began in 1945, a series of three Ranney wells were installed along the Lake Michigan shorelines in Manitowoc WI. Each well was 13 ft in diameter and 80 ft deep, constructed of reinforced concrete caissons, with two pumps rated at 2 MGD and 4 MGD; the actual pumping rate was between 5-6 MGD. One of the wells experienced reduced capacity in 1965 and needed a recharge but was ultimately abandoned in 1987. The Ranney well system could not support the water demand in the City of Manitowoc which then installed a surface water intake system in 1970 (Sea Grant 1992). Per Figure 10-26, soil permeability characteristics in Manitowoc are representative of characteristics at PBNP. Ranney wells at PBNP would likely experience similar challenges.

When several critical conditions are met, Ranney wells can be an effective impingement and entrainment reduction option for withdrawing between approximately 10 and 50,000 gpm. However, the geologic conditions in Manitowoc County near Lake Michigan are not conducive to a productive Ranney well. The original Ranney wells struggled to provide between 15-20 MGD (even with additional pumps that were later installed) to the City of Manitowoc. PBNP's

DIF is 1,108 MGD. Ranney wells would not be able to provide an appreciable portion of PBNP's water needs.

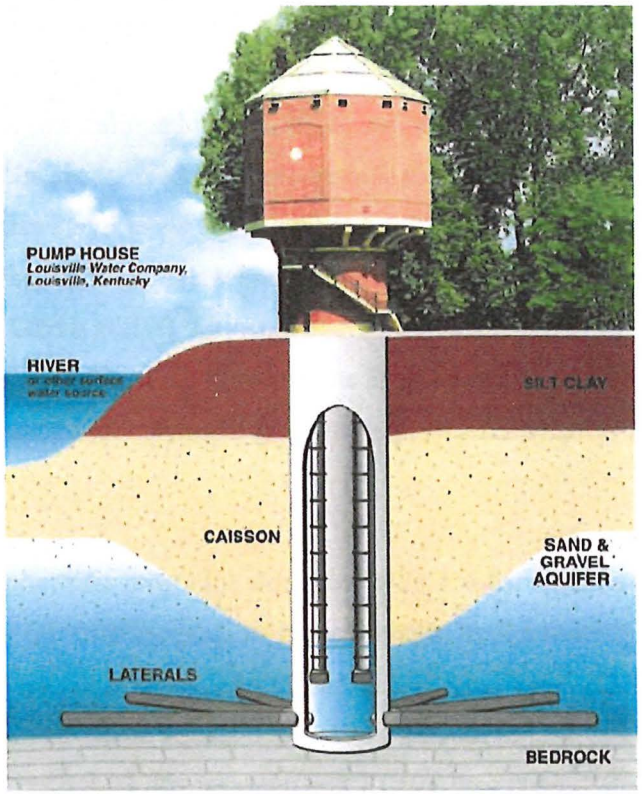
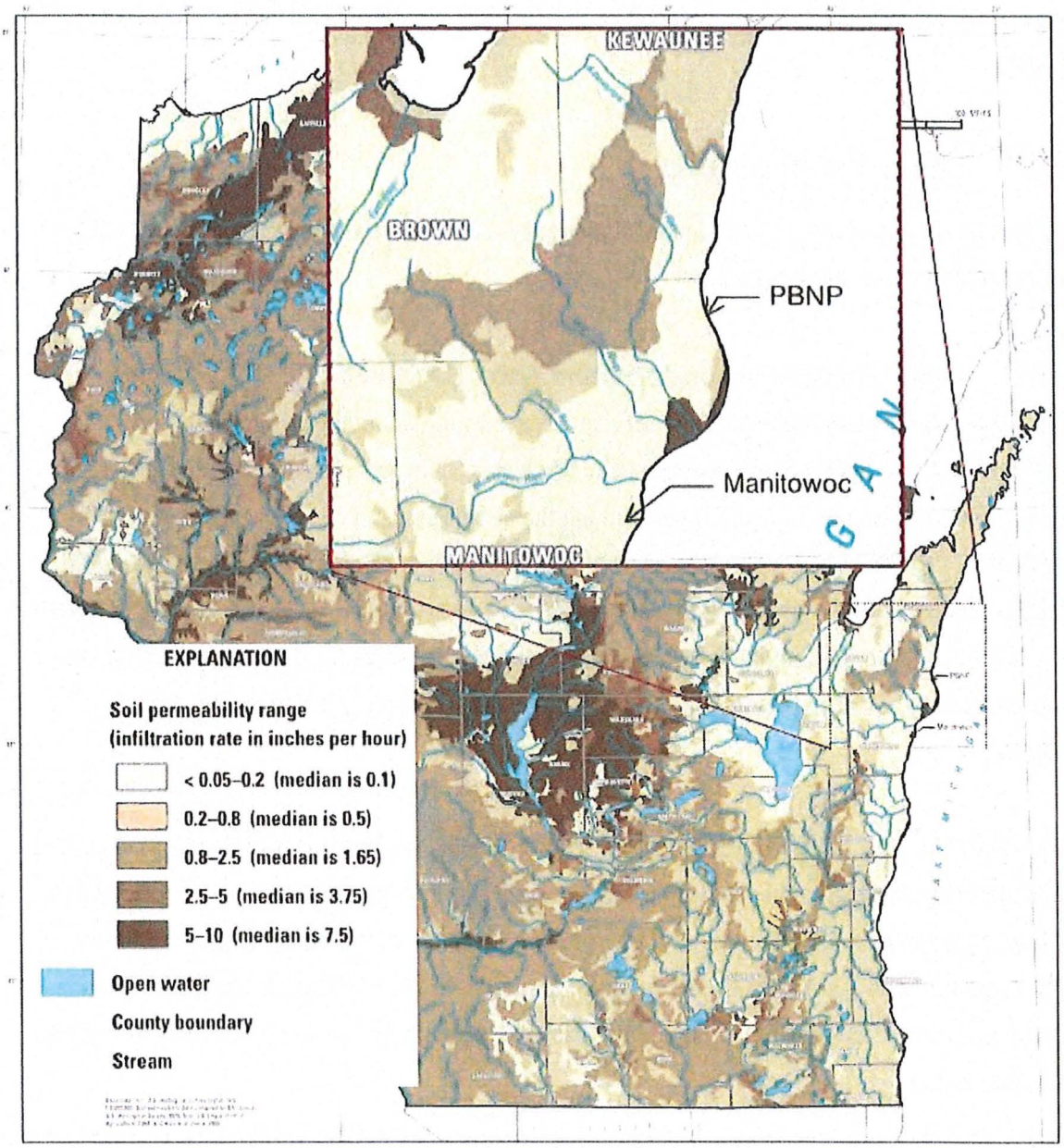


Figure 10-25. Basic Ranney Well

Source: Missimer *et al.*, 2010.



Soil Permeability in Wisconsin

Figure 10-26. Soil Permeability in Wisconsin

Source: USGS, 2005.

10.6.4 Alternate Cooling Water Source Feasibility

Based on findings presented in this subsection, alternate water sources and Ranney wells (which is an alternate technology that would withdraw from the same water source) are deemed

infeasible and impractical as supplemental cooling water sources and will not be evaluated further.

10.7 Other Technologies

This section discusses other technologies that already reduce entrainment at PBNP or could have the potential to reduce entrainment.

10.7.1 Winter Flow Reduction and Warm Water Recirculation

PBNP withdraws circulating water and service water through an intake crib located approximately 1,750-ft from the shore in Lake Michigan. This water is routed to an onshore intake structure, which pumps the water through the circulating and service water systems. The DIF for PBNP's withdrawal is 769,160 gpm and a velocity of approximately 3.8 fps at the intake structure; however, during the winter months (typically December through March), PBNP uses only one of two circulating water pumps per unit thereby reducing the withdrawal rate to approximately 502,160 gpm (723.1) and a velocity of approximately 2.5 fps at the intake structure.

Large quantities of frazil ice have historically been observed in open water to depths in excess of the intake crib; floating ice has the additional potential to block the intake crib (NextEra, 2015). As such, deicing ice melt flow is essential to prevent blockage of the intake with ice, and the Plant is permitted by the WDNR to recirculate warm water (WDNR, 2012). The Plant recirculates warm condenser discharge water back to the intake to prevent freezing in the system (NextEra, 2015).

Wintertime effective withdrawal rate is reduced to approximately 302,160 gpm for four of the twelve months. Reduced pumping and warm water recirculation results in approximately 20 percent reduction on an annual basis. While this reduction in intake flow is significant, it occurs outside of the seasons in which eggs and larvae occur in the lake (from late April to September). Therefore, the reductions in entrainment expected from the wintertime reductions in flow are expected to be minor.

10.7.2 Variable Speed Pumps

Variable speed pumps (VSPs) could allow the operator to increase or decrease the pumping rate (within the pump's capacity) based on the Unit 1 and Unit 2 condenser cooling water requirements to meet various operating or regulatory goals. The intention is to pump only the amount of water needed to adequately condense steam associated with the steam turbine's electric load thereby reducing the water withdrawal rate while meeting regulatory thermal criteria.

As presented in this section, PBNP is a nuclear power plant that operates at full capacity and has little opportunity to reduce flow beyond what is already achieved during Plant outages, from warm water recirculation for deicing, or idling circulating water pumps when possible in winter conditions. There is no additional appreciable opportunity to reduce flow using VSPs while retaining plant reliability and maintaining a margin of safety appropriate for a nuclear power plant.

10.7.2.1 Description of Technology

Pump speed refers to the rotational speed of the pump shaft. The shaft is connected to the impeller, and the impeller transfers energy to the water (Europump & the Hydraulic Institute, 2004). Slowing the rotation of the impeller reduces energy transfer rate to water and the water withdrawal rate from the waterbody. Adjusting of the pump speed is achieved by a variable speed drive (VSD) that controls the rotation speed of the pumps' electric motors. Matching the VSD to the motor and pump is subject to complex constraints with some motor/pump combinations being unsuitable for VSD. In addition, the "tunable range" of pump speed must be defined and is subject to system constraints as well as the potential opportunity for reductions in intake flow.

VSDs must be housed in a dust-, humidity- and temperature-controlled environment. A separate building would need to be constructed adjacent to the existing CWIS and as close as possible to the circulating pump motors, to house these drives; and the new building would need its own heating, ventilation and air-conditioning system to provide the necessary controlled environment. The PBNP Protected Area is fully built-up and the existing intake structure is surrounded by

underground piping and utilities; there is no space to construct a new building close enough to the existing pumps to house VSDs.

10.7.2.2 Opportunity for Flow Reduction

Generation data for periods 2015 through 2019 shows that PBNP Unit 1 generated 94.6 percent and Unit 2 at 94.7 percent on an annual average[87]. Importantly, when not in an outage condition, PBNP operates at or near 100 percent of rated capacities on a daily basis. Monthly averaged capacity utilization rates are shown in Table 10-26 for Unit 1 and Table 10-27 for Unit 2. Planned outages for Unit 1 occurred in five of the 60 months of record presented, and for Unit 2 for four of the 60 months of record[88]. During the non-outage months, the average capacity utilization rates for both units was at or near 100 percent. Therefore, while facilities with fluctuating generation may be able to reduce water use during reduced generation periods, PBNP is baseloaded, has experienced very few fluctuations in generation, and does not expect to experience them in the future. PBNP already takes advantage of low inlet water temperatures during winter months and shuts down a pump and recirculates warm water. PBNP has no opportunity for further flow reduction using VSPs.

Table 10-26. PBNP Unit 1 Monthly Average CUR

Month	2015	2016	2017	2018	2019
1	100%	100%	100%	100%	98%
2	100%	100%	100%	100%	99%
3	100%	35%	100%	100%	71%
4	100%	77%	99%	100%	29%
5	100%	100%	100%	99%	96%
6	100%	100%	100%	100%	100%
7	100%	100%	99%	100%	100%
8	99%	99%	98%	99%	99%
9	100%	99%	97%	100%	100%
10	100%	99%	18%	100%	100%
11	93%	100%	94%	101%	101%
12	92%	100%	101%	86%	100%

Months with full or partial refueling outages are highlighted.

[87] The capacity utilization rates presented in this section reflect actual generation data for period Jan 1, 2015 through Dec 31, 2019.
[88] Both units are on 18-month rotations, but staggered. The apparent discrepancy in the number of outages stems from the window of time examined for this evaluation.

Table 10-27. Unit 2 Monthly Average CUR

Month	2015	2016	2017	2018	2019
1	99%	100%	100%	100%	99%
2	100%	100%	100%	100%	99%
3	99%	100%	53%	100%	99%
4	100%	100%	39%	100%	100%
5	100%	99%	100%	100%	97%
6	100%	99%	100%	100%	99%
7	99%	99%	99%	100%	100%
8	99%	98%	98%	99%	93%
9	97%	99%	99%	97%	100%
10	7%	99%	100%	25%	100%
11	97%	100%	99%	100%	101%
12	100%	99%	100%	100%	100%

Months with full or partial refueling outages are highlighted.

10.7.2.3 Cost and Feasibility Considerations of Variable Speed Pumps

It is impractical and potentially infeasible to install or operate VSPs or VFDs at PBNP for the following reasons:

- Minimal flow reduction potential due to high utilization rate (nearly 100 percent).
- Lack of space to house the drives and controls.

Due to VSPs/VFDs being considered impractical and ineffective for flow reduction, costs have not been developed at this time. If costs were to be estimated in the future, costs would need to include the cost of variable frequency drives (if the existing pumps may be retrofitted) or new variable speed pumps (if the pumps cannot be retrofitted and need to be replaced in their entirety); a building complete with climate control for housing the drives; new power source and power distribution; instrumentation and controls; temperature and flow monitoring system upgrades and feedback logic to control the drives; direct and indirect construction costs; construction management; project management; permitting; design change package to update existing plant drawings and specifications. While site-specific costs were not developed, based on other sites, the capital costs would exceed $20 million and could be substantially more.

NextEra also notes that one of its contractors has performed, for the Electric Power Research Institute, a survey of facilities that retrofitted existing once-through cooling systems with VSP. The results of this survey consistently found that the rate of flow reduction anticipated in the planning phase were not realized in actual operation. The challenges of real-time changes in pumping rate are substantial and very difficult to predict in a planning mode. Therefore, even at facilities where an opportunity for flow reduction seemed apparent, the technology underperformed.

10.7.2.4 Summary of Variable Speed Pumps

Considering that PBNP generates at full capacity and that there is no appreciable margin between historic data and permit limit, this evaluation concludes that PBNP cannot reduce its circulating water flow in a meaningful way in order to reduce entrainment. The constraints on VSP installation at the site, their substantial costs, and the difficulty in predicting their success also contribute to their rejection at PBNP.

10.8 Summary of Findings

This report evaluated the following technologies as potential entrainment reduction measures at PBNP to comply with the Final Rule:

- Closed-cycle recirculating cooling systems including:
  - Standard MDCTs;
  - NDCTs;
  - Plume-abated MDCTs; and
  - Dry air-cooled condensers;
- Fine-mesh screen systems including:
  - Fine-slot wedgewire screens; and
  - Modified traveling water screens with fine mesh screens.
- Alternate water sources and water reuse options; and
- Other technologies, including:
  - Winter flow reduction and warm water recirculation; and
  - Entrainment reduction potential of VSPs.

10.8.1 Summary of the Engineering Feasibility and Cost Findings

Evaluation findings are summarized in Table 10-28.

Table 10-28. Summary of Findings

Technology	Feasibility/Practicality Finding	Key Reasoning for Finding
Closed-Cycle Recirculating Cooling System		
Standard mechanical draft cooling towers	Infeasible and impractical but evaluated further.	Construction and operational infeasibility. However, this technology is being evaluated further.
Natural draft cooling towers	Infeasible.	Design incompatibility. The approach to wet bulb temperature is smaller than can be supported by a natural draft cooling tower.
Plume-abated mechanical draft cooling towers	Impractical.	Larger and costlier than standard MDCT. Inferior to standard MDCT; therefore, not evaluated further.
Air-cooled condensers	Infeasible.	Insufficient space, and unacceptable energy penalty.
Fine-mesh screens		
Narrow slot wedgewire screens located at the intake crib	Infeasible.	Increased head loss through the system is unacceptable even with clean screens. Risk of frazil ice, debris, and biofouling worsening head loss is also unacceptable. Lack of sweeping velocity may impact reliability and biological effectiveness. The reliability of a by-pass of the expanded screens has unacceptable uncertainty given the critical nature of the service water to ensure Nuclear safety.
Fine mesh with expanded modified traveling water screens and a fish return located to the east of the screen house between the discharge flumes	Impractical and very likely infeasible.	The existing traveling water screens cannot be replaced with FMS due to unacceptable head loss and potential for screen clogging. This current screen configuration does not allow for a by-pass of the existing screens in head loss event. A concept for increasing the screen area and allowing by-pass was considered but the costs are extremely high and the dual unit outage necessary for installation is of unacceptable duration. Significant uncertainty also exists around the means of construction, the ability to ensure cooling system integrity during construction, and the costs of installation.

Technology	Feasibility/Practicality Finding	Key Reasoning for Finding
Alternate Water Sources		
Reuse Existing Water Sources	Infeasible.	No further opportunities to reuse service water or screenwash water.
Replace existing surface water source with alternate reclaimed water or groundwater sources	Infeasible.	Flowrates of alternate water sources are considered infeasible and impractical compared to PBNP DIF.
Groundwater	Infeasible.	Flowrates of PBNP and existing wells are considered infeasible and impractical compared to the Plant's DIF.
Ranney Wells	Infeasible.	Transmissivity at PBNP is not sufficiently high to withdraw requisite quantities from Lake Michigan. This technology does not appear to be suitable to withdraw once-through circulating water from PBNP.
Other Entrainment Protection Measures		
Winter Flow Reduction and Warm Water Recirculation	Implemented.	PBNP already employs these measures.
Variable speed pumps	Impractical and ineffective.	Baseload station operating close to its permitted heat load; no opportunity to reduce flow and still support reliable operations and consistent compliance

10.8.2 Technologies Retained for Biological Efficacy and Impacts Evaluations

Based on the summary in Table 10-28, technologies retained for biological and costing evaluations are listed in Table 10-29.

Table 10-29. Technologies Retained for Further Evaluation

Technology	Retained for Further Evaluation
Mechanical draft cooling towers	Yes
Natural draft cooling towers	No
Plume-abated mechanical draft cooling towers	No
Air-cooled condensers	No
Wedgewire screens in Lake Michigan	No
0.5-mm FMS in front of existing CWIS	Yes
Re-use existing water sources	No
Replace Lake Michigan water with other alternate reclaimed water or groundwater sources	No
Ranney Wells	No
Winter Flow Reduction and Warm Water Recirculation	Implemented
Variable speed pumps	No

10.8.3 Summary of Social Costs for Candidate Technologies

Based on the information presented above, Veritas Economic Consulting calculated social costs of potential retrofit of PBNP with closed-cycle cooling and fine mesh screens as described in Appendix 10-A. Table 10-30 provides a summary comparison of the social costs for closed-cycled cooling and fine mesh screens at both annual and net present value and a 3 and 7 percent discount rate.

This feasibility evaluation found that cooling towers are both infeasible and impractical; fine-slot wedgewire screens and fine-mesh traveling screens are infeasible. There are no viable alternate water sources or additional water reuse options.

Table 10-30. Total Engineering and Social Costs of Feasible Technology Options at Point Beach

		Compliance Costs[a]			Social Costs (Present Value)[b]					
					Electricity Price Increases Resulting From					
Discount Rate	Technology Type	Total Design, Construction, & Installation Costs	O&M Costs[c]	Fill Replacement[d]	Compliance Costs	Power System Costs	Externality Costs	Government Regulatory Costs	Total Social Costs	Annual Social Costs
3%	Closed-Cycle Cooling Retrofit	$629.6M	$5.3M	$25.5M	$450.8M	$258.5M	$5.5M	$0.11M	$714.9M	$26.5M
	Fine Mesh Screens	$165.2M	$0.8M	N/A	$103.1M	$109.4M	N/A	$0.03M	$212.5M	$8.2M
7%	Closed-Cycle Cooling Retrofit	$629.6M	$5.3M	$25.5M	$235.4M	$144.3M	$4.0M	$0.08M	$383.8M	$14.2M
	Fine Mesh Screens	$165.2M	$0.8M	N/A	$52.4M	$84.8M	N/A	$0.02M	$137.2M	$5.3M

[a] Compliance costs presented are undiscounted and in 2020 dollars.

[b] The social costs associated with each technology are presented in 2020 dollars and discounted at 3 and 7 percent using the specifications outlined in Appendix 10-A. The timing specification for Unit 2 is used to discount Total Design, Construction, & Installation Costs. Numbers may not sum due to rounding.

[c] Annual O&M costs are presented as an undiscounted value typical for a full year of operation. The actual annual discounted values are incorporated in the Social Costs (Present Value). To avoid double counting in the social cost analysis, the O&M portion of compliance costs does not include engineering estimates of parasitic load costs (e.g., costs to run pumps and fans for cooling towers) or costs from backpressure effects. Those costs are estimated in the power system modeling component of social costs.

[d] Fill Replacement is specified to occur once in 2038.

Source: Veritas, 2020.

11.0 Benefits Valuation Study 40 CFR 122.21(r)(11)

11.1 Introduction and Background

This section provides information on the incremental benefits of the candidate entrainment reduction technologies and operational measures evaluated in Section 10.0 using the entrainment characterization results presented in Section 9.0. The following is the text of 40 CFR 122.21(r)(11):

The benefits valuation study must include, but is not limited to, the following elements:

(i) Incremental changes in the numbers of individual fish and shellfish lost due to impingement and entrainments as defined in 40 CFR 125.92, for all life stages of each exposed species;

(ii) Description of basis for any estimates of changes in the stock sizes or harvest levels of commercial and recreational fish or shellfish species or forage fish species;

(iii) Description of basis for any monetized values assigned to changes in the stock size or harvest levels of commercial and recreational fish or shellfish species, forage fish and to any other ecosystem or non-use benefits;

(iv) A discussion of mitigation efforts completed prior to October 14, 2014, including how long they have been in effect and how effective they have been;

(v) Discussion, with quantification and monetization, where possible, of any other benefits expected to accrue to the environmental and local communities, including but not limited to improvements for mammals, birds, and other organisms and aquatic habitats;

(vi) Discussion, with quantification and monetization, where possible, of any benefits expected to result from any reductions in thermal discharges from entrainment technologies.

The methodology described in the following subsections is similar to that of EPA as presented in the Case Study Analysis for the Proposed Section 316(b) Phase II Existing Facilities Rule (USEPA, 2002). The steps pursued during the analysis are described in Section 11.2.

11.2 Review of Methods

The estimation of benefits was a multistep process:

1. Calculate incremental changes in entrained and impinged organisms annually.
2. Convert incremental changes into equivalent adults (EAs) and foregone production, using commonly applied and accepted models.
3. Transfer the foregone production of forage taxa to a commercially important finfish (Chinook Salmon) using a trophic transfer model.
4. Calculate equivalent yield of commercial/recreational (C/R) taxa by combining the foregone production of each C/R taxa with the trophic transferred foregone production of forage taxa.
5. Monetize the changes in yield (recreational, commercial, and nonuse values).

The baseline losses estimated for the Point Beach Nuclear Plant (PBNP or the Plant) were calculated using the observed organism entrainment rates (Section 9) and actual plant flow data (or AIF). Plant monitoring records documented a daily average withdrawal rate of 925.1 MGD for the 5-year period from 2015 through 2019 (see Section 3.0). The process above was then followed to calculate reductions in entrainment for the two potential technologies described in Section 10.0 given the conditions at PBNP:

- Retrofitting to closed-cycle cooling in the form of MDCTs
- Installation of fish-friendly FMS in new bays located in front of existing coarse-mesh screens

As noted in Section 10.0, alternative water supplies and variable speed pumps were determined to be infeasible and/or impractical and were not carried forward to the estimation of benefits.

NextEra intends to comply with IM BTA technology requirements in the form a system of measures as described in Section 6. The Final Rule does not require the estimation of the social benefit of that impingement mortality BTA nor does it require the estimation of monetized benefits of any IM reduction associated with entrainment measures.

11.2.1 Incremental Changes in Losses Due to Technologies (40 CFR 122.21(r)(11)(i))

Incremental changes in fish and shellfish entrainment and impingement mortality were calculated by using the baseline losses and calculating the potential live return for FMS and the percent reduction in intake flow for closed cycle retrofit.

11.2.1.1 Definition of Baseline Losses

To quantify the loss of fish and shellfish due to the operation of PBNP, a determination of the annual losses of fish and shellfish was calculated from the sample event densities observed at PBNP and the cooling water intake flow as detailed in Section 9.0 and adjusted to the 5 year AIF from 2015 to 2019. Seasonal changes in the AIF were used with the sample-round specific densities to arrive at a time varying rate of entrainment and impingement. Presentation of this information addresses two functions in this report:

- It provides a clear illustration of the methods used to estimate impacts and monetize their social benefit without confounding factors associated with the differential effectiveness of the additional entrainment technologies.
- It illustrates the maximum potential social benefit associated with complete reduction in entrainment and impingement at PBNP.

11.2.1.2 Shellfish

EPA has not defined the term "shellfish"; however, it is commonly understood to include organisms used for human consumption such as shrimp, crayfish, crabs and/or clams. It is also common to include these types of invertebrates that serve as forage for commercially and recreationally important taxa. None of these typically considered types of shellfish were entrained at PBNP in entrainment studies conducted in 1975, 2006, and 2017. Each of these surveys had very different invertebrate assemblages illustrating documented changes in the Lake Michigan invertebrate community including the growing dominance of invasive invertebrate species.

The entrainment studies at PBNP included enumeration of crayfish, amphipods and mysid shrimp (*Mysis* sp.). Early invertebrate entrainment (1975) included only the native species *Diporeia* sp. (a benthic amphipod) and *Mysis* sp. and was a fraction (<1 percent) of the more

recent estimates. While invertebrate entrainment in 2006 was similar in total numbers to that in 2017 it consisted almost exclusively (99.9 percent) of the native amphipod, *Gammarus* sp. Invertebrate entrainment in 2017 consisted of 78 percent non-native gammarid amphipod, *Echinogammarus ischnus*, and 28 percent native *Gammarus* sp. This shift to non-native species is consistent with documented changes in Lake Michigan.

E. ischnus was first reported from Lake Michigan in 1998 (Nalepa *et al.*, 2001), and has become one of the most abundant non-dreissenid benthic invertebrates in Lake Michigan where it has locally displaced native *Gammarus* sp. (Dermott *et al.*, 1998; Nalepa *et al.*, 2001). According to NOAA's Great Lakes Aquatic Nonindigenous Species Information System, there is little or no evidence that *E. ischus* and *Gammarus fasciatus* have significant socioeconomic or beneficial impacts in the Great Lakes and *E. ischnus* has a moderate environmental effect where it displaces native species (Kipp and Hopper, 2020; Benson *et al.*, 2020).

These amphipods are not found at this abundance in the majority of the lake as was shown in the comparison of ambient and entrainment densities during the Phase II study at PBNP (EA, 2007; Benson *et al.*, 2020; Kipp and Hopper, 2020; see Appendix 9-A). *Gammarus* densities in entrainment samples enumerated by EA (2007) were 34 to 88 times the densities observed in ambient samples. Thus, the density entrained is likely a result of colonization of the offshore intake crib or the intake forebay due to the availability of rocky substrates and associated biota (e.g., dreissenid mussels) in those areas.

Given the short life cycles of these invertebrates (the dominant one reaches maturity in a few weeks), it is likely that those captured in entrainment samples are adults and therefore not subject to additional growth. Additionally, some studies have shown that *Gammarus* sp. are likely to survive the increases in temperatures associated with entrainment, especially at lower ambient temperatures: up to 15.6°C ΔT at ambient temperatures of 11.2 to 7.1 °C resulted in no increased mortality in one study and greater than 90 percent survival was recorded at 7 to 8°C ΔT at ambient temperatures of 24.9 to 26.0°C in another study (Ginn *et al.,* 1974; Ginn *et al.,* 1976). While it is uncertain whether these organisms may survive entrainment, even if they do not survive passage through the plant, entrainment would not remove their biomass from the food web.

For this assessment and subsequent discussions, shellfish are defined to include these invertebrates, regardless of their C/R status. That is, shellfish with no C/R value, but that may serve as forage, have been considered in addition to direct losses of C/R species. Because of the potentially large proportion of forage shellfish that may be entrained at PBNP and their potential contribution to the food web of commercially and recreationally important species, NextEra believed it prudent to account for their losses and subsequent potential benefits with the application of each technology despite the uncertainties (See Section 11.5) associated with the following factors:

- Recent entrainment at PBNP is dominated by non-native species;
- Substantial local enrichment of these taxa was documented at the intake crib (EA, 2007 and see Appendix 9-A) making the observed organisms and their densities unrepresentative of the invertebrate forage base in the lake;
- Survival of the organisms is possible and, even if the rate of entrainment-related lethality is high their biomass remains available as forage;
- The rates of exclusion by FMS and post-exclusion survival are poorly known and have been assumed to be 100%, a likely over-estimate of the technology's effectiveness; and
- Life cycle parameters necessary to incorporate these taxa into the models defined above are not readily available and previous analyses in Lake Michigan did not include these invertebrates (e.g., Midwest Generation, 2019).

NextEra believes that inclusion of these organisms as forage in the benefits assessment is likely to over-estimate the actual benefits associated with the potential entrainment measures (see Section 11.5).

11.2.1.3 Entrainment Under Baseline Conditions

Appendix 11-C provides estimated annualized baseline entrainment rates for the two 1-year study periods by taxa and life stage. The rate of entrainment of fish and shellfish (commercial, recreational, and forage) that are projected to occur at PBNP was calculated as follows: sample event densities (number per gallon) from each sample year (April to September 2006 as Year 1, and April to September 2017 as Year 2)[89] were independently interpolated between sample

[89] It is understood that little or no entrainment occurs outside of the April to September period due to seasonality of spawning in Lake Michigan. For this reason, sampling periods are restricted to these months.

events and multiplied by average intake flow for the period. Sampling period-specific average flow was calculated using the average daily flows from 2015 through 2019.

11.2.1.4 Retrofit to Closed-cycle Cooling

Retrofitting PBNP with closed-cycle cooling is estimated to result in a 95.5 percent reduction in cooling water withdrawal (see Table 10-7 and calculations in Appendix 12-H) which will result in a commensurate reduction in entrainment during the recruitment season.

11.2.1.5 Estimating Efficacy of FMS

The addition of FMS at PBNP is assumed to reduce entrainment based on the rate of live return of those organisms excluded by the FMS. Therefore, to determine the benefits of the addition of FMS at PBNP, exclusion efficiencies and survival off the screens were applied to the estimated entrainment numbers (Figure 11-1).

Exclusion efficiencies ($\bar{E}$) were estimated based on site-specific measurements, when possible, of entrained organisms from Point Beach and using regression equations for length versus depth (Table 11-1). Where site specific measurements weren't available (mainly eggs) literature data or surrogate data for similar species were substituted. Larvae head capsule depth (HCD) and egg diameter were used to determine exclusion rates, if the HCD/egg diameter of an entrained organism was estimated to be greater than the mesh size, the organism was assumed to be excluded by the screen. While these organism dimensions have been found to be predictive of the rate of exclusion relative to mesh size, it is acknowledged that such an approach may over-predict exclusion rates when compared to empirical data due to factors such as areas in the screens that allow organisms to pass through, through-screen velocity forcing organisms through mesh, and the orientation of the organism relative to the mesh opening.

Data on Entrainment Rates

Entrainment data is organized in the following array:

Taxa $_i$, *Lifestage* $_j$, *Total Length* $_k$, *Head Capsule Depth* $_l$, *Count* $_m$

Taxa is to the highest resolution presented in the entrainment database.
Lifestage includes egg, yolk-sac larvae, post-yolk-sac larvae, juvenile.
Length is total length as measured directly on a subset of lifestage/taxa during each sampling round.
Head Capsule Depth (HCD) is measured directly on a subset of the lifestage/taxa on each sampling event or is estimated based on length data from Phase II studies. Expressed at mm resolution. Egg diameter will be used for that *Lifestage*.
Count is number of entrained organisms in the class expressed on a DIF or AIF basis for the sampling period. *Count* is summed across sampling periods for each class. Separate summaries of Count are developed for the two years of available data.
Class is the group defined by a common *Taxa*, *Life Stage*, and *Total Length*.

All Organisms for which HCD < mesh size (0.5, 1.0, 2.0 mm) are entrained. Others are excluded.

Estimate of Excluded Population

Two estimates of annual number of excluded organisms (Σ *Count*$_E$) will be developed for each *Taxa* and *Lifestage* based on the two separate years of entrainment data. For each *Taxa* and *Lifestage*, the distribution of *Total Length* and *HCD* will be tabulated:

Taxa $_i$, *Lifestage* $_j$, *Total Length* $_k$, *Head Capsule Depth* $_l$, Σ *Count*$_{E\ m}$

While three mesh sizes are considered, 0.5 mm mesh will be used to estimate social benefits.

Estimate Live Return Frequency for Two Cases

Fine Mesh Panels on Traveling Screens with a Fish Return.

Based on the available literature, a *Live Return Frequency (LRF)* will be estimated for each class (*Taxa, Lifestage, Total Length*). This exercise will require application of best professional judgment due to the relatively small literature on organism survival post-exclusion. For example, surrogate species may be assigned to represent a entrained species that is not present in the literature. Observations made in the field and laboratory about the relative post-exclusion survival of certain lifestages and organism length will be applied. All assumptions will be documented for each class.

$$AELR = \Sigma\ Count_{E\ m} \times LRF_n$$

Taxa $_i$, *Lifestage* $_j$, *Total Length* $_k$, *Head Capsule Depth* $_l$, Σ *Count*$_{E\ m}$, *LRF* $_n$

Annual Estimated Live Return is Calculated

Annual Estimated Live Return (AELR) will be estimated for each *Class*.

Taxa $_i$, *Lifestage* $_j$, *Total Length* $_k$, *Head Capsule Depth* $_l$, Σ *Count*$_{E\ m}$, *LRF* $_n$, *AELR* $_o$

Two separate annual estimates of *AELR* will be developed for each *Class*.

Data Used to Estimate Production Foregone, etc.

Two annual estimate of *AELR* for each *Class* will be used in biological models allowing *Taxa* and *Lifestage* specific parameters within the models.

Figure 11-1. Calculation Methodology of FMS Benefits Summary

Table 11–1. Average FMS Exclusion Estimated for Species at PBNP

Species	Life Stage	No. Excluded >= 0.5 mm	No. Excluded >= 1.0 mm	No. Excluded > 2.0 mm	Total Taxa	Ratio Excluded >= 0.5 mm	Ratio Excluded >= 1.0 mm	Ratio Excluded > 2.0 mm
Alewife	Egg	34	34	0	34	1.00	1.00	0.00
Alewife	Juvenile	20	20	20	20	1.00	1.00	1.00
Alewife	PYSL	7	1	0	7	1.00	0.14	0.00
Alewife	Adult	1	1	1	1	1.00	1.00	1.00
Alosa sp.	Juvenile	2	2	2	2	1.00	1.00	1.00
Burbot	Juvenile	1	1	1	1	1.00	1.00	1.00
Burbot	YSL	15	0	0	15	1.00	0.00	0.00
Burbot	PYSL	1	1	0	1	1.00	1.00	0.00
Burbot	Larvae	use post yolk sac larvae						
Catostomidae	Egg	1	1	0	1	1.00	1.00	0.00
Clupeidae	Larvae	1	0	0	1	1.00	0.00	0.00
Common Carp	YSL	1	0	0	1	1.00	0.00	0.00
Coregoninae	YSL	2	2	0	2	1.00	1.00	0.00
Cyprinidae	Larvae	0	0	0	1	0.00	0.00	0.00
Cyprinidae	YSL	1	0	0	1	1.00	0.00	0.00
Lepomis sp.	PYSL	1	0	0	1	1.00	0.00	0.00
Rainbow Smelt	Juvenile	85	85	85	85	1.00	1.00	1.00
Rainbow Smelt	Larvae	3	3	3	3	1.00	1.00	1.00
Rainbow Smelt	PYSL	9	7	6	9	1.00	0.78	0.67
Rainbow Smelt	Adult	1	1	1	1	1.00	1.00	1.00
Round Goby	Adult	7	7	7	7	1.00	1.00	1.00

Round Goby	Juvenile	453	452	68	453	1.00	1.00	0.15
Sculpin sp.	Larvae	1	1	1	1	1.00	1.00	1.00
Sculpin sp.	PYSL	1	1	1	1	1.00	1.00	1.00
Slimy Sculpin	PYSL	2	2	0	2	1.00	1.00	0.00
Unid Stickleback	Larvae	1	1	1	1	1.00	1.00	1.00
Unid Stickleback	YSL	2	2	0	2	1.00	1.00	0.00
Unidentified	Egg	8	8	0	8	1.00	1.00	0.00
Unidentified	Larvae	4	3	0	4	1.00	0.75	0.00

Note: YSL = Yolk sac larvae, PYSL=Post yolk sac larvae

Source: EA, 2017.

ECT

To determine exclusion of ichthyoplankton for the three FMS sizes (i.e., 0.5 mm, 1.0 mm, and 2.0 mm), the number of individuals in a given taxa and life stage with an HCD estimated to be greater than a mesh size was calculated:

$$E_{FMS} = \frac{n_{FMS}}{n_t}$$

Where E_{FMS} is the proportion of excluded individuals at a given taxa/life stage group and FMS size, n_{FMS} is the number of organisms of that taxa/life stage group with a HCD greater than the given FMS size, and n_t is the total number of individuals in that taxa/life stage group. For each mesh size, this rate of exclusion for each taxa/life stage group was then applied to each taxa and life stage, to calculate the total number of each taxa/ life stage group excluded.

Rates of live return for taxa and life stage were taken from two studies at Prairie Island Nuclear Generating Plant on the Mississippi River in Minnesota and one at Somerset Station on Lake Ontario in Somerset, New York. In the studies at Prairie Island Nuclear Generating Plant, samples were collected off 0.5 mm mesh nylon vertical traveling screens. For the main study used to estimate post-exclusion survival (Kuhl and Mueller 1998), survival was estimated at three points in time: a) immediately after wash-off from the screen; b) following holding of the washed off organisms for a latency period (and therefore independent of the initial survival); and c) the product of the initial and latent survival rates referred to as the overall survival rate. Initial and latent survival varied within those categories and between them for the various taxa and life stages. The second Prairie Island study used for survival rates (Giese and Mueller 2002) reported only the initial survival rate. The third study was conducted at Somerset Station and included survival rates of fish impinged on 1-mm mesh Ristroph-type traveling screens and also included estimates of latent survival (McLaren and Tuttle, 2000). Where latent survival was available it was prioritized for use in this analysis.

While the available data from the literature included most of the organisms entrained at PBNP, surrogates were used to ensure that in no case was any entrained organism excluded from the analysis. Surrogate species were species in the documents that were the same genus or family and/or had other similar, relevant characteristics such as body type, etc. If a life stage for an

entrained taxon was listed as "larvae"[90], post yolk-sac larvae survival rates were used for the survival rate. Life stages for invertebrates were not recorded in the data. Due to the short life cycles of the majority of entrainment, it was assumed they were all adults. Similarly, there were instances where a Group/Surrogate contained survival for one larvae type and not the other. In those cases, the available survival rate was applied to both. Survival data from the literature were chosen for use in this analysis based on availability, similarity of facility, and relative location. Additionally, the rates of live return for fish eggs and Gammarids were conservatively assumed to be 100 percent due to lack of available data in the literature.

Survival data from the literature are summarized in Table 11-2. Rates of exclusion and survival were calculated by taxa (i) and life stage (j), when possible. The combined taxa and life stage is referred to a Class (k).

The rate of survival (Survival) of otherwise entrainable organisms is the product of their rate of exclusion for the class and the live return frequency by class:

$$Survival_k = \bar{E}_k \times LRF_k$$

The reduction in EM (annual estimated live return number per year) with the application of the FMS[91] was calculated by the product of the rate of Survival for the class and the sum of the product of the density of individuals in the class (Density) during the sampling period (l) and the AIF for the period:

$$Annual\ estimated\ live\ return_k = Survival_k \times \sum Density_{kl} \times AIF_l$$

The exclusion rate and average survival rates for the taxa/life stage pairs and, when necessary, their surrogates, are illustrated in Table 11-3.

[90] The "larvae" designation was used by the firm conducting the identification and enumeration (EA), for those life stages that were not easily identifiable as "yolk-sac" or "post yolk-sac" larvae. Therefore, by using the post yolk-sac survival rates, which tend to be higher than other life stages, we are erring on a conservative estimate of survival.

[91] Referred to in Figure 11-1 as the annual estimated live return.

Table 11–2. Survival of Organisms Excluded on FMS – Literature Values

Taxa	Life Stage	Surrogate Used	Survival Rate
Alewife	Egg	Assumption	100.0%
Alewife	Juvenile	Gizzard shad	2.3%
Alewife	Post yolk sac	Gizzard shad	0.1%
Alewife	Adult	Gizzard shad	2.3%
Alosa sp.	Juvenile	Gizzard shad	2.3%
Burbot	Juvenile	Burbot	14.3%
Burbot	Yolk sac	Burbot	14.3%
Burbot	Larvae	Burbot	14.3%
Burbot	Post yolk sac	Burbot	14.3%
Catostomidae	Egg	Assumption	100.0%
Clupeidae	Larvae	Gizzard shad	0.1%
Common Carp	Yolk sac	Carp	23.7%
Coregoninae	Yolk sac	Salmonids	42.4%
Cyprinidae	Larvae	Cyprinidae	1.5%
Cyprinidae	Yolk sac	Cyprinidae	0.1%
Lepomis sp.	Post yolk sac	Lepomis	1.0%
Rainbow Smelt	Adult	Rainbow smelt	29.7%
Rainbow Smelt	Juvenile	Rainbow smelt	29.7%
Rainbow Smelt	Larvae	Rainbow smelt	29.7%
Rainbow Smelt	Post yolk sac	Rainbow smelt	29.7%
Round Goby	Adult	Cyprinidae	38.1%
Round Goby	Juvenile	Cyprinidae	46.1%
Sculpin sp.	Larvae	Sculpins	67.9%
Sculpin sp.	Post yolk sac	Sculpins	67.9%
Slimy Sculpin	Post yolk sac	Sculpins	67.9%
Unid Stickleback	Larvae	Cyprinidae	1.5%
Unid Stickleback	Yolk sac	Cyprinidae	0.1%
Unidentified	Egg	Assumption	100.0%
Unidentified	Larvae	Unidentified (mean all)	7.1%
Gammarids	Adult	Assumption	100.0%

Source: Giese & Mueller 2002, Kuhl & Mueller 1988, McLaren & Tuttle, 2000.

Table 11–3. Summary of Estimated Rate of Live Return Used in the Assessment of Benefits of FMS at PBNP

Taxa	Life Stage	Rate of Live Return (0.5 mm mesh)
Alewife	Egg	100.0%
Alewife	Juvenile	2.3%
Alewife	Post yolk sac	0.1%
Alewife	Adult	2.3%
Alosa sp.	Juvenile	2.3%
Burbot	Juvenile	14.3%
Burbot	Yolk sac	14.3%
Burbot	Post yolk sac	14.3%
Burbot	Larvae	100.0%
Catostomidae	Egg	100.0%
Clupeidae	Larvae	0.1%
Common Carp	Yolk sac	23.7%
Coregoninae	Yolk sac	23.7%
Cyprinidae	Larvae	0.0%
Cyprinidae	Yolk sac	0.1%
Lepomis sp.	Post yolk sac	1.0%
Rainbow Smelt	Juvenile	29.7%
Rainbow Smelt	Larvae	29.7%
Rainbow Smelt	Post yolk sac	29.7%
Rainbow Smelt	Adult	29.7%
Round Goby	Adult	38.1%
Round Goby	Juvenile	46.1%
Sculpin sp.	Larvae	67.9%
Sculpin sp.	Post yolk sac	67.9%
Slimy Sculpin	Post yolk sac	67.9%
Unid Stickleback	Larvae	1.5%
Unid Stickleback	Yolk sac	0.1%
Unidentified	Egg	100.0%
Unidentified	Larvae	7.1%
Gammarids	Adult	100.0%

Source: ECT, 2020.

11.2.2 Basis for Estimates of Changes in Stock Size or Harvest Levels

To quantify the benefits to aquatic organisms of a technology for comparison between technologies, the annual entrainment losses of C/R taxa were converted to EAs using the forward projection approach (EPRI, 2012). The forward protection approach uses the life history parameters of the taxa (i.e., growth rate and rate of survival) to estimate the number of individuals of the taxa to survive to a specific age as well as their mass at that age. For C/R taxa, the age of equivalence is defined for each surrogate taxon as described in Table 11-4. Table 11-4 summarizes the life history parameters used in the models (Appendix 11-B).

Prior to calculating the EAs and production foregone, surrogates were assigned to individual taxa if and when life-history parameters were not available for that taxa. Surrogates were selected based on taxonomic characteristics as well as considerations such as commercial or recreational importance. Table 11-5 summarizes the application of surrogates. Where an ichthyoplankton taxon either wasn't assigned to a specific surrogate or was unknown, the category "fish", was used, and their annualized counts were applied to the identified surrogates based on the proportion of the surrogates to the total annualized count. Unknown life stage numbers were distributed in the same manner across the life stages of the candidate surrogates. The surrogate taxa Gammarids was used for all invertebrates due to the dominance of gammarids in invertebrate entrainment. Thus, all fish and shellfish entrained and impinged have been accounted for in the benefits analysis. Appendix 11-C includes a table of annualized entrainment counts of surrogates.

Foregone production of biomass for each sample year for each surrogate taxon was also calculated using Rago's (1984) model as described by EPRI (2012). The biomass of unknown taxa was accounted for through the dispersion of their counts across the other surrogate taxa as described previously.

Table 11-4. Biological Model Surrogate Taxa Life History Parameters

Taxa	Common Name	Status	Trophic Level	Lifestage	Total Stage Mortality (per stage)	Fishing Mortality (per stage)	Stage Duration (days)	% Mature	% Female	Fecundity (number per year)	Start Weight (gram)	References	Rationale for Age of Equivalence*
Alosa pseudoharengus	Alewife	Invasive/ Forage	3.4	Egg	0.36	-	6	0%	50%	-	3.00E-05	EPRI, 2012	Age when 50% mature.
				YSL	4.47	-	13	0%	50%	-	3.00E-05		
				PYSL	1.12	-	40	0%	50%	-	6.90E-04		
				Juvenile	4.04	-	306	0%	50%	-	6.60E-02		
				1	0.30	-	365	0%	50%	-	21		
				2	0.47	-	365	44%	50%	21,788	30		
				3	0.58	-	365	71%	50%	39,418	32		
				4	0.65	-	365	88%	50%	57,191	40		
				5	0.70	-	365	100%	50%	68,803	45		
				6	0.70	-	365	100%	50%	82,132	49		
				7	0.70	-	365	100%	50%	90,361	52		
				8	0.70	-	365	100%	50%	97,350	54		
Lepomis macrochirus	Bluegill	Forage	3.2	Egg	0.042	-	2	0%	50%	-	6.37E-04	EPRI, 2012; EPA 2006	Age when 100% mature
				Yolk sac larvae	0.168	-	8	0%	50%	-	6.37E-04		
				Post-yolk sac larvae	5.30	-	20	0%	50%	-	6.37E-04		
				Juvenile	4.24	-	335	0%	50%	-	0.012		
				1	1.2	-	365	0%	50%	-	5.2		
				2	1.2	-	365	100%	50%	80,000	35.0		
				3	1.2	-	365	100%	50%	80,000	87.3		
				4	1.2	-	365	100%	50%	80,000	150.0		
				5	1.2	-	365	100%	50%	80,000	212.9		
				6	1.2	-	365	100%	50%	80,000	270.1		
				7	1.2	-	365	100%	50%	80,000	319.1		
Lota lota	Burbot	Forage	3.8	Egg	0.96	-	40	0%	50%	-	2.00E-05	EPRI, 2012; EPA, 2002	Age when 100% mature
				YSL	1.92	-	5	0%	50%	-	2.00E-05		
				PYSL	2.81	-	30	0%	50%	-	2.00E-05		
				Juvenile	1.20	-	290	0%	50%	-	0.04		
				1	0.25	-	365	0%	50%	-	62		
				2	0.25	-	365	0%	50%	-	172		
				3	0.25	-	365	0%	50%	-	338		
				4	0.25	-	365	100%	50%	600,000	551		
				5	0.25	-	365	100%	50%	600,000	798		

Taxa	Common Name	Status	Trophic Level	Lifestage	Total Stage Mortality (per stage)	Fishing Mortality (per stage)	Stage Duration (days)	% Mature	% Female	Fecundity (number per year)	Start Weight (gram)	References	Rationale for Age of Equivalence*
				6	0.25	-	365	100%	50%	600,000	1068		
				7	0.25	-	365	100%	50%	600,000	1350		
				8	0.25	-	365	100%	50%	600,000	1635		
				9	0.25	-	365	100%	50%	600,000	1916		
				10	0.25	-	365	100%	50%	600,000	2187		
				11	0.25	-	365	100%	50%	600,000	2445		
				12	0.25	-	365	100%	50%	600,000	2688		
				13	0.25	-	365	100%	50%	600,000	2913		
				14	0.25	-	365	100%	50%	600,000	3122		
				15	0.25	-	365	100%	50%	600,000	3313		
				16	0.25	-	365	100%	50%	600,000	3487		
				17	0.25	-	365	100%	50%	600,000	3644		
				18	0.25	-	365	100%	50%	600,000	3786		
				19	0.25	-	365	100%	50%	600,000	3914		
				20	0.25	-	365	100%	50%	600,000	4029		

Table 11–4. Biological Model Surrogate Taxa Life History Parameters (Continued, Page 2 of 3)

Taxa	Common Name	Status	Trophic Level	Lifestage	Total Stage Mortality (per stage)	Fishing Mortality (per stage)	Stage Duration (days)	% Mature	% Female	Fecundity (number per year)	Start Weight (gram)	References	Rationale for Age of Equivalence[a]
Ameiurus nebulosus	Brown Bullhead	Recreational	3.7	Egg	1.10	-	8	0%	50%	-	1.82E-03	EPRI, 2012; EPA 2006	Age when 50% mature and begin reproducing.
				YSL	1.24	-	9	0%	50%	-	1.82E-03		
				PYSL	1.93	-	14	0%	50%	-	1.82E-03		
				Juvenile	2.85	-	334	0%	50%	-	0.05		
				1	0.60	-	365	0%	50%	-	53		
				2	0.70	0.11	365	50%	50%	3,247	160		
				3	0.80	0.22	365	100%	50%	3,247	272		
				4	0.80	0.22	365	100%	50%	3,247	363		
				5	0.80	0.22	365	100%	50%	3,247	429		
				6	0.80	0.22	365	100%	50%	3,247	475		
				7	0.80	0.22	365	100%	50%	3,247	505		
Cyprinus carpio	Common Carp	Recreational	3.1	Egg	3.6	-	7	0%	50%	-	6.49E-05	EPA, 2002	Age of highest fishing mortality
				YSL	3.2	-	7	0%	50%	-	3.05E-03		
				PYSL	2.64	-	7	0%	50%	-	4.20E-03		
				Juvenile	3.96	-	344	0%	50%	-	5.35E-03		
				1	1.20	0.60	365	50%	50%	36,000	10		
				2	0.34	0.17	365	100%	50%	171,750	358		
				3	0.34	0.17	365	100%	50%	307,500	549		
				4	0.34	0.17	365	100%	50%	443,250	821		
				5	0.34	0.17	365	100%	50%	579,000	2327		
				6	0.34	0.17	365	100%	50%	714,750	2504		
				7	0.34	0.17	365	100%	50%	850,500	2640		
				8	0.34	0.17	365	100%	50%	986,250	3066		
				9	0.34	0.17	365	100%	50%	1,122,000	3706		
				10	0.34	0.17	365	100%	50%	1,257,750	3878		
				11	0.34	0.17	365	100%	50%	1,393,500	4055		
				12	0.34	0.17	365	100%	50%	1,529,250	4427		
				13	0.34	0.17	365	100%	50%	1,665,000	4627		
				14	0.34	0.17	365	100%	50%	1,800,750	4808		
				15	0.34	0.17	365	100%	50%	1,936,500	5035		
				16	0.34	0.17	365	100%	50%	2,072,250	5216		
				17	0.34	0.17	365	100%	50%	2,208,000	5398		

Taxa	Common Name	Status	Trophic Level	Lifestage	Total Stage Mortality (per stage)	Fishing Mortality (per stage)	Stage Duration (days)	% Mature	% Female	Fecundity (number per year)	Start Weight (gram)	References	Rationale for Age of Equivalence*
Dorosoma cepedianum	Gizzard Shad	Forage	2.4	Eggs	0.895	-	2	0%	50%	-	5.68E-05	EPRI, 2012; EPA 2006	Age when 50% are mature and begin reproducing.
				Larvae	6,447	-	27	0%	50%	-	5.68E-05		
				Juveniles	4,447	-	336	0%	50%	-	0.1		
				1	0.9	-	365	50%	50%	59,482	21		
				2	0.9	-	365	100%	50%	341,997	110		
				3	0.9	-	365	100%	50%	341,997	227		
				4	0.9	-	365	100%	50%	341,997	319		
				5	0.9	-	365	100%	50%	341,997	409		
				6	0.9	-	365	100%	50%	341,997	409		
				7	0.9	-	365	100%	50%	341,997	409		

Table 11–4. Biological Model Surrogate Taxa Life History Parameters (Continued, Page 3 of 3)

Taxa	Common Name	Status	Trophic Level	Lifestage	Total Stage Mortality (per stage)	Fishing Mortality (per stage)	Stage Duration (days)	% Mature	% Female	Fecundity (number per year)	Start Weight (gram)	References	Rationale for Age of Equivalence*
Coregonus clupeaformis	Lake Whitefish	Commercial/ Recreational	3.2	Eggs	5.20	-	120	0%	50%	-	4.00E-03	EPRI, 2012; EPA 2002	Age when fishing mortality begins
				Larvae	0.74	-	45	0%	50%	-	4.00E-03		
				Juveniles	2.64	-	200	0%	50%	-	0.05		
				1	0.45	-	365	0%	50%	-	24		
				2	0.45	-	365	0%	50%	-	154		
				3	0.45	-	365	0%	50%	-	399		
				4	0.68	0.23	365	50%	50%	67,892	717		
				5	0.90	0.45	365	100%	50%	67,892	1061		
				6	0.90	0.45	365	100%	50%	67,892	1398		
				7	0.90	0.45	365	100%	50%	67,892	1707		
				8	0.90	0.45	365	100%	50%	67,892	1978		
				9	0.90	0.45	365	100%	50%	67,892	2208		
				10	0.90	0.45	365	100%	50%	67,892	2399		
				11	0.90	0.45	365	100%	50%	67,892	2556		
				12	0.90	0.45	365	100%	50%	67,892	2683		
Osmerus mordax	Rainbow Smelt	Commercial/ Recreational	3	Egg	4.60	-	20	0%	50%	-	8.63E-04	EPRI, 2012; EPA 2006	Age when 100% mature
				Larvae	3.06	-	90	0%	50%	-	8.63E-04		
				Juvenile	3.24	-	255	0%	50%	-	5.98E-02		
				1	1.00	-	365	0%	50%	-	1.4		
				2	1.00	0.02	365	100%	50%	26,594	17		
				3	1.00	0.03	365	100%	50%	26,594	24		
				4	1.00	0.03	365	100%	50%	26,594	55		
				5	1.00	0.03	365	100%	50%	26,594	69		
				6	1.00	0.03	365	100%	50%	26,594	86		
				7	1.00	0.03	365	100%	50%	26,594	153		
Neogobius melanostomus	Round Goby	Forage	3.3	Egg	0.09	-	5	0%	50%	-	1.00E-04	EPRI, 2012	Age when 100% mature
				Larvae	0.54	-	31	0%	50%	-	1.00E-04		
				Juveniles	5.74	-	329	0%	50%	-	0.009		
				1	1.93	-	365	100%	50%	750	4		
				2	1.93	-	365	100%	50%	750	7		
				3	1.93	-	365	100%	50%	750	11		
				4	1.97	-	365	100%	50%	750	17		

Taxa	Common Name	Status	Trophic Level	Lifestage	Total Stage Mortality (per stage)	Fishing Mortality (per stage)	Stage Duration (days)	% Mature	% Female	Fecundity (number per year)	Start Weight (gram)	References	Rationale for Age of Equivalence*
Cottus cognatus	Slimy Sculpin	Forage	3.4	Egg	0.23	-	28	0%	50%	-	1.80E-03	EPRI, 2012; EPA 2006	Age when 100% mature
				Larvae/Juvenile	2.82	-	337	0%	50%	-	1.80E-03		
				1	1.25	-	365	0%	50%	106	0.5		
				2	1.25	0.40	365	100%	50%	106	2		
				3	1.25	0.80	365	100%	50%	106	5		
				4	1.25	0.80	365	100%	50%	106	10		
				5	1.25	0.80	365	100%	50%	106	16		
Gasterosteus aculeatus	Threespine Stickleback	Forage	3.3	Egg	0.37	-	10	0%	50%	0%	1.80E-03	EPRI, 2012; EPA 2006	Age when 100% mature
				Larvae	1.46	-	40	0%	50%	-	1.80E-03		
				Juvenile	3.14	-	315	0%	50%	-	4.65E-02		
				1	0.28	-	365	100%	50%	249	1.20		
				2	0.28	-	365	100%	50%	249	2.34		
				3	0.28	-	365	100%	50%	249	4.26		

Taxa	Common Name	Status	Trophic Level	Lifestage	Total Stage Mortality (per stage)	Fishing Mortality (per stage)	Stage Duration (days)	% Mature	% Female	Fecundity (number per year)	Start Weight (gram)	References	Rationale for Age of Equivalence*
Oncorhynchus tshawytscha	Chinook Salmon	Recreational/ Stocked	4.4	Egg	1.41	-	60	0%	50%	-	1.09E-02	Rutherford, 1997; Tsehaye *et al.*, 2014; EPA 2006; Breck, 2020.	Age when 50% are mature and begin reproducing.
				Larvae	6.08	-	337	0%	50%	-	5.31E+00		
				Juvenile	0.19	-	365	0%	50%	-	7.40E+02		
				1	0.12	0.03	365	0%	50%	-	740.0		
				2	0.33	0.15	365	50%	50%	5,615	1870		
				3	0.99	0.35	365	100%	50%	5,615	3730		
				4	0.99	0.35	365	100%	50%	5,615	5710		
				5	0.99	0.35	365	100%	50%	5,615	7690		
Gammarus spp.	Gammarids	Forage	2.6	Eggs/Larvae/Juvenile	2.58	-	55	0%	50%	-	1.00E-08	Benson et al., 2020; Crosier. *et al.*, 2020; Kley and Maier, 2006.	Age when 100% mature.
				Adult	4.64	-	310	100%	66%	20	0.02		
Crayfish	Crayfish	Forage	3	Eggs	3.57	-	1.5	0%	50%	—	7.60E-06	EPRI, 2012; Birkley and Gulliksen, 2003; EPA, 2002. * adapted from brown, pink and white shrimp.	Age when 100% mature.
				Prolarvae	1.89	-	9.5	0%	50%	—	5.70E-05		
				Postlarvae	1.89	-	15	0%	50%	—	8.00E-04		
				Juvenile	1.74	-	56	0%	50%	—	0.0053		
				Pre-adult	3.88	3.50	125	0%	50%	—	2.50		
				Adults	0.16	0.14	323	100%	50%	3,571,429	6.60		

*Gray shading indicates EA age used in the models.

Sources: EPRI, 2012.
EPA, 2002.
FishBase, 2020.
ECT, 2020.

Table 11–5. Modeling Surrogate Taxa

Surrogate*	Scientific Name	Common Name
Alewife	*Alosa pseudoharengus*	Alewife
	Alosa spp.	Unidentified Alosa (IM only)
Bluegill	*Lepomis* spp.	Unidentified Lepomis
	Lepomis cyanellus	Green Sunfish (IM only)
	Lepomis gibbosus	Pumpkinseed (IM only)
Burbot	*Lota lota*	Burbot
Brown Bullhead	Catostomidae	Suckers
	Ameiurus melas	Black Bullhead (IM only)
	Ictalurus punctatus	Channel Catfish (IM only)
	Catostomus catostomus	Longnose Sucker (IM only)
	Catostomus commersonii	White Sucker (IM only)
Common Carp	*Cyprinus carpio*	Common Carp
	Cyprinidae	Minnows and Carps
Gizzard Shad	Clupeidae	Herring and Shad
	Dorosoma cepedianum	Gizzard Shad (IM only)
Lake Whitefish	Coregonidae	Freshwater whitefish
	Coregonus clupeaformis	Lake Whitefish (IM only)
	Prosopium cylindraceum	Round Whitefish (IM only)
Rainbow Smelt	*Osmerus mordax*	Rainbow Smelt
Round Goby	*Neogobius melanostomus*	Round Goby
Slimy Sculpin	Cottidae	Sculpin
	Cottus cognatus	Slimy Sculpin
	Myoxocephalus thompsonii	Deepwater Sculpin (IM only)
	Cottus bairdii	Mottled Sculpin (IM only)
	Cottus spp.	Unidentified Cottus (IM only)
Threespine Stickleback	Gasterosteidae	Stickleback
	Culaea inconstans	Brook Stickleback (IM only)
	Pungitius pungitius	Ninespine Stickleback (IM only)
	Gasterosteus aculeatus	Threespine Stickleback (IM only)
Fish	Unidentified	Unidentified
	Pomoxis nigromaculatus	Black Crappie (IM only)

Surrogate*	Scientific Name	Common Name
	Coregonus hoyi	Bloater (IM only)
	Salmo trutta	Brown Trout (IM only)
	Umbra limi	Central Mudminnow (IM only)
	Oncorhynchus tshawytscha	Chinook Salmon (IM only)
	Oncorhynchus kisutch	Coho Salmon (IM only)
	Luxilus cornutus	Common Shiner (IM only)
	Notropis atherinoides	Emerald Shiner (IM only)
	Pimephales promelas	Fathead Minnow (IM only)
	Aplodinotus grunniens	Freshwater Drum (IM only)
	Notemigonus crysoleucas	Golden Shiner (IM only)
	Acipenser fulvescens	Lake Sturgeon (IM only)
	Salvelinus namaycush	Lake Trout (IM only)
	Rhinichthys cataractae	Longnose Dace (IM only)
	Micropterus dolomieu	Smallmouth Bass (IM only)
	Notropis hudsonius	Spottail Shiner (IM only)
	Percopsis omiscomaycus	Trout-Perch (IM only)
	Morone americana	White Perch (IM only)
	Perca flavescens	Yellow Perch (IM only)
Gammarids	*Echinogammarus ischnus*	Scud
	Gammaridae	Scuds
	Gammarus sp.	Scuds
	Hemimysis anomala	bloody red shrimp (invasive)
	Hyalella azteca	a scud
	Mysis diluviana	opossum shrimp
Crayfish	*Faxonius propinquus*	Northern clearwater crayfish (IM only)

*Surrogates were selected based on both taxonomic characteristics as well as considerations for forage, commercial, or recreational importance.

Source: ECT, 2020.

The life history parameters used in the EA model and production foregone models were largely based on parameters presented in EPRI (2012). However, because of errors observed for some

models, rebalancing[92] of the parameters was needed in some cases. In addition, some species were not covered adequately by EPRI (2012) (i.e., Chinook Salmon, Gammarids), so life history parameters were provided by other sources and, when necessary, balanced appropriately. Life history parameters do not assume any density dependence. Thus, as the population increases, it is able to do so unhindered by the number of individuals in the population. Similarly, if the populations' sizes are below the system's capacity, the rate of survival and recruitment does not exhibit "compensation" to exploit that capacity. This is clearly not how ecosystems function; however, it provides a method of accounting for changes in populations that is useful for this type of assessment and supported by EPA (2002).

To analyze the benefit of each proposed technology carried forward from Section 10.0, the total benefit that would be observed if there were no entrainment at PBNP was calculated (without-entrainment). In this case, benefit is defined as the addition of C/R taxa that would occur because of the complete survival of the entrained and impinged fish and shellfish at PBNP.

The first step was to transfer the kilograms of production foregone of forage fish and shellfish surrogate taxa to the C/R taxa that occur within Lake Michigan. For entrainment, Chinook Salmon was chosen as the taxa of finfish to model as benefiting from the increased forage based on many factors including the high trophic level, availability of life history information, and the presence of a C/R fishery within Lake Michigan. While Chinook Salmon is not entrained at PBNP, it is found in impingement and is an important component of the recreational fishery within Lake Michigan (WDNR, 2017). Chinook Salmon are not native in Lake Michigan but have been introduced as a sport fish. The salmon population in Lake Michigan is maintained by extensive stocking of fingerlings, although WDNR has recorded some natural reproduction in tributaries. Chinook Salmon feeds heavily on Alewife. While Chinook Salmon were not found in entrainment samples, many of the important forage fish that this species relies on were. While applying the foregone biomass to one taxon is not realistic, as there are many consumers within Lake Michigan (i.e., burbot, trout, salmon, bass, walleye, etc. [NOAA, 2020]), it provides a

[92] Life history parameters are called balanced when the modeled population replaces itself from generation to generation. Checking for balance and providing adjustments in the parameters to achieve balance is performed using solvers in Excel®.

simple method of accounting that allows for comparisons between technologies and provides a method of incorporating the forage base into the C/R harvest analysis (see also Section 11.5).

The conversion of forage biomass as production foregone to Chinook Salmon was conducted using a trophic transfer model. Table 11-4 provides the trophic level of each surrogate taxa modelled. For a transfer between trophic levels differing by less than or equal to one full trophic level, a 10-percent transfer efficiency was used (EPA, 2002; May, 1976; Pauly and Christensen, 1995). For a transfer between trophic levels greater than one, trophic transfer coefficient (TT) was calculated as follows (Lindeman, 1942):

$$TT_{i,j} = 10^{TL_j - TL_i}$$

where: $TT_{i,j}$ = aggregate trophic transfer coefficient from forage taxa j, to Chinook Salmon.
TL_j = trophic level of the forage taxa j.
TL_i = trophic level of Chinook Salmon.

The trophic transfer model is one widely used to model the transfer of energy within food webs due to its simplicity and applicability to many systems (Pauly and Christensen, 1995). Trophic levels for different taxa were obtained from FishBase (2020).

The biomass that was transferred to Chinook Salmon via the trophic transfer described previously was converted into EAs by dividing the biomass by the average weight of an age 2 (age fully exploited in fishery) Chinook Salmon (Table 11-4).

The total number of EAs (from production foregone of forage taxa plus direct entrainment) were then used to calculate the loss of biomass to the fishery of all C/R taxa considered (Brown Bullhead, Common Carp, Lake Whitefish, Bluegill, Rainbow Smelt, and Slimy Sculpin) because of entrainment using the Equivalent Yield Model (EPRI, 2012) to provide the benefit to the fishery as kilograms of C/R catch. Biomass is representative of the whole fish.

To determine how the changes in annual entrainment as a result of the proposed technology would affect the C/R fisheries of Lake Michigan, the annual benefits were projected over the life

of the potential technology at the facility (Table 11-6). Regardless of technology, the plant is assumed to be decommissioned at the end of 2053.

Table 11–6. Years of Projection for Each Technology Considered

Technology	Without Entrainment	Closed-cycle Cooling	FMS
Start year	2027	2027	2028
End year	2053	2053	2053

Note: Unit 1 retirement estimated in 2050 and Unit 2 in 2053. To simplify the analysis and to be conservative 2053 was used.
Source: ECT, 2020.

To simulate how the benefits would change over the life of the plant, dynamic Leslie matrix (Leslie, 1945) models are populated with survival rates and weights at age from Table 11-4 and simulated forward until they reach the estimates of EAs:

- For entrained taxa, in the year the technology comes online, there is typically no benefit observed, because entrainment typically occurs before the age of equivalence.
- The following year, each life stage is "grown" up (using the survival parameters from Table 11-4). Only those life stages that have reached the age of equivalence are counted.
- For subsequent years, as each life stage "grows" up to the age of equivalence, their numbers are added to the benefits.
- Once each age has hit their maximum age, they begin to die-off and thus hit a steady state of EAs, in which the rate of organisms attaining EA and those subject to mortality are equal. This steady state is the calculated total yearly EA from the models.
- When PBNP is assumed to be decommissioned (2053), the maximum age EA counts decay via the survival parameter for the EA of that taxa.

The same was also done for projecting the change in forage biomass as production foregone except instead of EA (counts), the production foregone (kg) was used which also includes the biomass of organisms entrained.

These projected annual EAs and production foregone underwent the same procedure as described previously to convert counts of individual organisms to biomass of C/R taxa considered.

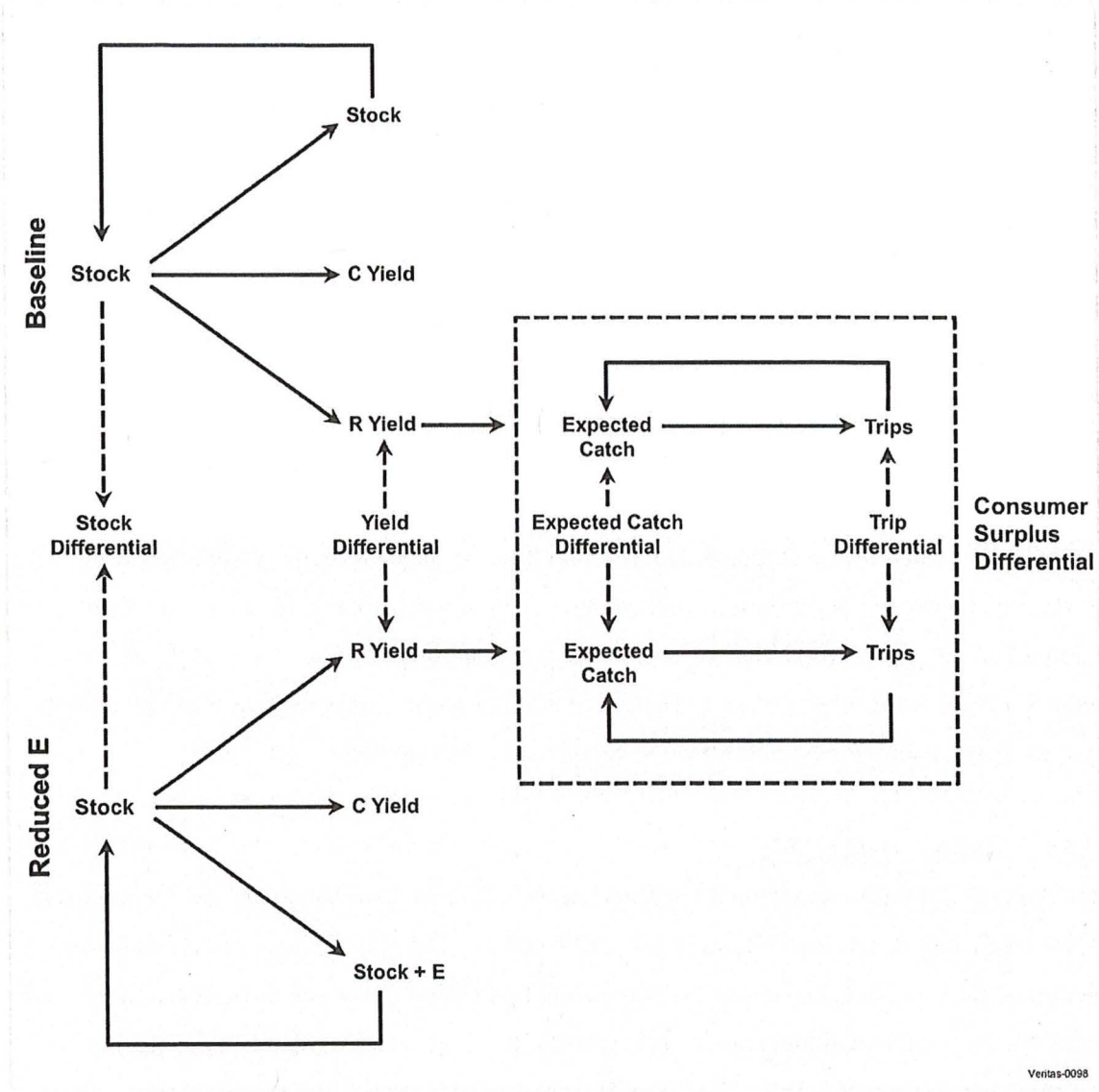
11.2.3 Basis for Monetized Values Assigned to Changes in Stock Size or Harvest Levels

Estimating the benefits of entrainment reductions requires assessing the relationship between entrainment, its corresponding changes to the relevant fishery, and the social impact of any fishery changes. The methodology uses a resource-economic simulation to evaluate the effects entrainment has on C/R fisheries and is described in Appendix 11-B: Entrainment Reduction Benefits Study: Point Beach Nuclear Plant.

The methodology extends the most relevant fishery and resource-economic studies published in the peer-reviewed literature. Important modeling features include linking yield equivalence, expected catch, and choice-based behavioral fishing models and are used to simulate conditions under with-entrainment (utilizing conditions observed in sample Year 1 and sample Year 2) and reduced-entrainment conditions, and the differences between these two conditions determine the benefits of entrainment reductions.

Figure 11-2 provides an overview of the methodology for evaluating the economic benefits of reducing entrainment at PBNP. The shading in the bottom portion of the figure denotes the evaluation is separated into two parts: with-entrainment (top white portion) and reduced-entrainment (bottom shaded portion). The calculated difference in recreational and commercial yield, catch rates, trips, angler welfare, and commercial profits represent the benefits of entrainment reductions. As the top portion of the figure shows, the approach begins by specifying the with-entrainment yield for each evaluated species and dividing that into recreational (R) and commercial yield (C). The model then relates that yield to expected catch rates for the affected water body under with-entrainment conditions

Figure 11-2. Overview of Methodology for Estimating the Benefits of Entrainment Reductions



Source: Veritas, 2020.

(for brevity, the figure illustrates this process for estimating recreational fishing benefits). Those catch rates are apportioned over the estimated number of trips occurring at affected sites.

Under reduced-entrainment conditions, reduction in entrainment and the change in C/R yield that would accompany the entrainment reduction are identified. The new recreational yield is incorporated into changes in expected catch rates, and the corresponding changes in trips that would accompany increased catch rates are estimated. To calculate recreational fishing benefits, the model evaluates the differences between the with-entrainment and reduced-entrainment conditions, including yield, expected catch, and trips. The box around the expected catch and trip differentials identifies these results in the recreational fishing benefits measured as the consumer surplus differential. Consumer surplus is the difference between what an angler has to pay for a fishing trip and what the angler would be willing to pay.

Simulating the linked models produces equilibrium-based changes in stock, yield, trips, and expected catch under reduced-entrainment conditions. Equations from welfare and market-based economics are used to identify changes in consumer and producer surplus, which are then discounted to calculate present values. The following subsections provide additional detail on the recreational, commercial, and nonuse value components of the model.

11.2.3.1 Recreational Benefits

Lake Michigan provides recreational fisheries for residents and visitors with access for anglers at boat ramps, fishing piers, marinas, and many shore access points. Stock-level effects could be experienced as changes in catch rates by people hoping to catch the affected species in these waterways. Recreational anglers modeled as potentially being affected include those fishing Lake Michigan, Green Bay, and Lake Winnebago and on other rivers and inland lakes in Wisconsin.

Appendix 11-B provides an in-depth description of the methodology used to estimate recreational benefits under with-entrainment and reduced-entrainment conditions.

11.2.3.2 Commercial Benefits

Commercial benefits from entrainment reductions accrue in the form of increased profits attributable to the higher catch per unit effort (CPUE) associated with increases in fish populations (thereby benefiting the commercial fishery) and/or in the form of lower prices (thereby benefiting the consumer). To assess the commercial fishing benefits, the methodology first characterizes the current market conditions that exist in the relevant vicinity of PBNP. The methodology characterizes the operation of that commercial fishery under the with-entrainment conditions and evaluates the commercial fishing market conditions. It then uses the information from changes in commercial yield to determine the effect on CPUE, market prices, producer surplus, and consumer surplus under reduced-entrainment conditions. Finally, the methodology estimates the difference in producer surplus and consumer surplus under the with- and reduced-entrainment conditions to determine the commercial fishing benefits.

Commercial fishers that were modeled as potentially being affected include those fishing the Wisconsin waters of Lake Michigan from Manitowoc County and neighboring counties. To assess the commercial fishing benefits, the analysis applies the price per pound from the NOAA Fisheries' data of annual landings in the Wisconsin waters of Lake Michigan to the changes in commercial yield estimated at PBNP. The change in commercial yield is multiplied by the change in price to estimate commercial fishing benefits.

A detailed description of the methodology used for determining commercial benefits is provided in Appendix 11-B.

11.2.3.3 Nonuse Benefits

The final category of benefits that could be monetized is nonuse benefits. Since the development of the 2004 version of the Final Rule, the EPA has used a number of different methods to measure the potential nonuse values associated with reductions in impingement and entrainment. These include techniques such as habitat replacement cost, societal revealed preference, and the Fisher–Raucher approximation. Most recently, as part of supporting the development of the 2014 version of the Final Rule, EPA administered a stated preference survey to develop the total values (use and nonuse) associated with the Final Rule. While the EPA developed econometric models of the survey data and estimated respondents' willingness to pay for alternative

impingement and entrainment reductions, they did not incorporate the results of the survey into the estimate of the Final Rule's benefits.

Regardless, states have issued suggestions for how the stated preference survey results can be used to inform site-specific benefit estimates (e.g., Wisconsin Department of Natural Resources [WDNR], 2016). Regulators have made suggestions in public meetings that benefit valuation studies should, in the least, identify the implications that the stated preference study results have for an individual site's nonuse benefit estimates, and peer reviewers have asked whether the results of the stated preference survey have been considered as part of the 316(b) benefits valuation study.

Given the survey's existence and these suggestions and questions from regulators and peer reviewers, a simulation model has been developed that uses the best available information from the EPA's stated preference survey and the literature to identify the implications of what the survey results imply for the potential nonuse benefits of 100-percent reduction in impingement and entrainment at PBNP.

Appendix 11-B provides a more detailed description of the steps taken to quantify nonuse benefits and the results of that quantification.

11.2.4 Discussion of Mitigation Efforts Made Prior to the Rule

The Final Rule requires a discussion of mitigation efforts completed prior to October 14, 2014. PBNP has achieved a substantial reduction in estimated entrainment and impingement relative to a facility of the same generating capacity with a shoreline intake due to several factors including the intake crib design, offshore intake, acoustic deterrent system optimized to deter alewife, and seasonal reductions in cooling water flow (described in Sections 5.3 and 6). No credit is considered for these prior measures in the monetization of social benefits of the entrainment technologies.

11.2.5 Discussion of Other Benefits, with Quantification and Monetization where Possible

The Final Rule at 40 CFR 122.21(r)(11)(v) calls for:

> *"Discussion, with quantification and monetization, where possible, of any other benefits expected to accrue to the environmental and local communities, including but not limited to improvements for mammals, birds, and other organisms and aquatic habitats;"*

This section addresses that requirement of the Final Rule beginning with a general review of the potential benefits of any reductions in entrainment and impingement.

11.2.5.1 General Considerations

Other benefits that may result from a reduction in entrainment and impingement include an indirect effect on birds and terrestrial species that might use Lake Michigan for habitat or food supply. However, due to the complex interactions in the ecology of the system, it is difficult to predict what kind of effect may occur. An ecosystem model was conducted for Barnegat Bay, New Jersey to quantify the potential effects of substantial reduction in water withdrawals by the Oyster Creek Generating Station. Results indicate that the changes in individual species abundance were small and the direction of the change varied. Some species that were directly affected by the intakes decreased with reduced withdrawals due to increased predation mortality (Vasslides *et al.*, 2016).

The fish community in particular in Lake Michigan has experienced wide fluctuations in abundance and community composition due to the introduction of invasive species, over-fishing, changes in habitat quality, and stocking and management of fisheries. Native Lake Trout populations experienced a precipitous decline in the 1950s due partly to overfishing and partly to predation by invasive Sea Lamprey. Invasive Alewife populations in the lake expanded without the top down predation pressures. With the implementation of control efforts of sea lamprey beginning in the 1960s opportunities to stock top predators in the lake arose and stocking of native Lake Trout along with non-native Chinook Salmon, Coho Salmon, Rainbow Trout and Brown Trout was implemented to create more opportunities for anglers (WDNR 2017). These changes along with the more recent bottom-up pressures from decreased primary production due to invasive dreissenid mussels (quagga mussels and zebra mussels) illustrate the complexity of the food web within Lake Michigan (WDNR, 2017; Madenjian *et al.*, 2015).

The area around PBNP is surrounded by farm fields with small patches of forest. Point Beach State Forest is located approximately 2 miles south of PBNP. Natural communities present on the state forest include Great Lakes Ridge and Swale, Great Lakes Beach, and Great Lakes Dune complexes and the forests are dominated by northern mesic forest and swamp conifer forest (WDNR, 2012).

Birds and other wildlife that could benefit from other cooling water technologies include those that eat fish, including many shore birds. For example, the population of mergansers (a fish-eating bird) may increase if (a) the availability of their food increases and (b) the merganser population is currently limited by food availability. Given the ecological mechanism thought to constrain many bird populations and the marginal nature of the predicted changes (Section 11.4), it is likely that bird or wildlife population levels would not change in any material sense as the result of alternative cooling water technologies at PBNP. Many bird populations, particularly species of waterfowl, are thought to be constrained by density dependence on their breeding grounds and not food availability alone (Gunnarrsson *et al.*, 2013).

11.2.5.2 Impacts to Federally-listed Species

No impacts to federally-listed species have been recorded as a result of the PBNP CWIS and no lake-dwelling species is federally-listed.

11.2.6 Discussion of Benefits from Reductions in Thermal Discharges, with Quantification and Monetization where Possible

The PBNP has two on-shore discharge structures that currently release a combined maximum of 770,000 gallons per minute (gpm) at a mean temperature increase of 13.5°C (24.3°F) above the intake water temperature at the maximum flow rate. Section 283.31 Wis. Stats. requires a Wisconsin Discharge Elimination System (WPDES) permit for the discharge of a pollutant from a point source into waters of the state. The term "pollutant" includes the addition of heat from a point source. Prior studies at PBNP have determined that the thermal discharge has not had an adverse effect on the aquatic community (WEPCO, 1976; EA, 2008). No substantial benefit would therefore be anticipated from a reduction in heat load in the discharge.

The thermal plume from PBNP may attract some fish species including alewife (EA, 2008) which in turn attract fishing birds such as bald eagles, pelicans, and seagulls. Reductions in thermal loading from the plant may reduce this attraction and in turn reduce the potential social benefits associated with these bird species.

11.3 Baseline Fishing Conditions

Existing fishing conditions are defined as the current conditions at PBNP, which include entrainment. The characterization of baseline fishing conditions considers recreational and commercial fishing, both current and into the future. To characterize existing fishing conditions, an assessment of current C/R yield with entrainment at PBNP, the number of C/R anglers potentially affected by the impact of entrainment at PBNP on C/R yield, the number of fishing trips the anglers take, the sites those anglers visit, and catch rates was completed.

Appendix 11-B provides a detailed description of how baseline fishing conditions, both recreational and commercial, are defined and estimated at PBNP.

11.4 Technology-specific Findings

This section presents the results of the benefits analysis for each technology considered. The without-entrainment condition is presented to estimate the benefits of a complete reduction in entrainment at PBNP. This scenario is presented to provide context for the benefits estimated for the other technologies being considered. Appendices 11-D, 11-E, and 11-F provide the detailed entrainment data for the baseline condition, closed-cycle cooling, and FMS, respectively.

11.4.1 Without-entrainment Condition

The without-entrainment condition is if PBNP were to shut down the cooling water intake completely. This case is considered as it provides a transparent illustration of the steps involved in the biological modeling and economic assessment without any complications introduced by the differential effectiveness of the entrainment technologies.

11.4.1.1 Changes in Fish and Shellfish

Table 11-7 summarizes the numbers of entrained organisms that would no longer be entrained in the without-entrainment condition (Table 11-7, Appendix 11-C).

Table 11–7. Annual Benefit as Reduction in Entrainment (Number) Resulting If PBNP Were to Shut Down the Cooling Water Intake

Type	Entrainment Sample Year	
	1	2
Fish	8,350,048	9,896,328
Shellfish	4,183,762,410	4,663,281,971
Total	4,192,112,458	4,673,178,299

Source: ECT, 2020.

The average annual entrainment losses of fish eggs are estimated at 425,000 eggs (575,000 in 2007 and 276,000 in 2017; Appendix 11-C). To put this in perspective, an average-sized female Lake Whitefish, a part of the C/R fishery within Lake Michigan, has an annual egg production rate of approximately 68,000 eggs (EPRI, 2012) and may spawn every year or every other year from age 4 to age 12. Even assuming that all of the entrained eggs are of this species the average entrainment of eggs at PBNP represents the annual egg production of only 6.25 female Lake Whitefish, a small fraction of the harvest and the local population. In reality, the set of eggs entrained at PBNP will represent a sample of the taxa reproducing in the vicinity, indicating that the losses are the production of a small number of adults of many species.

11.4.1.2 Changes in Stocks and Harvest

Table 11-8 provides the results of the estimation of benefits (as kilograms of C/R harvest returned to the fishery) if PBNP were to shut down (Appendix 11-C).

Figure 11-3 illustrates the estimated total (direct and indirect) recreational yield changes for recreational taxa (Bluegill, Brown Bullhead, Common Carp, Lake Whitefish, and Chinook Salmon) entrained at PBNP following complete elimination of entrainment at PBNP. The shape of the curves is a result of the methodology described in Section 11.2.2, which has the population

"growing up" from their respective life stages to the annual EAs and then decaying after decommissioning of the facility (2053) via the survival parameters presented in Table 11-5.

Figure 11-4 illustrates the estimated changes in kilograms of commercially harvested taxa (Lake Whitefish and Rainbow Smelt) in response to the elimination of entrainment at PBNP.

Table 11–8. Modelled Annual Benefits of Baseline Condition

Scientific Name	Common Name	Entrainment							
		Entrained Equivalent Adults (number)		Production Foregone (kg)		Direct Foregone Fishery Yield (kg)		Total Foregone Fishery Yield (kg)	
		Sample Years							
		1	2	1	2	1	2	1	2
Fish									
Alosa pseudoharengus	GL Alewife			6,821	9,489				
Lota lota	Burbot			253	5,041				
Ameiurus nebulosus	Brown Bullhead	191	92			50	24	50	24.1
Dorosoma cepedianum	Gizzard Shad			0.48	2				
Cyprinus carpio	Common Carp	19	-			138	-	138	-
Coregonus clupeaformis	Lake Whitefish	1,415	-			6,037	-	6,037	-
Lepomis macrochirus	Bluegill	2	-			1.00	-	1.00	-
Osmerus mordax	Rainbow Smelt	139,568	90,996			753	491	753	491
Neogobius melanostomus	Round Goby			-	657				
Cottus cognatus	Slimy Sculpin			59.16	-				
Gasterosteus aculeatus	Threespine Stickleback			23	-				
Production foregone of Chinook Salmon from fish								1,041	2,192
Fish Total		**141,196**	**91,088**	**7,156**	**15,189**	**6,979**	**515**	**8,020**	**27,072**
Percent reduction by technology		100%	100%	100%	100%	100%	100%	100%	100%
Shellfish									
Gammarus sp.	Gammarids	4,183,762,410	4,663,281,971	83,675	93,266	-	-	-	-

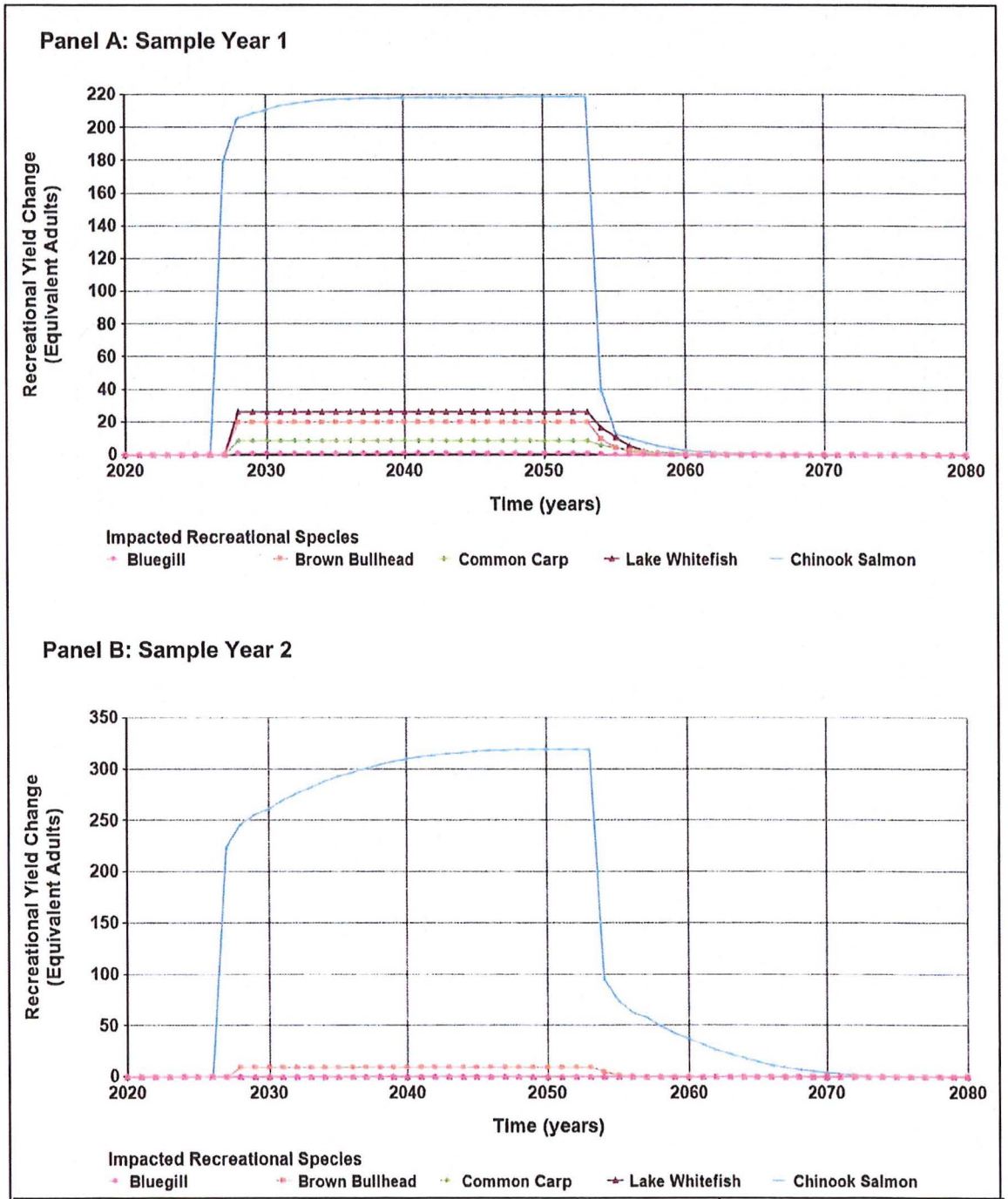
ECT

Scientific Name	Common Name	Entrainment							
		Entrained Equivalent Adults (number)		Production Foregone (kg)		Direct Foregone Fishery Yield (kg)		Total Foregone Fishery Yield (kg)	
		Sample Years							
		1	2	1	2	1	2	1	2
Production foregone of Chinook Salmon from shellfish								1,931	2,153
Shellfish Total		**4,183,762,410**	**4,663,281,971**	**83,675**	**93,266**	**-**	**-**	**1,931**	**2,153**
Percent reduction by technology		100%	100%	100%	100%	100%	100%	100%	100%
Annual Total		**4,183,903,607**	**4,673,373,059**	**90,831**	**108,454**	**6,979**	**515**	**9,951**	**4,860**
Percent reduction by technology		**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Note: Gray shading indicates C/R taxa.

Source: ECT, 2020.

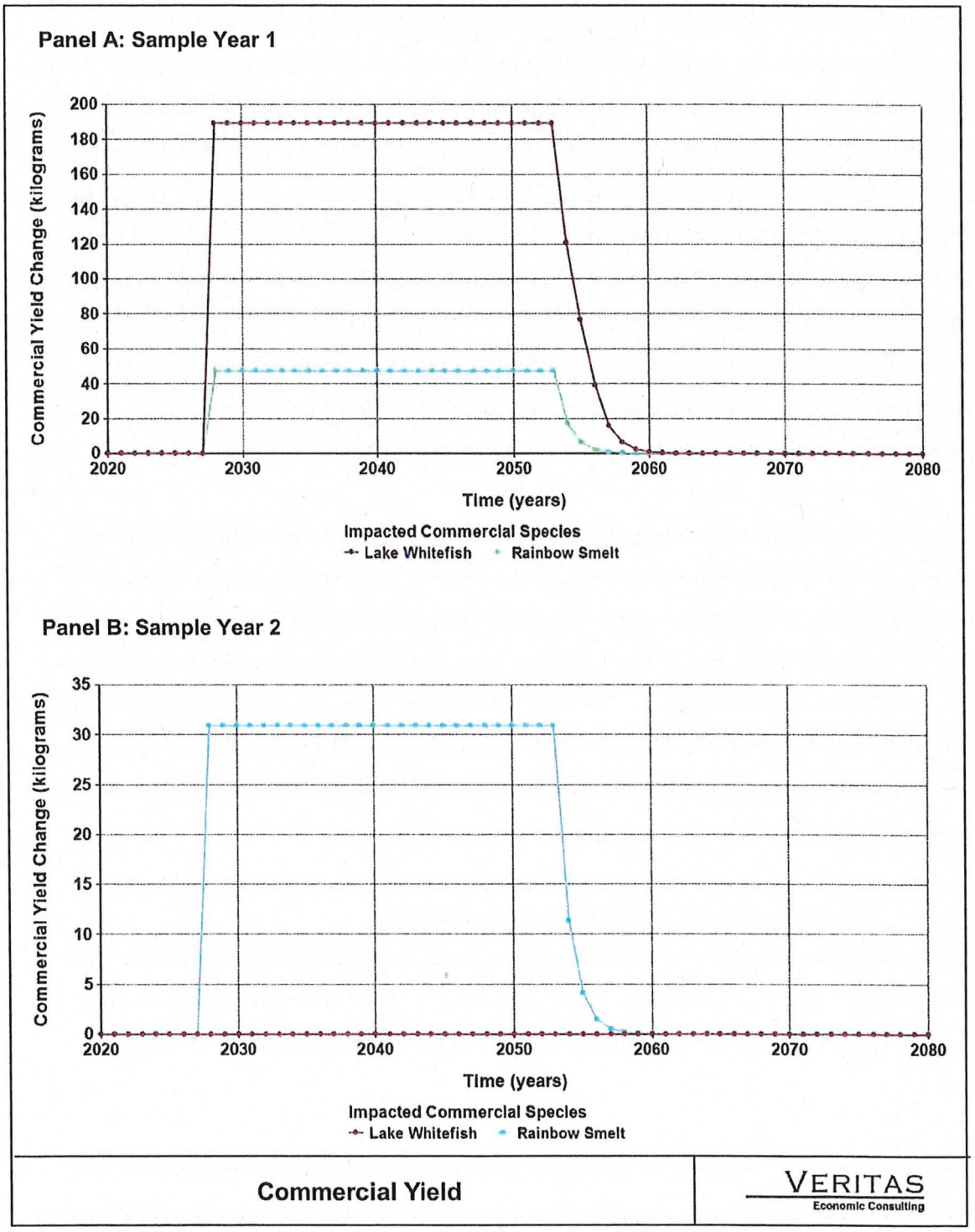
Figure 11-3. Total (Direct and Indirect) Changes in Recreational Yield



Recreational Yield

VERITAS
Economic Consulting

Figure 11-4. Total (Direct and Indirect) Changes in Commercial Yield



The average total annual foregone fishery yield is estimated as 7,406 kg (Table 11-8). This number represents the annual total loss of biomass from the C/R fisheries due to entrainment losses, both direct and production foregone from forage, from the operation of PBNP. This estimate is designed to be an overestimation of these losses by employing a number of modeling assumptions (i.e., entrainment results in 100-percent lethality, all entrainment losses affect C/R taxa and no others, and selection of various parameters to maximize the estimated effects on stocks). For perspective, the annual commercial finfish landings for the Wisconsin Great Lakes from 2015 through 2018 range from 1,107,000 to 1,369,000 kg, or an average of 1,227,000 kg. Thus, the foregone fishery yield because of the estimated entrainment rates at PBNP represents approximately 0.60 percent of the average (2015 to 2018) annual commercial yield of the Wisconsin Great Lakes. Direct losses of C/R fish represented the majority of total foregone fishery yield in year 1, whereas production foregone of Chinook Salmon from fish and shellfish represented the majority in year 2.

In addition to the estimated annual commercial harvest, the recreational landings in the Great Lakes in Wisconsin, although not specifically quantified at this level, are substantially higher than the commercial landings for many species including Chinook and Coho Salmon, Steelhead, Lake Trout, Brown Trout, Brook Trout, Yellow Perch, Bullheads, Largemouth Bass, Northern Pike, and Lake Sturgeon. Therefore, the estimated losses from PBNP are a very small fraction of the combined harvest from commercial and recreational fishing. From the observed species trends, it would appear the substantial fecundity of the species affected by entrainment losses at PBNP allows the populations to accommodate the ongoing losses.

11.4.1.3 Monetized Value of Changes in Stocks and Harvest

The benefits from a shutdown of the cooling water intake at PBNP would be experienced over the otherwise expected remaining life of the plant from the day it shut down. For modelling purposes, the year of shut down is defined as 2027 with the planned life of PBNP ending in 2053.

Benefits are assumed to commence on January 1 and end on December 31 for each year. No changes in entrainment density are expected to occur from one year to the next for each scenario

(i.e., the organism densities are assumed to be fixed according to the year that the entrainment characterization was performed).

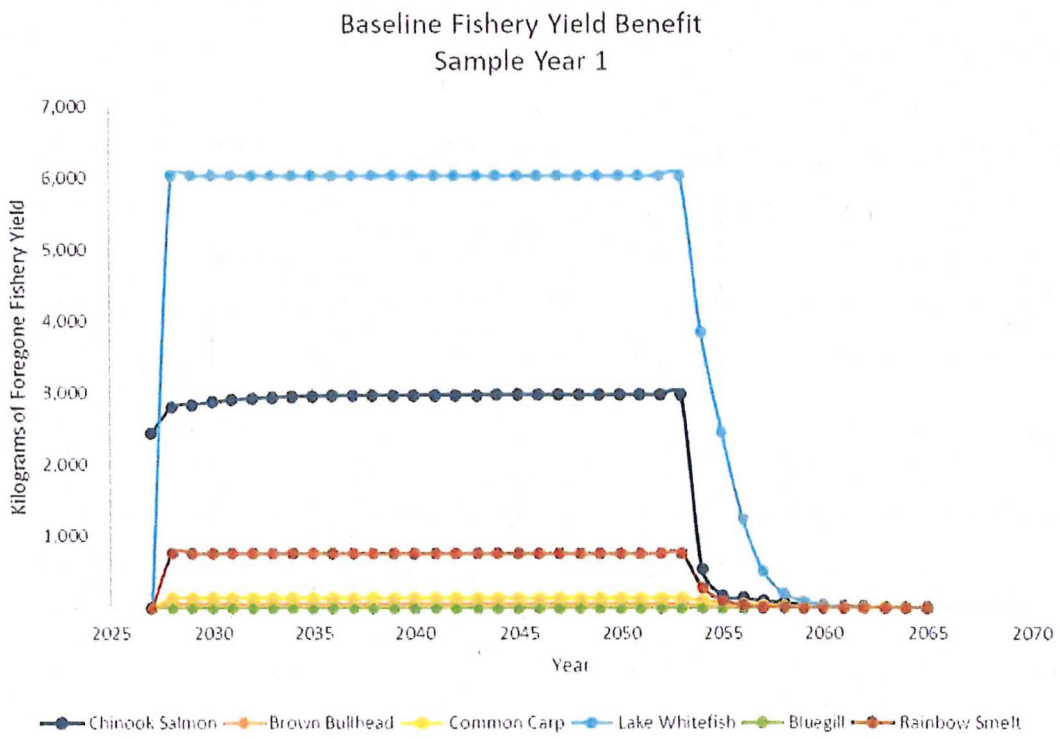
Figure 11-5 illustrates how those benefits to species presumed to receive the forage production foregone (as kilograms of C/R taxa) would be realized over the projected life of PBNP to define the baseline condition in which all other technologies will be compared. Chinook Salmon were not found in entrainment samples but were found in impingement and were selected to receive production foregone based on their importance to the fishery in Lake Michigan.

Valuing Changes in Recreational Yield

After apportioning the estimated yield changes over the affected sites identified in Appendix 11-B, the per-trip expected catch changes can be calculated. Figure 11-6 presents the per-trip change in the expected catch of each recreationally harvested taxa at each of the affected sites.

Figure 11-7 depicts the annual change in dollar-valued welfare associated with the estimated trip changes from a complete elimination in entrainment at PBNP.

Table 11-9 summarizes the total social benefits as a result of changes in the recreational stock in response to the complete elimination of entrainment at PBNP (Appendix 11-B). Values are presented in both present value (over the life of the facility) and annual value.



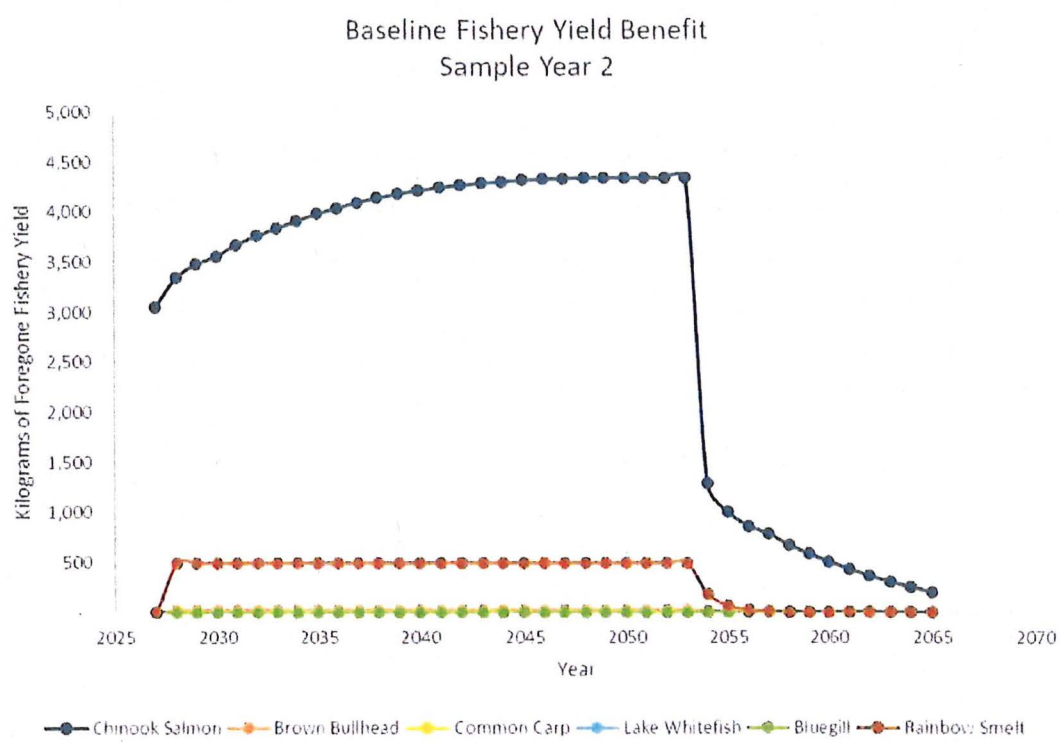


Figure 11-5. Point Beach Nuclear Plant Life Fishery Yield Benefit Under Baseline Conditions

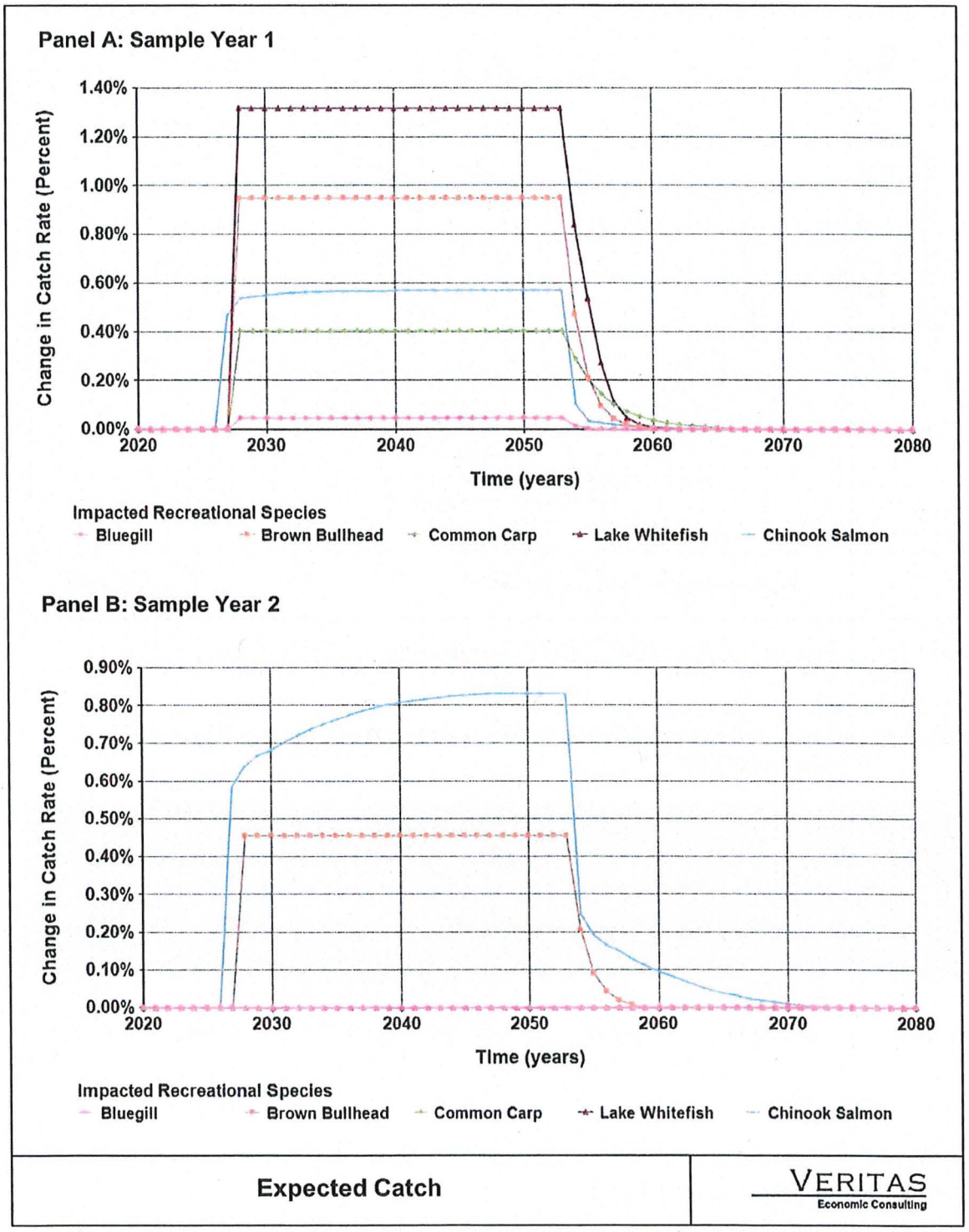


Figure 11-6. Change in Expected Catch per Trip by Species at Affected Sites

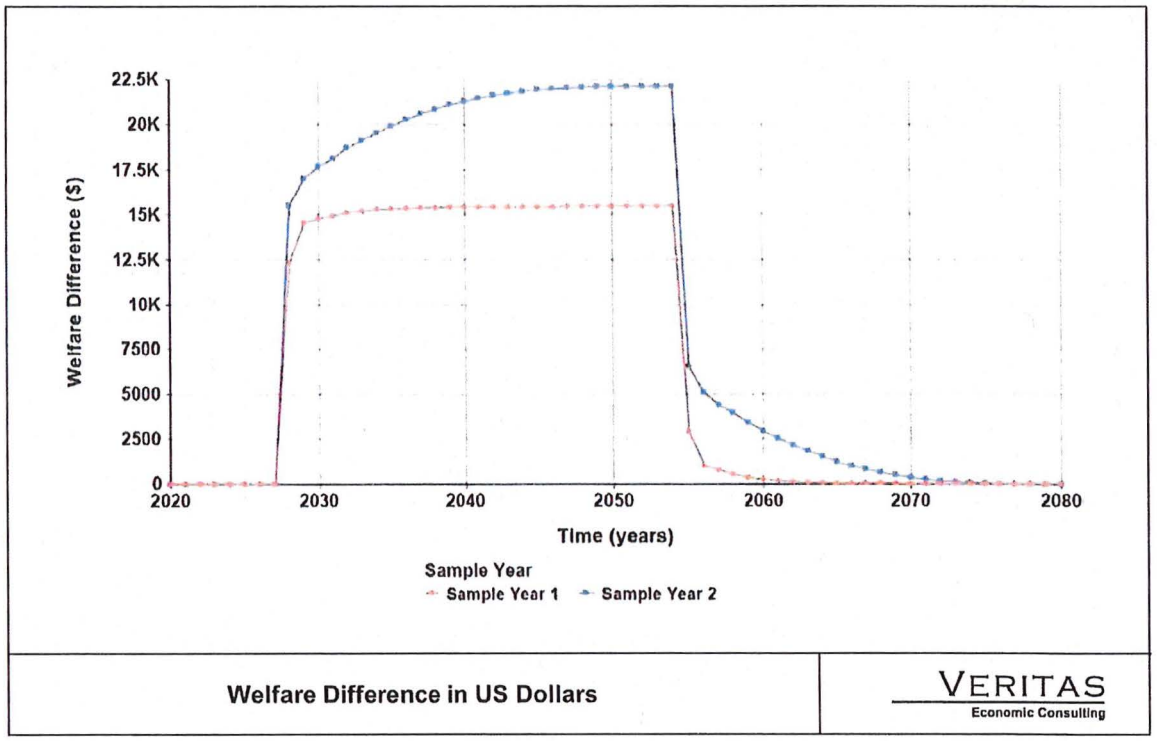


Figure 11-7. Change in Welfare with a 100-Percent Reduction in Entrainment at PBNP

Table 11–9. Summary of Recreational Social Benefits as a Result of Complete Elimination of Entrainment at PBNP.

Discount Rate	Technology	Entrainment Reduction	Present Value ($)		Annual Value ($)	
			Sample Years			
			1	2	1	2
3%	Baseline	100%	227,716	314,263	8,434	11,639
7%	Baseline	100%	112,563	150,196	4,169	5,563

Source: Veritas, 2020.

Valuing Changes in Commercial Yield

Figure 11-8 illustrates the changes in commercial value in response to the complete elimination of entrainment at PBNP.

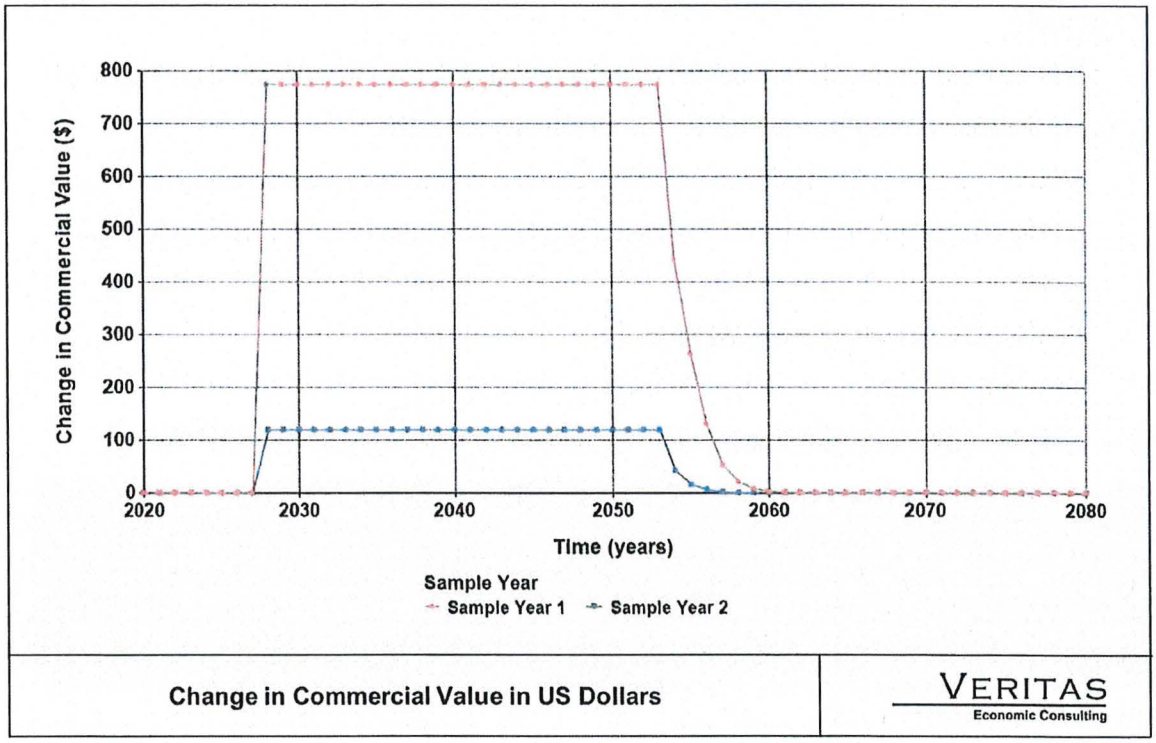


Figure 11-8. Change in Commercial Value with a 100-Percent Reduction in Entrainment at PBNP

Table 11-10 summarizes the total social benefits as a result of changes in the commercial stock in response to the complete elimination of entrainment at PBNP (Appendix 11-C). Values are presented in both present value (over the life of the facility) and annual value.

Table 11–10. Summary of Commercial Social Benefits as a Result of Complete Elimination of Entrainment at PBNP

Discount Rate	Technology	Entrainment Reduction	Present Value ($)		Annual Value ($)	
			Sample Years			
			1	2	1	2
3%	Baseline	100%	11,578	1,761	429	65
7%	Baseline	100%	5,786	886	214	33

Source: Veritas, 2020.

Nonuse Value

Table 11-11 summarizes the nonuse benefits estimates and presents three different regions used to evaluate the nonuse benefits of reductions in entrainment at PBNP:

- All the households in Manitowoc County, Wisconsin, the county where PBNP is located
- All the households in the states included in the inland region of EPA's stated preference survey
- All the households in the United States.

Table 11–11. Summary of Nonuse Benefits for 100-Percent Entrainment Reduction at PBNP

Specified Population of Households	3% Discount Rate ($)				7% Discount Rate ($)			
	Present Value		Annual Value		Present Value		Annual Value	
	Sample Years							
	1	2	1	2	1	2	1	2
Manitowoc County	158	101	6	4	80	51	3	2
EPA's Inland Region*	25,313	16,073	938	595	12,737	8,087	472	300
United States	71,649	45,495	2,654	1,685	36,054	22,892	1,335	848

* Arkansas, Arizona, Colorado, Idaho, Iowa, Illinois, Indiana, Kansas, Kentucky, Michigan, Minnesota, Missouri, Montana, North Dakota, Nebraska, New Mexico, Nevada, Ohio, Oklahoma, South Dakota, Tennessee, Utah, Wisconsin, West Virginia, Wyoming.

Source: Veritas, 2020.

The nonuse benefits are estimated over the same time period as the C/R benefits: from 2026 to 2053. Table 11-11 presents the nonuse benefit of 100-percent reduction in PBNP's entrainment across the two different entrainment sample years using two different discount rates: 3 and 7 percent.

11.4.2 Closed-cycle Cooling

11.4.2.1 Changes in Fish and Shellfish

Table 11-12 summarizes annual entrainment numbers of fish that would no longer be entrained if PBNP were to retrofit with closed-cycle cooling (Appendix 11-D), representing a 95.5-percent decrease in entrainment.

Table 11–12. Annual Benefit (as Reduction in Entrainment) that Would Result if PBNP Were to Retrofit with Closed-cycle Cooling

Animal	Sample Years	
	1	2
Fish	7,974,296	9,450,993
Shellfish	3,995,493,102	4,453,434,282
Total	**4,003,467,398**	**4,462,885,27**

Source: ECT, 2020.

11.4.2.2 Changes in Stocks and Harvest

Table 11-13 provides the results of the estimation of benefits (as kilograms of commercial harvest returned to the fishery) if PBNP were to retrofit with closed-cycle cooling (Appendix 11-D). The benefits would be first observed in 2027. The average total annual foregone fishery yield is estimated as 7,073 kg.

11.4.2.3 Monetized Value of Changes in Stocks and Harvest

The benefits of retrofitting to closed-cycle cooling at PBNP would be experienced over the expected remaining life of the plant from the day the cooling towers came online. For modeling purposes, the year of retrofit is defined as 2027 with the expected life of PBNP ending in 2053.

Table 11–13. Modelled Annual Benefits of Retrofit to Closed-cycle Cooling

Scientific Name	Common Name	Entrainment							
		Entrained Equivalent Adults (number)		Production Foregone (kg)		Direct Foregone Fishery Yield (kg)		Total Foregone Fishery Yield (kg)	
		Sample Years							
		1	2	1	2	1	2	1	2
Fish									
Alosa pseudoharengus	GL Alewife			6,514	9,062				
Lota lota	Burbot			242	4,814				
Ameiurus nebulosus	Brown Bullhead	183	88			48	23	48	23
Dorosoma cepedianum	Gizzard Shad			0.46	2				
Cyprinus carpio	Common Carp	18	-			132	-	132	-
Coregonus clupeaformis	Lake Whitefish	1,351	-			5,765	-	5,765	-
Lepomis macrochirus	Bluegill	3	-			0.96	-	0.96	-
Osmerus mordax	Rainbow Smelt	133,287	86,901			719	469	719	469
Neogobius melanostomus	Round Goby			-	627				
Cottus cognatus	Slimy Sculpin			57	-				
Gasterosteus aculeatus	Threespine Stickleback			22	-				
Production foregone of Chinook Salmon from fish								995	2,093
Fish Total		**134,842**	**86,989**	**6,834**	**14,505**	**6,665**	**492**	**7,659**	**2,585**
Percent reduction by technology		95.5%	95.5%	95.5%	95.5%	95.5%	95.5%	95.5%	95.5%

Scientific Name	Common Name	Entrainment							
		Entrained Equivalent Adults (number)		Production Foregone (kg)		Direct Foregone Fishery Yield (kg)		Total Foregone Fishery Yield (kg)	
		Sample Years							
		1	2	1	2	1	2	1	2
Shellfish									
Gammarus sp.	Gammarids	3,995,493,102	4,453,434,282	79,910	89,069	-	-	-	-
Production foregone of Chinook Salmon from shellfish								1,844	2,056
Shellfish Total		**3,995,493,102**	**4,453,434,282**	**79,910**	**89,069**	**-**	**-**	**1,844**	**2,056**
Percent reduction by technology		95.5%	95.5%	95.5%	95.5%	95.5%	95.5%	95.5%	95.5%
Annual Total		**3,995,627,944**	**4,453,521,271**	**86,744**	**103,574**	**6,665**	**492**	**9,504**	**4,641**
Percent reduction by technology		95.5%	95.5%	95.5%	95.5%	95.5%	95.5%	95.5%	95.5%

Note: Gray shading indicates C/R taxa.

Source: ECT, 2020.

Figure 11-9 illustrates how those benefits (as kilograms of commercial taxa) would be realized over the projected life of PBNP. This represents a total benefit of 95.5 percent of the baseline conditions (4.5 percent less than complete closure of PBNP).

Valuing Changes in Recreational Yield

Table 11-14 summarizes the total social benefits as a result of changes in the recreational stock in response to the reduction in entrainment resulting from the retrofit to closed-cycle cooling (Appendix 11-B). Values are presented in both present value (over the life of the facility) and annual value.

Table 11–14. Summary of Recreational Social Benefits as a Result of Reduction in Entrainment from Closed-cycle Cooling

Discount Rate	Technology	Entrainment Reduction	Present Value ($)		Annual Value ($)	
			Sample Years			
			1	2	1	2
3%	Closed-cycle cooling	95.5%	217,428	300,046	8,053	11,113
7%	Closed-cycle cooling	95.5%	107,477	143,401	3,981	5,311

Source: Veritas, 2020.

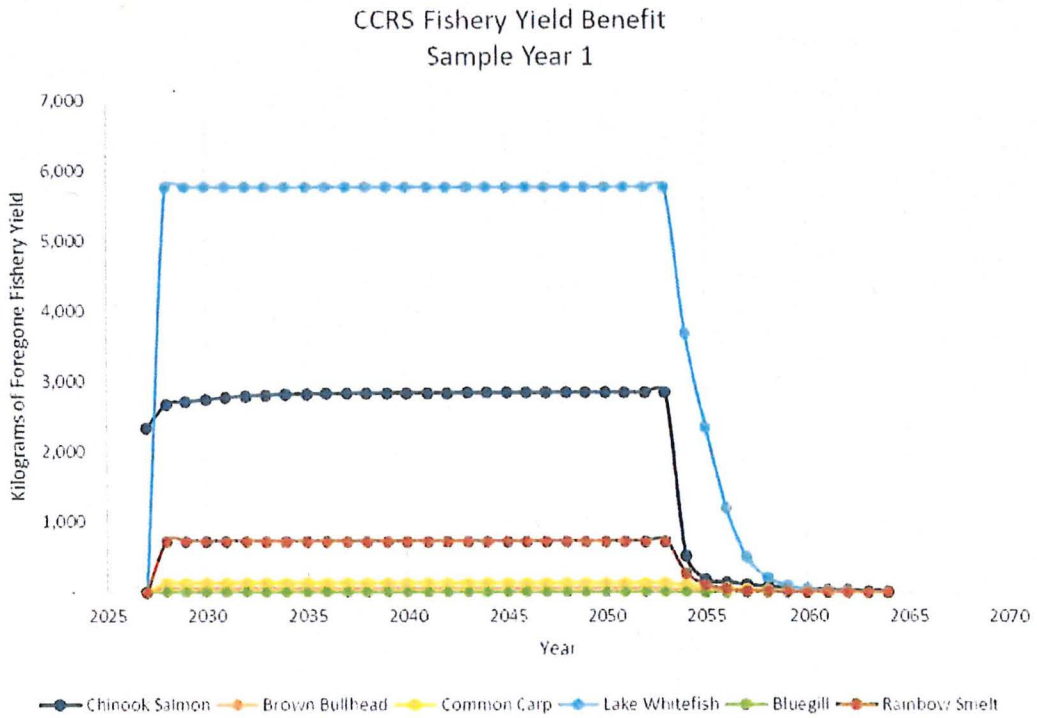
Valuing Changes in Commercial Yield

Table 11-15 summarizes the total social benefits as a result of changes in the commercial stock in response to the reduction in entrainment resulting from the retrofit to closed-cycle cooling (Appendix 11-B). Values are presented in both present value (over the life of the facility) and annual value.

Table 11–15. Summary of Commercial Social Benefits as a Result of Reduction in Entrainment from Closed-cycle Cooling

Discount Rate	Technology	Entrainment Reduction	Present Value ($)		Annual Value ($)	
			Sample Years			
			1	2	1	2
3%	Closed-cycle cooling	95.5%	11,053	1,680	409	62
7%	Closed-cycle cooling	95.5%	5,524	845	205	31

Source: Veritas, 2020.



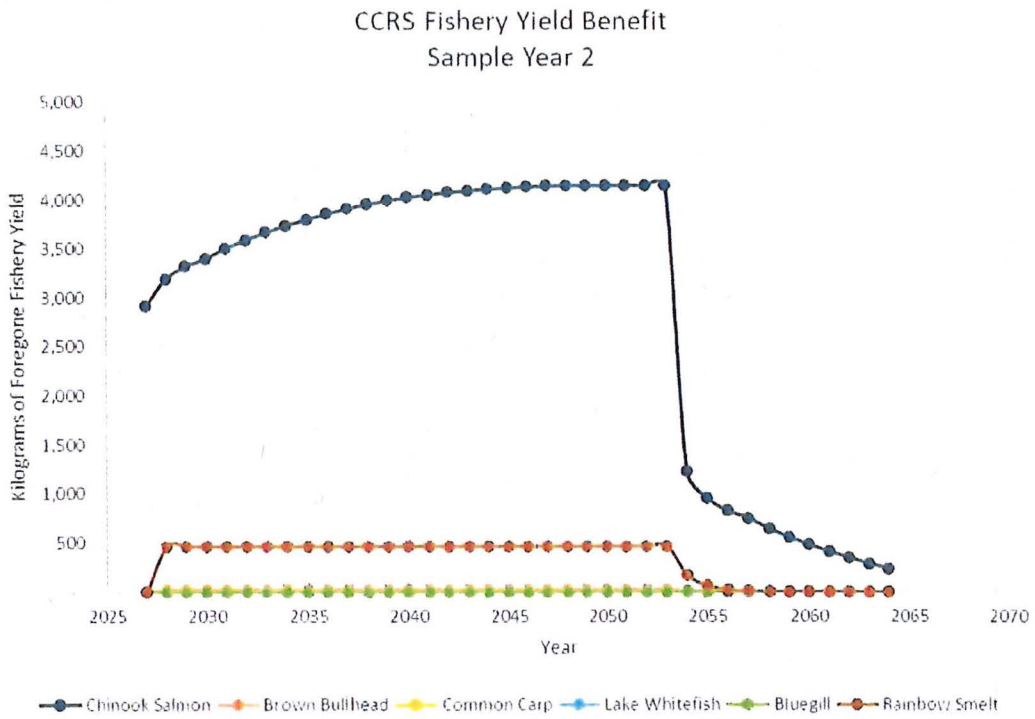


Figure 11-9. Point Beach Nuclear Plant Life Fishery Yield Benefits After Retrofit to CCRS

Nonuse Value

Table 11-16 summarizes the nonuse benefits of reductions in entrainment at PBNP due to closed-cycle cooling for all households in the United States.

Table 11–16. Summary of Nonuse Benefits as a Result of Reduction in Entrainment from Closed-cycle Cooling

Specified Population of Households	3% Discount Rate ($)				7% Discount Rate ($)			
	Present Value		Annual Value		Present Value		Annual Value	
	Sample Years							
	1	2	1	2	1	2	1	2
United States	68,425	43,448	2,534	1,609	34,432	21,862	1,275	810

Source: Veritas, 2020.

The nonuse benefits are estimated over the same time period as the C/R benefits for closed-cycle cooling reductions: from 2027 to 2053.

11.4.2.4 Mitigation Effort Made Prior to Rule

Refer to Section 11.2.4.

11.4.2.5 Other Benefits

Refer to Section 11.2.5.

11.4.2.6 Reduction in Thermal Discharge

The Final Rule requires the benefits expected to result from any reduction in thermal discharges from each technology be discussed. Since there will be a reduction in flow because of closed-cycle cooling of 95.5 percent, the amount of heated water entering Lake Michigan will also be decreased. In addition, the water discharged from the closed-cycle cooling system in the form of blowdown will not generally be heated relative to ambient to the extent the discharge currently is.

11.4.3 FMS

11.4.3.1 Changes in Fish and Shellfish

Table 11-17 summarizes the annual entrainment number of fish that would no longer be entrained if PBNP were to be retrofit with FMS (Appendix 11-E). This represents a 29- and 22.5-percent decrease in entrainment (as numbers of organisms) in sample years 1 and 2, respectively. the average total annual foregone fishery yield is estimated as 2,361 kg.

Table 11–17. Annual Benefit (as Reduction in Entrainment) that Would Result if PBNP Were to Retrofit with FMS

Animal	Sample Years	
	1	2
Fish	2,442,457	2,282,889
Shellfish	4,183,762,410	4,663,281,971
Total	**4,186,204,867**	**4,665,564,860**

Source: ECT, 2020.

11.4.3.2 Changes in Stocks and Harvest

Table 11-18 provides the results of the estimate of benefits (as kilograms of commercial harvest returned to the fishery) if PBNP were to be retrofitted with FMS. The benefits would be first observed in 2027.

Table 11–18. Modelled Annual Benefits of Retrofit to FMS

Scientific Name	Common Name	Entrainment							
		Entrained Equivalent Adults (number)		Production Foregone (kg)		Direct Foregone Fishery Yield (kg)		Total Foregone Fishery Yield (kg)	
		Sample Years							
		1	2	1	2	1	2	1	2
Fish									
Alosa pseudoharengus	GL Alewife			157	211				
Lota lota	Burbot			36	682				
Ameiurus nebulosus	Brown Bullhead	191	92			50	24	50	24
Dorosoma cepedianum	Gizzard Shad			0.0002	0.0009				
Cyprinus carpio	Common Carp	0.29	-			2	-	2	-
Coregonus clupeaformis	Lake Whitefish	-	-			-	-	-	-
Lepomis macrochirus	Bluegill	0.02	-			0.0051	-	0.0051	-
Osmerus mordax	Rainbow Smelt	41,424	26,883			224	145	224	145
Neogobius melanostomus	Round Goby			-	255				
Cottus cognatus	Slimy Sculpin			39	-				
Gasterosteus aculeatus	Threespine Stickleback			0.13	-				
Production foregone of Chinook Salmon from fish								34	159
	Fish Total	**41,615**	**26,975**	**233**	**1,147**	**276**	**169**	**310**	**329**
	Percent reduction by technology	29%	30%	3%	8%	4%	33%	4%	12%
Shellfish									

Scientific Name	Common Name	Entrainment							
		Entrained Equivalent Adults (number)		Production Foregone (kg)		Direct Foregone Fishery Yield (kg)		Total Foregone Fishery Yield (kg)	
		Sample Years							
		1	2	1	2	1	2	1	2
***Gammarid* sp.**	Gammarids	4,183,762,410	4,663,281,971	83,675	93,266	-	-	-	-
Production foregone of Chinook Salmon from shellfish								1,931	2,153
Shellfish Total		**4,183,762,410**	**4,663,281,971**	**83,675**	**93,266**	**-**	**-**	**1,931**	**2,153**
Percent reduction by technology		100%	100%	100%	100%	-	-	100%	100%
Annual Total		**4,183,804,026**	**4,663,308,946**	**83,908**	**94,413**	**276**	**169**	**2,241**	**2,481**
Percent reduction by technology		**100%**	**100%**	**92%**	**87%**	**4%**	**33%**	**23%**	**51%**

Note: Gray shading indicates C/R taxa.

Source: ECT, 2020.

11.4.3.3 Monetized Value of Changes in Stocks and Harvest

Figure 11-10 illustrates how the benefits of retrofitting PBNP with FMS would be experienced over the projected life of PBNP. This represents a total benefit (as C/R biomass) of 15 to 12 percent from baseline conditions, depending upon the year (85 to 87 percent less than complete closure of PBNP).

Valuing Changes in Recreational Yield

Table 11-19 summarizes the total social benefits as a result of changes in the recreational stock in response to the reduction in entrainment resulting from the use of FMS (Appendix 11-B). Values are presented in both present value (over the life of the facility) and annual value.

Table 11–19. Summary of Recreational Social Benefits as a Result of Reduction in Entrainment from FMS

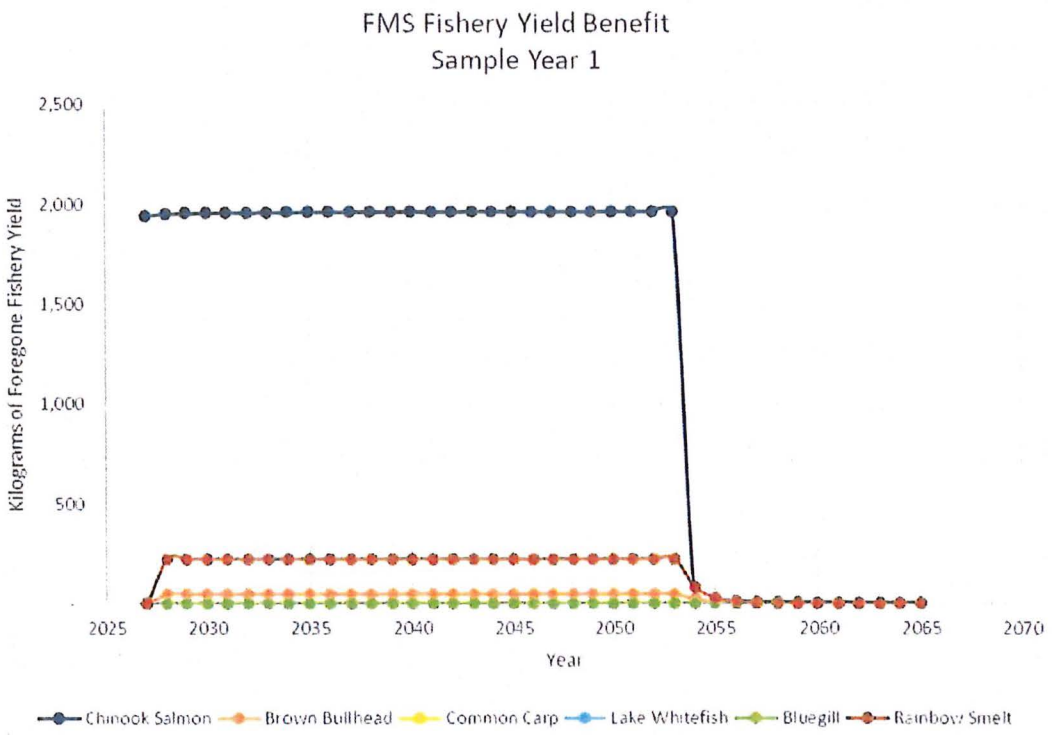
Discount Rate	Technology	Entrainment Reduction*	Present Value ($)		Annual Value ($)	
			Sample Years			
			1	2	1	2
3%	FMS	0 to 100%	148,804	173,237	5,723	6,663
7%	FMS	0 to 100%	74,454	85,947	2,864	3,306

Note: *Reduction in rate of entrainment varies by taxa and lifestage of the excluded organisms.

Source: Veritas, 2020.

Valuing Changes in Commercial Yield

Table 11-20 summarizes the total social benefits as a result of changes in the commercial stock in response to the reduction in entrainment resulting from the use of FMS (Appendix 11-B). Values are presented in both present value (over the life of the facility) and annual value.



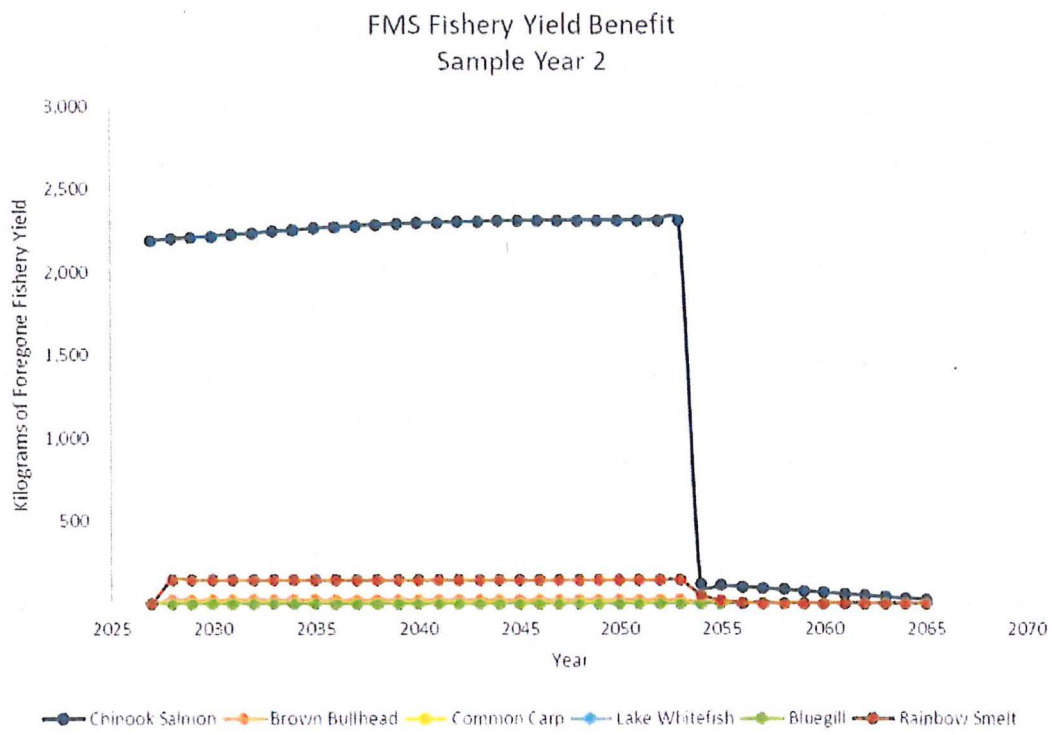


Figure 11-10. Point Beach Nuclear Plant Life Fishery Yield Benefits After Retrofit to FMS

Table 11–20. Summary of Commercial Social Benefits as a Result of Reduction in Entrainment from FMS

Discount Rate	Technology	Entrainment Reduction	Present Value		Annual Value	
			Sample Years			
			1	2	1	2
3%	FMS	1 to 100%	791	512	30	20
7%	FMS	1 to 100%	398	258	15	10

Note: Reduction in rate of entrainment varies by taxa and life stage of the excluded organisms.

Source: Veritas, 2020.

Nonuse Value

Table 11-21 summarizes the nonuse benefits of reductions in entrainment at PBNP due to FMS for all households in the United States.

Table 11–21. Summary of Nonuse Benefits as a Result of Reduction in Entrainment from FMS

Specified Population of Households	3% Discount Rate ($)				7% Discount Rate ($)			
	Present Value		Annual Value		Present Value		Annual Value	
	Sample Years							
	1	2	1	2	1	2	1	2
United States	20,978	13,442	807	517	10,558	6,764	406	260

Source: Veritas, 2020.

The nonuse benefits are estimated over the same time period as the C/R benefits for FMS reductions: from 2028 to 2053.

11.4.3.4 Mitigation Effort Made Prior to Rule

Refer to Section 11.2.4.

11.4.3.5 Other Benefits

Refer to Section 11.2.5.

11.4.3.6 Reduction in Thermal Discharge

Addition of FMS would not affect the thermal loading; therefore, there would be no change in the thermal discharge.

11.4.4 Summary of Monetized Benefits for Candidate Measures

Table 11-22 summarizes the monetized recreational, commercial, and nonuse benefits of the candidate measures as detailed previously. Following the complete elimination of entrainment at PBNP, closed-cycle cooling provides the greatest social benefit as is expected, because it provides the greatest reduction in entrainment.

Table 11–22. Summary of Recreational and Commercial Social Benefits of Entrainment Reduction Alternatives at PBNP

Discount Rate	Technology	Entrainment Reduction	Present Value ($)				Annual Value ($)			
			Rec	Com	Non-use	Total	Rec	Com	Non-use	Total
Sample Year 1										
3%	Without entrainment	100%	227,716	11,578	71,649	310,944	8,434	429	2,654	11,516
	Closed-cycle	95.5%	217,428	11,053	68,425	296,906	8,053	409	2,534	10,997
	FMS	0-100%	148,804	791	20,978	170,573	5,723	30	807	6,561
7%	Without entrainment	100%	112,563	5,786	36,054	154,404	4,169	214	1,335	5,719
	Closed-cycle	95.5%	107,477	5,524	34,432	147,433	3,981	205	1,275	5,460
	FMS	0-100%	74,454	398	10,558	85,410	2,864	15	406	3,285
Sample Year 2										
3%	Without entrainment	100%	314,263	1,761	45,495	361,518	11,639	65	1,685	13,390
	Closed-cycle	95.5%	300,046	1,680	43,448	345,174	11,113	62	1,609	12,784
	FMS	0-100%	173,237	512	13,442	187,191	6,663	20	517	7,200

Discount Rate	Technology	Entrainment Reduction	Present Value ($)					Annual Value ($)		
			Rec	Com	Non-use	Total	Rec	Com	Non-use	Total
7%	Without entrainment	100%	150,196	886	22,892	173,973	5,563	33	848	6,443
	Closed-cycle	95.5%	143,401	845	21,862	166,108	5,311	31	810	6,152
	FMS	0-100%	85,947	258	6,764	92,969	3,306	10	260	3,576

Source: Veritas, 2020.

11.5 Discussion of Uncertainty

Due to the complex interactions of environmental systems, there is, understandably, a level of uncertainty that comes along with biological models. It is important to understand these uncertainties and how each parameter can affect the end results. Though there are statistical methods that attempt to quantify the degree of uncertainty, it was believed, for this application, such statistical methods were not necessary or useful, and a qualitative approach was taken. Table 11-23 summarizes the parameters used in the biological modelling described previously and includes a discussion, and quantification where appropriate, of how changes to the parameters affect the end results used to formulate the decision on entrainment BTA. Section 1.5 in Appendix 11-B also includes a discussion of uncertainty in the benefits assessment.

Also, when completing the social costs, it is recognized that, since the modeling goes out decades into the future, differences from the current state of fishing and fisheries management (e.g., stocking) could impact results. This means anticipated changes in site quality and availability or changes in economic conditions and fishing preferences should be expressed in the with-entrainment case going forward.

Although participation in recreational fishing declined nationally years ago, fishing license sales have rebounded in recent years—dramatically in some states. According to the National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, the number of anglers rose 11 percent from 2006 to 2011. Based on fishing license sales from 2004 to 2020, fishing participation

remained relatively stable among Wisconsin anglers with around 1.4 million licenses sold per year (USFWS, 2020). Thus, it is reasonable to state that the current C/R fishing status is appropriate to apply to future conditions.

11.5.1 Cumulative Effects of Uncertainty

Several areas of uncertainty have been described in Table 11-23. Independently, these uncertainties may not have a large impact on the final social benefits and/or they deliberately overestimate likely benefits. However, when combined, they have the potential to become additive and possibly (though unlikely in most circumstances) change the results of the assessment, including the relative ranking of potential entrainment measures.

Furthermore, the cumulative effects for one technology (FMS) may be greater than others, because that technology has more assumptions associated with it (exclusion and survival parameters) or the assumptions affect that technology more than others.

Every effort was made to recognize, process, and choose the appropriate value for the assessment using best professional judgement (BPJ). The decisions made for this assessment were carefully considered and vetted by the team and others and represent the BPJ at the time of writing this report.

Table 11–23. Uncertainties of Benefits Valuation Study

Category of Input	Range of Variation or Options	Rationale for Value Chosen	Sensitivity of Alternative Choice
Rates of entrainment	Entrainment data were collected from April through September in 2006 and 2017, with samples collected every two weeks. The same sampling protocol was used for both studies, and the total rate of entrainment over the two years was similar. However, the species composition and rate of entrainment of particular species varied between the two years. Interannual variation of this magnitude is not unusual and changes in species composition are documented in the Great Lakes.	Given the variation between the two years of data appears to be typical of the Lake Michigan system, the decision was made to consider quantitatively both sets of data. Though the magnitude of entrainment rates across the two sample years is very similar and does not necessarily warrant consideration separately, the rates of entrainment for certain species were substantially different. The observed interannual variation in taxa also becomes important after applying the exclusion efficiencies of FMS. Therefore, both sets were used to estimate reductions in entrainment and attending social benefits. The alternative approaches of selecting one year over another or averaging the two years would fail to illustrate the variation in social benefits due to taxa variations.	The alternative options would fail to illustrate the variation in entrainment and attending benefits. Depending upon approach selected (maximum, average, or minimum), the range of benefits would be incompletely characterized.
Consideration of FMS exclusion and post-exclusion survival	The approach to estimating the efficacy of FMS relied on available survival data from the literature and exclusion based on the size of the organism. Exclusion rates based on organism size may over predict the exclusion rates due to factors such as areas in the screens that allow organisms to pass through, through-screen velocity forcing organisms through mesh, and the orientation of the organism relative to the mesh opening. Post exclusion survival is based on literature data for fish survival on fine mesh travelling screens from similar facilities. When multiple values are available, there is variation in both of these parameters for a given taxa/life stage pair. There is also literature on rates of exclusion and/or survival at other facilities and laboratory settings.	Variation in the rates of exclusion and post-exclusion survival are expected and, in response, the mean family value was used to estimate the population's behavior. Both size (the predictor of rates of exclusion) and post-exclusion survival appear to be approximately normally distributed, making the arithmetic mean a reasonable estimate of the population's central tendency. The data analysis approach recognizes live return to the waterbody is dependent on three conditions: (1) exclusion by the screen; (2) survival of the exclusion or impingement process; and (3) survival of the return process. The methodology employed uses the exclusion and survival values of taxa that were observed and puts as much reliance on the observed entrainment counts as possible.	The approach employed uses the most relevant data and analyzes them in a way that is unbiased. While there are likely errors in the estimates of the rates of exclusion and post-exclusion survival, such errors are likely to be random in nature, and there is no known bias in the approach that would over- or underestimate live return. Uncertainty in the survival estimates are considerably higher for those taxa and life stages that were not characterized directly in the literature. The decision to apply surrogates to those organisms is more accurate than omitting them from the analysis.
Survival rate in the fish return	Following exclusion by and wash-off from the screens, the organisms would be returned to the source waterbody via a fish return system. The rate of survival in the fish return is unknown, and survival in such circumstances has not been well characterized to date. It is reasonable to assume that survival would not be 100 percent, given the stresses associated with potential changes in temperature, predation, and turbulence in the flume.	The rate of survival in the return system was assumed to be 100 percent, given the lack of more specific data. This value was selected to maximize the estimated social benefit in the absence of more definitive information.	The rate of survival in the return system is almost certainly less than 100 percent, making the estimated rates of live return, and social benefits, an overestimate of actual rates.

Category of Input	Range of Variation or Options	Rationale for Value Chosen	Sensitivity of Alternative Choice
Trophic levels	The trophic level of a taxa may vary based on changes in feeding habits through its life cycle, variation in feeding opportunities in space and time, and inclusion of multiple species based on the inability to perform definitive identifications. It is common practice in modeling of food chain dynamics to assign an average trophic level to a species based on its range of feeding habits. Trophic levels are typically expressed to the tenths place (e.g., 3.2). It is also common practice to assign trophic levels based on best professional judgment when the data are missing or when individual species may be considered under a single higher-level category (e.g., family rather than species).	The trophic levels used to model the food chain transfers were taken from the FishBase.org database. These values reflect the range of dietary habits of the species based on their position in the ecosystem. The values correspond well with the trophic levels of other sources (e.g., SeaAroundUs.org). These parameters represent a consensus approach from a creditable source. When necessary, alternative sources for trophic levels were obtained from the literature or developed based on best professional judgment. Such an alternative is more appropriate than omitting the organism from the modeling.	No systematic bias is associated with the use of consensus trophic levels. Any divergence in the actual trophic levels are likely to be distributed about the consensus value, suggesting that some parameters may be high and some low. Failure to model the taxa in the absence of a literature trophic level would underestimate potential benefits.
Trophic transfer efficiency	The trophic transfer approach interprets observed average biomasses at different trophic levels. Typically, a 10-to-1 forage to predator ratio is applied. Additional options include a blended transfer efficiency of 2.5 percent as was presented by EPA (2002).	A trophic transfer efficiency of 10 percent was chosen due to the wide use of the value and support for application in food web modelling (Pauly and Christensen, 1995). To account for variations in the trophic levels, a modified transfer efficiency was applied as detailed in Section 11.2.2.	There are recognized inconsistencies of the 10 percent trophic transfer efficiency with the estimates developed for recreational and commercial species. In particular, it is specified that higher trophic level species are under fishing pressure from above (humans), rendering them unlikely to be constrained by forage availability. Use of the 10 percent trophic transfer is likely to provide an overestimate of increased C/R stocks. No alternative approach is viewed as more realistic.

Category of Input	Range of Variation or Options	Rationale for Value Chosen	Sensitivity of Alternative Choice
Life history parameters	The literature often states the need to exercise caution when choosing and assigning life history parameters when doing EA and production foregone modelling as small changes in these parameters can have a large impact on the final EA numbers or production foregone biomass (EPRI, 2012). Also, the number of life stages chosen can also greatly affect these end results. Having mortalities associated with each individual life stage, especially when the mortality differs between life stages, is felt to be the best way to model the population. This methodology also allows one to apply the proper weights and growth rates of each life stage to more closely model how growth progresses. The life history parameters used are often obtained from studies in different parts of the county which have different temperature ranges, hours of daylight, seasonal variations, etc. from the location of the facility in which they are being applied. These environmental differences have the potential to create differences in growth and survival. When local data was available, the life-history parameters where modified and rebalanced in an attempt to provide the most appropriate estimate. Also, ensuring the parameters are balanced (i.e., the modeled population is stable) is important and was a crucial part of determining the appropriate life history parameter values.	The values chosen for each species modelled was based on a thorough literature search of accredited sources as well as a consideration of the biology of each species. Each suite of life history parameters was tested for balance and adjusted if necessary. Fishing mortality rates were modified to reflect local conditions if site specific data were available. Model application made no attempt to consider "compensation," the phenomena of reproductive success and recruitment increasing at lower population densities and decreasing at higher densities.	To the extent possible, reliance was placed on accepted sources of life cycle parameters (e.g., EPRI, 2012; prior analysis by EPA). These parameters include the number of life stages as well as the life stage-specific survival rates and sizes. Each set of parameters was checked for balance. Given the nature of the biological modeling, errors in parameterization may result in substantial changes in the model estimates. While this potential is acknowledged, this assessment attempted to minimize errors by relying on parameters developed by recognized authorities.
Age of equivalence	Age of equivalence is the ultimate age of the organism considered in the modeling. Given that mortality prior to the age of equivalence acts to limit the number of organisms at that age, the assumed age of equivalence has an important effect on the resulting population and social benefits. On the other hand, as organisms age, their mass generally increases potentially mitigating mortality when considering biomass. A number of candidate ages of equivalence could be considered (e.g., age at maturity, a fixed age [e.g., Age-1], onset of C/R harvest, etc.).	C/R taxa age of equivalence was assumed to be the age at which the given taxa experience the maximum C/R harvest. For C/R species, it is reasonable to define the age of equivalence at the point at which the organism is subject to maximum harvest. Such an approach accounts for harvest patterns as well as fishing regulations.	Choosing a different age for the EA target could have an important effect on the final numbers and biomass of EAs. If the age is set too low, the numbers would be overestimated, and if set too high, the numbers would be underestimated. As noted previously, errors in biomass under these circumstances are likely to be muted given the growth of organisms as they age. It is difficult to quantify the potential errors associated with these factors. It is likely the selected age of equivalence results in overestimates for some taxa and underestimates for others.

Category of Input	Range of Variation or Options	Rationale for Value Chosen	Sensitivity of Alternative Choice
Identification of early life stages	The identification of early life stages of fish and shellfish is difficult and in many cases was not possible or only made to the family level, especially eggs. Approximately 75 percent of the eggs were unidentified. The two options available include incorporating unidentified taxa/lifestages into the entrainment data using the proportions that identified taxa are found in the entrainment samples or to exclude the unidentified lifestages entirely. Additionally, it is likely that the great majority of the eggs collected in entrainment samples are not viable. Modeling unviable life stages could overestimate the number that survive to equivalent adults.	The choice was made to include the large proportion of unknown eggs observed in PBNP data by spreading the unidentified organisms across the identified taxa for the same life stage in the proportions that they are found in entrainment samples. Including unviable eggs in the analysis is mitigated by the fact that eggs typically have a very low survival rate. This choice was made since viable or not, these unidentified lifestages still contribute to the forage base as biomass and thus, their consideration in the benefits valuation was deemed appropriate.	While distributing the unidentified eggs across the known taxa may result in potential error, the alternative of excluding those eggs from the assessment was viewed as unacceptable, as it would result in an underestimate of social benefits.
Consideration of invertebrates in the biological modeling	There are two available choices for considering invertebrates, largely amphipods, in the biological modeling: a) use surrogate values and estimated values to parameterize the models despite doubts of the representativeness of the data; or b) omit the organisms from the analyses.	The organisms were included in the analysis based on the potential for them to provide a forage base for commercially or recreationally important species despite the following factors: a) The dominance of invertebrate entrainment by invasive species in recent entrainment data; b) Modeling of the invertebrates as "adult equivalents" or "production foregone" is uncertain due to the lack of some relevant model parameters for the taxa as well as, in some cases, the absence of a clear ecological nexus; c) the literature indicates that the dominant entrained organism is of limited ecological value; d) The rates of entrainment are believed to over-estimate the densities in the lake due to enrichment in the habitat local to the intake crib; e) Given that the organisms are likely to be adults and therefore not subject to additional growth, passage through the plant, even if lethal to the invertebrates, may not diminish the biomass of forage available; and f) the rates of exclusion and post-exclusion survival on FMS are poorly understood and both rates are assumed to be 100%..	It is very likely that including these invertebrates in the analysis results in an overestimate of forage losses associated with entrainment, and, in turn, the benefit of entrainment reductions. In fact, the inclusion of shellfish in the social benefits estimation increases the estimated number of salmon due to trophic transfer in the vicinity of PBNP which in turn changes the fishing behavior of anglers. As a result, 90 percent of the monetized social benefits estimated for PBNP are due to the inclusion of shellfish as forage.

Category of Input	Range of Variation or Options	Rationale for Value Chosen	Sensitivity of Alternative Choice
Application of surrogates	Through the benefits valuation process, surrogates were used in two places: application of FMS exclusion efficiency and survival and modelling of EA and production foregone. The choice of surrogate for modeling purposes made every effort to maintain the taxa within the same Family if data at the species level were not available. However, many identified taxa did not have Family surrogates, and they were subsequently placed into the 'fish' grouping. The fish grouping accounted for approximately 8.5 percent of fish taxa the entrainment. These groupings were then distributed into the surrogates that did have life history parameters for modelling. The error associated with this approach is not well understood. Additionally, some surrogates were selected based on commercial or recreational importance or contribution to the forage base.	In general, the 'fish' grouping was distributed into the surrogates based on the proportion of the surrogate taxa to the whole sample. This was done to provide a meaningful range to the potential parameters. The choice to exclude taxa as surrogates was based on knowledge of the species' life histories and observations of the type and size of organisms actually being entrained at PBNP.	While use of modeling parameters derived from surrogate species results in potential error, the alternative of excluding those organisms from the assessment was viewed as unacceptable, as it would result in an underestimate of social benefits.
Applying forage biomass to C/R taxa	When modeling the potential impacts of the loss of forage biomass, it is possible to consider the contribution of biomass as production foregone of a variety of C/R taxa. Approaches considered included: (1) distribution of production foregone among C/R taxa that were subject to entrainment in proportion to their rate of C/R landings; and (2) application of production foregone to a single C/R taxon understood to have C/R relevance and is biologically appropriate (i.e., it is known to prey on the forage species entrained). Also, the model used assumes all natural mortality is a result of being consumed by predators and that no biomass is released to the environment (decomposition and consumption by benthic organisms/bacteria) or completely removed from the environment (e.g., eaten by land-based predators).	In the modeling of production foregone for C/R species, the assumption was made that a single taxon, Chinook Salmon, would benefit from the reduction in the losses of forage fish. This was done largely on biological grounds based on: (1) the knowledge that Chinook Salmon use Lake Michigan as feeding grounds; and (2) based on their trophic position, they are likely to feed on forage fish. In addition, Chinook Salmon are used in Lake Michigan to analyze the Predator Prey Ratio within the lake and are therefore deemed an important component of the current Lake Michigan fishery as well as being a preferred and targeted species for recreational and charter anglers (WDNR, 2017). The alternative approach of distributing forage among a set of C/R species was rejected because of the tenuous biological connections implied. For example, some C/R species are known to feed and be subject to harvest in offshore waters and/or unlikely to prey in a substantial way on forage fish due to their similar trophic levels. To take into account all possible causes of natural mortality is not possible due to the complex nature of such interactions and lack of available information on the topic in the location of PBNP.	The alternative approach of applying increased biomass of forage to a spectrum of C/R species is likely to overestimate their increase in harvest due to inappropriate assumptions regarding their residence in the area and/or their predator-prey relationship with the forage. The approach selected is believed to be more appropriate. Selection of a predator taxa that is relatively high in the food chain (i.e., Chinook Salmon) does result in loss of biomass associated with greater change in trophic levels and the attending reduction in trophic transfer. This is believed to be realistic and acceptable based on the attributes of the taxa. It is important to highlight that this approach assumes all foregone production of forage is consumed by C/R species. This is certainly not the case and, therefore, results in an overestimate of potential benefits. The assumption that all natural mortality is a result of being consumed by predators overestimates the potential benefits.

Source: ECT, 2020.

12.0 122.21(r)(12) Non-Water Quality, Environmental and Other Impact Study

12.1 Introduction and Background

12.1.1 Final Rule Requirement

In Title 40 of Code of Federal Regulations (CFR) Part 122.21(r)(12)[93], *Non-water Quality Environmental and Other Impacts Study*, the regulations state:

> *"The owner or operator of an existing facility that withdraws greater than 125 mgd actual intake flow (AIF) must develop for submission to the Director a detailed facility-specific discussion of the changes in non-water quality environmental and other impacts attributed to each technology and operational measure considered in paragraph (r)(10) of this section, including both impacts increased and impacts decreased."*

Per the regulations, a facility-specific report must be submitted that addresses non-water quality environmental and other impacts for each technology or operational measure considered in the 40 CFR Part 122.21(r)(10) report. The report must include the following items pursuant to the regulations at 40 CFR Part 122.21(r)(12):

- *(i) Estimates of changes to energy consumption, including but not limited to, auxiliary power consumption and turbine backpressure energy penalty;*
- *(ii) Estimates of air pollutant emissions and of the human health and environmental impacts associated with such emissions;*
- *(iii) Estimates of changes in noise;*
- *(iv) A discussion of impacts to safety, including documentation of the potential for plumes, icing, and availability of emergency cooling water;*

[93] As noted in Section 1, the State of Wisconsin has promulgated its own rule, Chapter NR 111, Cooling Water Intake Structures, that also governs the assessment of the CWIS at PBNP. While NextEra believes that NR 111 was intended to be consistent with the EPA Final Rule, there are some slight differences that will be pointed out when relevant.

(v) *A discussion of facility reliability, including but not limited to facility availability, production of steam, impacts to production based on process unit heating or cooling, and reliability due to cooling water availability;*

(vi) *Significant changes in consumption of water, including a facility-specific comparison of the evaporative losses of both once-through cooling and closed-cycle recirculating systems, and documentation of impacts attributable to changes in water consumption; and*

(vii) *A discussion of all reasonable attempts to mitigate each of these factors.*

This document discusses impacts that could arise from installing and operating closed-cycle cooling towers, fine-mesh screens, alternate water sources, and existing design and operational measures at Point Beach Nuclear Plant (PBNP).

12.1.2 Document Organization

The 40 CFR 122.21(r)(10) report prepared for PBNP presents the feasibility and practicality of implementing entrainment reduction technologies and associated costs to the owner and to society. The 122.21(r)(11) report evaluates benefits. This 122.21(r)(12) report evaluates non-water quality environmental and other impacts.

As specified by 40 CFR 122.21(r)(12), this report evaluates energy consumption, emissions, noise, safety, facility reliability, and consumptive use of water associated with technologies retained in the 40 CFR 122.21(r)(10) report for further evaluation.

Some potential impacts are readily quantifiable (e.g., changes in water consumption), but others are difficult to quantify (e.g., impacts to safety). This report describes relevant impacts to PBNP and the surrounding communities, and where possible, quantifies the impacts.

Each section also includes a discussion of potential mitigation measures and the uncertainties associated with the evaluation.

The remainder of the document is organized as follows:

- Section 12.2 provides a summary of the technologies and operational measures discussed in the 40 CFR Part 122.21(r)(10) report and the technologies retained for impact analysis;
- Section 12.3 provides a discussion of the impacts of retrofitting the existing plant with closed-cycle cooling towers;

- Section 12.4 discusses the impacts of a retrofitting the existing intake structure with fine-mesh traveling water screens; because narrow-slot wedgewire screens were deemed infeasible at PBNP their impacts are not discussed in detail;
- Alternate water sources are not viable; therefore, no additional impacts are discussed in Section 12.5;
- Winter flow reduction/warm water recirculation are already implemented and variable speed pump retrofit is impractical at PBNP, therefore no additional impacts discussed in Section 12.6; and,
- Section 12.7 provides a summary of the findings of this evaluation.

Per 40 CFR 122.21(r)(12), Sections 12.3 and 12.4 are organized similarly with each section discussing energy consumption, emissions, noise, safety, facility reliability, and the increase in consumptive water use associated with that technology. The organization of each impact evaluation is also similar. Each subsection starts by describing the nature of the impact and how it impacts society. The next subsection quantifies the impact after describing the method and data employed for the calculation. Engineering calculations are provided in Appendix 12. Each impact evaluation includes a discussion on potential mitigation methods and ends with a discussion on uncertainties.

12.1.3 Background on the Area

Since the magnitude of impacts is often driven by proximity to population centers, it is helpful to understand the population density and characteristics surrounding PBNP. The general layout of PBNP and its surroundings is shown on

Figure 12-1.

Figure 12-2 provides the population density within a 5-mile radius of PBNP; shows the population density within a 1-mile radius.

Consistent with many nuclear power plant settings, the population surrounding PBNP is sparse. There are very few residential, commercial or industrial properties immediately surrounding PBNP. Some of the farmland is expected to be converted to a solar farm. Therefore, any localized visual or noise-type issues will have little impact beyond the plant.

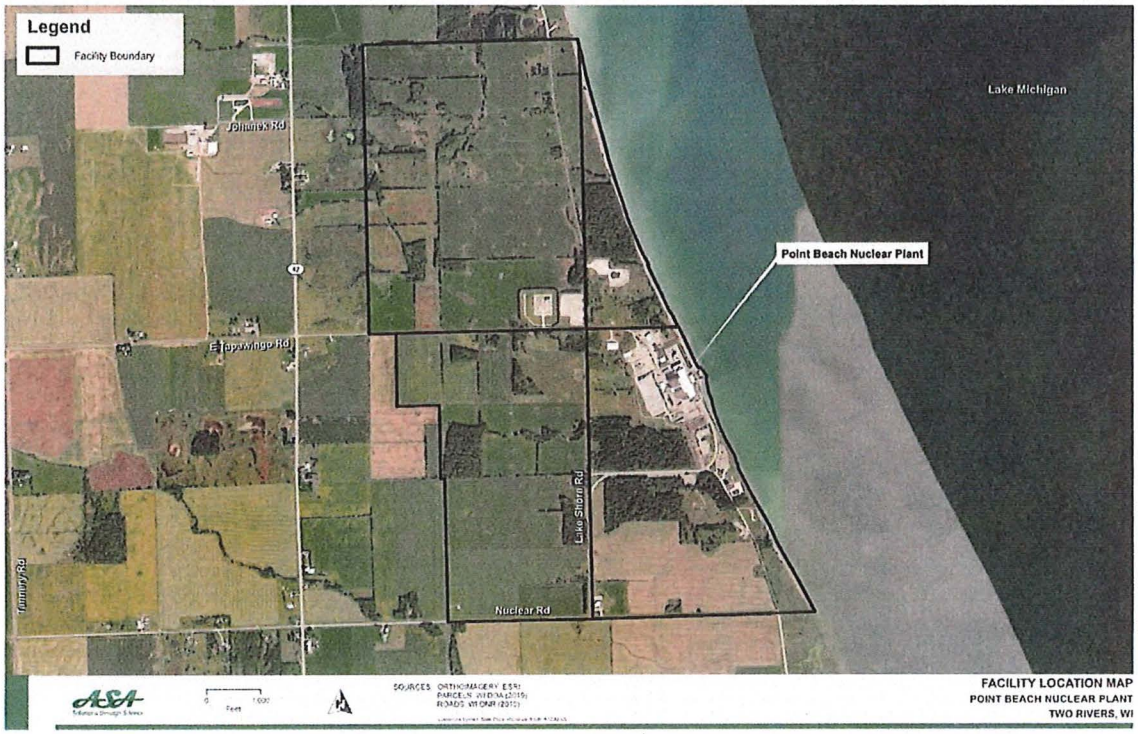


Figure 12-1. Point Beach Nuclear Plant Location Map

Source: US Census Bureau, 2018

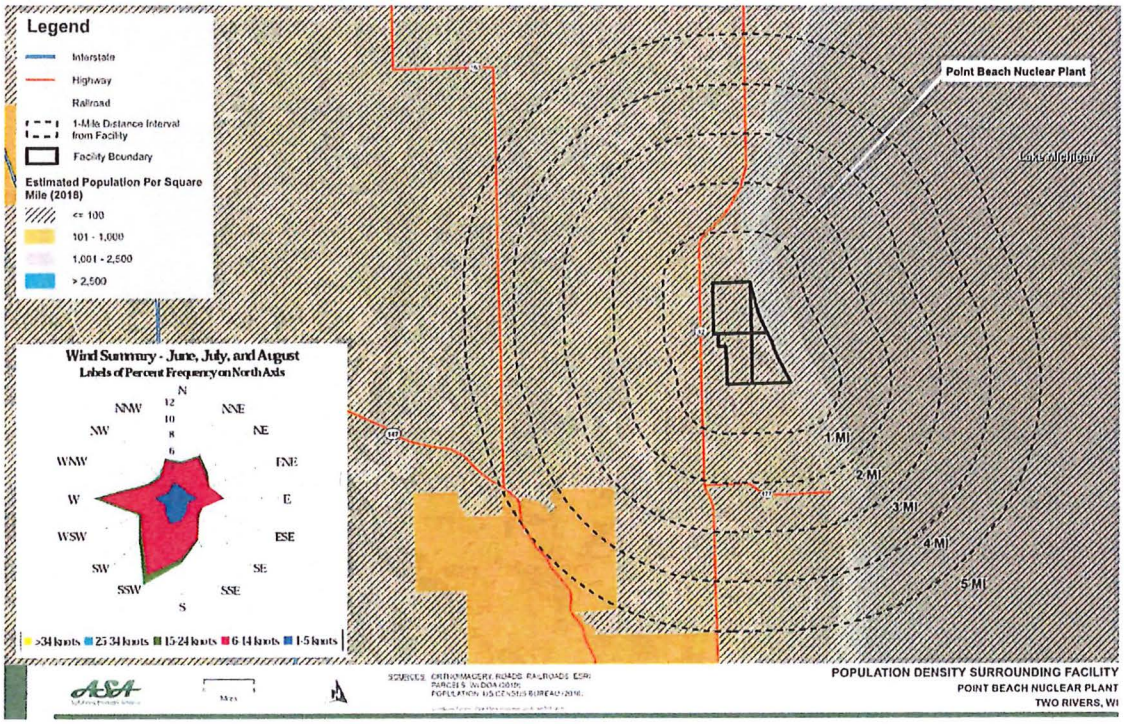


Figure 12-2. Population Density Surrounding Point Beach Nuclear Plant – 5-Mile Radius

Source: US Census Bureau, 2018

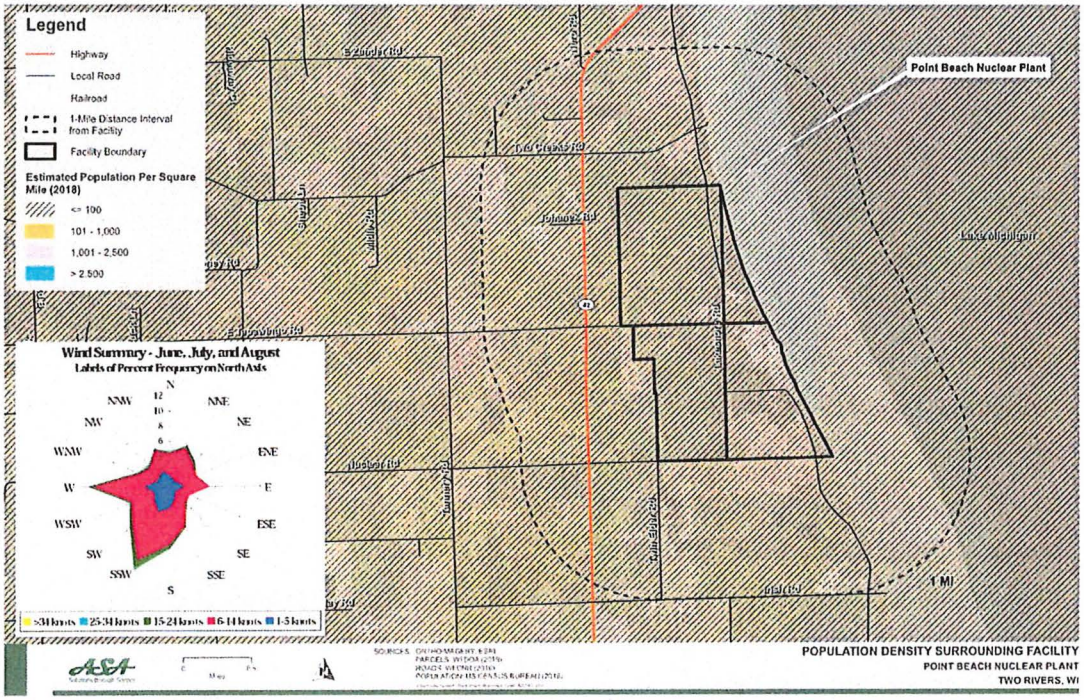


Figure 12-3. Population Density Surrounding Point Beach Nuclear Plant - 1-Mile Radius

12.2 Technologies and Operational Measures in 122.21(r)(10) and 122.21(r)(12)

Section 12.2.1 lists the technologies evaluated in Section 10. Based on that evaluation, technologies that were deemed feasible, practical, and required by regulations to be evaluated in 122.21(r)(12) are listed in subsection 12.2.2, and are the focus of this report.

12.2.1 Technologies and Operational Measures Discussed in 122.21(r)(10)

The entrainment reduction technologies and operational measures that have been evaluated in Section 10 are as follows:

- Exclusion Devices
  - Traveling Water Screen Modifications
  - Fixed Screen Devices
  - Ranney Wells
- Flow Reduction
  - Installation and operation of Mechanical Draft Cooling Towers
  - Installation and operation of Natural Draft Cooling Towers
  - Installation and operation of Plume-Abated Mechanical Draft Cooling Towers
  - Installation and operation of Air-Cooled Condensers
  - Re-use Existing Water Sources
  - Replacement of Existing Surface Water Source with Alternate Reclaimed Water or Groundwater Sources
  - Use of Variable Speed Pumps
  - Reduced pumping and warm water recirculation during winter months

12.2.2 Technologies and Operational Measures Discussed in 122.21(r)(12)

The following technologies or operational measures were retained for impact and cost evaluation because they were deemed potentially feasible and practical for installation and operation, or required by the Final Rule to be evaluated further:

- Retrofitting the existing once-through cooling water system to a closed-cycle recirculating system utilizing a mechanical draft cooling tower (MDCT);

- Constructing an expanded intake upstream of the existing cooling water intake structure (CWIS) and installing 0.5-mm fine-mesh screens and fish return system; and,

- Flow reduction impact of PBNP utilizing the existing winter flow reductions and warm water recirculation; there would be no further impacts if these measures were determined to be Best Technology Available (BTA) at PBNP.

Owing to lack of yield or efficacy, use of an alternate water source (whether groundwater or reclaimed water), variable speed pumps, and Ranney wells were found to be infeasible at PBNP, and therefore their impacts will not be discussed in this report.

12.3 Closed-Cycle Recirculating System

Per 40 CFR 122.21(r)(12), this section discusses impacts related to energy consumption, emissions, noise, safety, facility reliability, and the increase in consumptive water use at PBNP with respect to a hypothetical closed-cycle recirculating system (CCRS) retrofit. The hypothetical retrofit would involve retrofitting the existing once-through cooling system to a closed-cycle recirculating cooling system utilizing two MDCTs.

12.3.1 Energy Consumption (122.21(r)(12)(i))

12.3.1.1 Description

There are two forms of energy losses associated with a closed-cycle cooling tower retrofit at a power plant: parasitic losses and backpressure energy penalty.

Parasitic loss is the energy that is used to operate additional equipment, such as the operation of cooling tower fans and cooling tower booster pumps. All technologies will likely consume a small quantity of energy by way of additional lighting, signage, and meters among various other items; however, these are minor uses and will not be quantified. Parasitic losses, where quantified, will be evaluated directly using the horsepower (hp) rating of the equipment (when available) and the anticipated hours of operation per year.

Backpressure energy penalty is energy that PBNP would not be able to produce because of increases in the turbine backpressure due to the retrofit.

The temperature of once-through cooling water depends on that of the source waterbody. The temperature of closed-cycle cooling water depends on the ambient wet bulb temperature and the design of the cooling tower. During most of the year, the temperature of water in a closed-cycle system is higher than the temperature of water from a once-through system, though there may be short periods of time each year when the opposite may be true. The turbine's power generation efficiency depends on the quality of exhaust steam, temperature of condenser cooling water, and various other condenser losses. Use of a closed-cycle cooling tower, which results in warmer cooling water, reduces the efficiency of the turbine and its capacity to produce electricity; this is referred to as the backpressure energy penalty.

This evaluation will estimate the energy penalty that would result from retrofitting PBNP's Unit 1 and Unit 2 with hypothetical MDCTs using a parametric relationship developed by the U.S. Department of Energy (USDOE, 2002). This evaluation captures only the impact due to the hypothetical MDCTs.

This evaluation does not capture the potential energy loss/penalty on the solar farm planned to surround PBNP. The potential plume and solids deposition could impact the production efficiency of the solar arrays; but because the solar farm is not yet built and the actual impacts are unknown they are not discussed further.

12.3.1.2 Quantification

The parasitic losses for the hypothetical closed-cycle cooling tower retrofit include the operation of the fans, booster pumps, make-up water pumps, blowdown pumps, lighting, signage, chemical pumps, flow meters, etc., related to the hypothetical MDCTs.

Under the hypothetical retrofit scenario for this evaluation, a new make-up water crib and intake structure would be constructed east of the hypothetical MDCT (Location A) to facilitate the withdrawal of water from Lake Michigan to replenish water lost from the recirculating system due to evaporation, drift, and blowdown. The existing cooling water system for Unit 1 and Unit 2 has an intake crib, two intake pipes, and an onshore Plant intake structure which has two circulating water pumps per unit, three service water pumps per unit[94], two screenwash pumps,

[94] There are six existing service water pumps at PBNP; however, three pumps are required for normal operation (NEE, 2020).

and two fire pumps that run intermittently on a closed fire loop[95] (NEE, 2020). See Section 10.2.2 for specifics. These existing pumps would remain in place and continue to be used in the hypothetical closed-cycle system. Additional MDCT booster pumps would be installed to pump water to the hypothetical MDCTs.

Eight booster pumps per tower, each rated at approximately 47,000 gpm, are assumed to route hot water from the wet well to the top of the hypothetical MDCTs' wet decks. Cooling tower booster pump energy consumption was estimated assuming approximately 950 ft of 4.5-ft[96] diameter pipe for each booster pump which would result in approximately 3.1 ft of friction losses; and approximately 6,000 ft of 12-ft[97] diameter pipe which would result in approximately 7.6 ft of friction losses. Calculations assume concrete pipe[98]. It is assumed that each of the two piping systems would have twenty 90-degree elbows and 10 wye fittings per line, resulting in approximately 6.3 ft of minor losses for the booster pump discharge pipes and approximately 11.1 ft of minor losses for the hot/cold conveyance pipes. Static head for each booster pump would be approximately 78 ft. Total dynamic head (TDH) for each booster pump would be approximately 127 ft, including a 20 percent contingency. All pumps associated with the retrofit are assumed to be 85 percent efficient with 90 percent efficient motors. As such, the total energy consumption for the Unit 1 and Unit 2 hypothetical booster pumps is estimated to be 23.6 megawatts (MW).

Per this evaluation, each hypothetical MDCT would need one make-up water pump[99] (two pumps total) each rated at approximately 8,300 gpm and approximately 0.09 MW. The two blowdown pumps[100] would each be rated at approximately 1,650 gpm and 0.01 MW. The energy consumed by each hypothetical MDCT fan would be 250 hp (SPX, 2019), which, for 30 fans per tower, is estimated to total approximately 5.6 MW (11.2 MW total for both MDCTs). Total

[95] Note that the rule does not include fire or emergency pumps as part of the design intake rate.
[96] This results in 6.5 feet per second (fps) in-pipe water velocity (full pipe).
[97] This results in 8.7 feet per second (fps) in-pipe water velocity using Manning's equation (pipe not full).
[98] Hazen-Williams roughness coefficient of 100.
[99] Makeup water pumps replenish water lost (evaporation and drift) or removed (blowdown) from the closed-cycle system. The makeup pumps would discharge directly into the circulating water piping or into the cooling tower basin; specifics would be determined during detailed design if closed-cycle cooling were selected as entrainment BTA. See Section 10 for additional discussion.
[100] Evaporation causes parameters to concentrate in the circulating system. Blowdown pumps remove a portion of water from the circulating water system to control for minerals and other dissolved solids. See Section 10 for additional discussion.

energy consumption by fans, booster pumps, make-up water pumps, and blowdown pumps associated with the retrofit is estimated to be approximately 35 MW. See Appendix 12-A and Appendix 12-B for detailed engineering calculations.

The USDOE (2002) reported estimates of the backpressure energy penalty for a range of steam turbine backpressure penalties for the one percent highest temperature conditions. Using a condenser temperature rise of 22 degrees Fahrenheit (°F) for each unit with the modeled backpressure energy penalty, reduction in PBNP's efficiency was estimated to be 1.4 percent. The gross capacities of Unit 1 and Unit 2 are 623 MW and 627 MW, respectively; therefore, the energy penalty associated with the closed-cycle system would be approximately 17.6 MW.

The annual parasitic energy consumption from the addition of the hypothetical MDCTs to convert the existing once-through cooled Plant to closed-cycle cooling would be approximately 152,482 megawatt-hours (MWhr) if Unit 1 were operated continuously and approximately 154,040 MWhr if Unit 2 were operated continuously. The annual loss due to back pressure energy penalty would be approximately 77,250 MWhr per unit for a total 153,981 for the Plant.

Annual energy loss due to parasitic and backpressure penalty, assuming historical capacity utilization rate (CUR) would be approximately 436,000 MWhr/year for both units. This additional energy draw would commence in late 2026 and terminate in October 2050 for Unit 1 and March 2053 for Unit 2.

Energy consumption by the hypothetical MDCT system at PBNP is summarized in Table 12-1.

Table 12-1. Energy Consumption Due to Hypothetical MDCTs at PBNP

Energy Consumption from Hypothetical CCRS Retrofit	Unit 1	Unit 2
Hypothetical Cooling Tower Booster Pumps (MW)	11.7	11.9
Make-up Water Pumps (MW)	0.08	0.09
Blowdown Pumps (MW)	0.01	0.01
MDCT Fans (MW)	5.6	5.6
Backpressure Energy Penalty (MW)	8.8	8.8
Total Annual Energy Consumption (parasitic and backpressure) with Continuous Operation (MWhr/year)	229,226	231,277
Total Annual Energy Consumption (parasitic and backpressure) Using CUR Factor (MWhr/year)	215,137	220,855

As an approximate benchmark, an American household consumes roughly 10.4 MWhr/yr[101] of electricity on average (EIA, 2018). The hypothetical MDCTs at PBNP would consume the equivalent amount of electricity that could be used to supply approximately 42,000 homes in total (assuming the average CUR for each unit).

During the warmest and most humid times of the year when the actual wet bulb temperature exceeds the design wet bulb temperature, PBNP would need to reduce generation (de-rate) both units. However, this would be an opportunity cost to PBNP. The anticipated de-rate associated with the hypothetical MDCTs is estimated to be 11,000 MWhr/year for each unit or 22,000 MWhr/year total for the plant.

Both the facility level cost and the social cost associated with potential changes to energy consumption are reported in Section 10.

[101] Per EIA (2018), "In 2017, the average annual electricity consumption for a U.S. residential utility customer was 10,399 kilowatt-hours (kWh), an average of 867 kWh per month".

12.3.1.3 Impact Mitigation Methods (122.21(r)(12)(vii))

Energy consumed by the hypothetical MDCTs at PBNP may be replaced in a variety of ways, and may include:

- Using electricity from the grid. The advantage of this option is that the grid would provide a reliable source of electricity for use at PBNP when required. The disadvantage of this option is the potentially higher cost and adding an additional load to the grid. The true impact is not mitigated.
- Construct a solar energy farm. The advantage of this option is that once constructed, it would harness renewable energy. The disadvantage of this option is that its energy production is dependent on the time of day and weather conditions rather than the demand for electricity. There are current plans to install solar arrays on the property surrounding the Plant; however, the purpose of these solar arrays is not for mitigation of existing energy consumption at PBNP. Given the existing plans for the solar project, there is minimal land available for additional solar arrays specifically for mitigating hypothetical MDCT impacts.
- Install a few wind turbines on site. The advantage of this option is that once constructed, it would harness renewable energy. However, there is minimal space onsite to install wind turbines at PBNP.
- Construct a larger cooling tower. A temperature of 5°F is the theoretical minimum approach temperature that a MDCT can be designed for, while 10°F is the practical minimum. The hypothetical cooling towers evaluated for PBNP have been designed for an approach temperature of 10°F and 99th percentile wet bulb temperature, yet the total backpressure energy penalty is approximately 17.6 MW, or 154,000 MWhr annually (assuming continuous operation of Unit 1 and Unit 2). Making the cooling towers even larger could reduce the backpressure energy penalty, but would increase parasitic losses. Therefore, this is not a practical or sustainable solution.

While several different methods could potentially be employed to increase electricity production or decrease electricity use in an effort to compensate for the increased energy consumption

caused by cooling tower operation, none of the above methods appear to be practical. Therefore, this hypothetical design does not incorporate further mitigation measures.

12.3.1.4 Uncertainty

The uncertainties associated with the energy consumption estimate include, but are not limited to:

- The total estimated new piping length for booster pumps, make-up water pumps, and blowdown pumps are based on measurements on an aerial image. When buried and aboveground infrastructure are considered in detail, longer pipe lengths may be needed. Longer pipes will result in greater headloss and larger energy consumption. Additional pipe alignment evaluations would need to be performed to improve the alignment and estimate pipe length with greater accuracy.

- The backpressure energy penalty was estimated using USDOE (2002) modeled results for cooling system conversions. This evaluation used values from a surrogate site with a similar temperature differential as PBNP; the actual penalty may deviate from this estimate.

- Parasitic losses assume approximate pipe and pump sizes representative of the PBNP system; the actual in-pipe water velocities may be different and may result in higher or lower parasitic losses.

- The evaluation used a surrogate facility for the backpressure energy penalty calculation. The surrogate facility was selected based on condenser characteristics. That facility does not have an offshore intake on the Lake Michigan bed. Therefore, the actual temperature impact may be different than calculated here.

- A solar farm is planned and expected to surround PBNP. If the solar farm and MDCT were built, the potential plume and solids that could settle on the solar arrays could impact the generation efficiency of the arrays. Depending on the intensity of the plume the impact could be significant. But given the various uncertainties, the energy penalty at the planned solar farm is not included here.

12.3.2 Air Pollutant Emissions, Environmental Impacts, and Human Health (122.21(r)(12)(ii))

12.3.2.1 Description

Installing and operating cooling towers at PBNP can increase emissions in three ways:

1. Cooling tower emissions. These are primarily particulate matter (PM) emissions derived from solids in the circulating water. These emissions would occur at PBNP.

2. Auxiliary emissions during tie-ins-related unit downtime. When PBNP is in a tie-ins-related downtime, another facility would need to makeup for lost generation at PBNP. Most of the energy consumed at PBNP is generated by nuclear power, which does not emit air pollutants. All makeup power would be generated using fossil fuels. Tie-ins-related downtime at nuclear facilities therefore result in significant combustion emissions.

3. Auxiliary emissions during the operations period to replace the energy lost due to backpressure energy penalty and parasitic losses. Nuclear power stations are base loaded, and are not able to increase power production to compensate for the cooling towers-related energy consumption. Therefore, all of the additional energy would need to be generated off-site, resulting in an increase in combustion emissions.

Cooling Tower Particulate Matter Emissions

Operation of cooling towers results in the emission of several trace elements, but the levels of emissions are highly variable depending upon the nature of the source water. PM, driven by the concentration of total dissolved solids (TDS) and total suspended solids (TSS) in the source water and the cooling tower operating regime, would be the largest source of air emissions from PBNP after the installation of cooling towers. Therefore, cooling tower-related emissions will be evaluated under the umbrella of PM.

Drift droplets, resulting from evaporative cooling tower operation, contain solids in the form of salts and organic matter entrained in the cooling water. The water in drift droplets exiting the cooling towers evaporates leaving the solid matter in the air column. These solids range in size based on the cooling water quality and drift droplet size and are generically designated as PM. PM_{10} refers to PM that is 10 microns[102] in diameter or smaller, and $PM_{2.5}$ refers to PM that is 2.5 microns or smaller. PM_{10} particles have a larger diameter and are heavier than $PM_{2.5}$ particles. Compared to $PM_{2.5}$, PM_{10} particle deposition velocity is faster, and the deposition distance is shorter.

Smaller PM can have a greater impact on human health. PM_{10} and $PM_{2.5}$ emissions are regulated; therefore, this section evaluates total PM, PM_{10} and $PM_{2.5}$. Total PM emissions exceeding 25

[102] A micron is a common reference for a micrometer, which is equal to one-millionth (10^{-6}) of a meter.

tons per year or PM_{10} emissions exceeding 15 tons per year require additional evaluations and permits, such as Prevention of Significant Deterioration (PSD) review in attaining areas, and New Source Review (NSR) in non-attaining areas.

Based on the size and weight of PM, the highest rate of mineral deposition can occur up to approximately 2,500 ft away from a MDCT for freshwater facilities and up to approximately 3,600 ft away for saline or brackish water facilities (EPRI, 2011). Because saline and brackish waters have a higher TDS, more particles get entrained in the exhaust airstream; therefore, PM deposition occurs in a larger area with saline or brackish water compared to freshwater. PM would be carried further distances during periods of strong winds. PBNP would utilize Lake Michigan as source water for its cooling system; Lake Michigan is a freshwater source. Considering the lake's TDS concentration, PM may be expected to get carried up to approximately 2,500 ft away from the towers.

The TDS concentration in the drift particles is directly proportional to the TDS concentration in the source waterbody; the TDS concentration in drift particles is equal to the TDS concentration in the circulating water system and is estimated as the source water TDS times the cycles of concentration (COC)[103].

The quality of the blowdown stream depends on the quality of water in the circulating water system and the treatment system or systems to remove constituents prior to blowdown. Removing dissolved solids requires reverse osmosis/thermal/crystallizing-type treatment methods which are rarely employed for blowdown treatment. Hence, it is reasonable to assume that the TDS concentration in the blowdown is the same as the TDS concentration in the circulating water system. The TDS concentration allowable in the blowdown would be governed by PBNP's Wisconsin Pollutant Discharge Elimination System (WPDES) permit. The evaluation assumed that the hypothetical PBNP cooling towers would be operated at 5 COC.

[103] COC is discussed in more detail in the 40 CFR 122.21(r)(10) report. COC is defined by the USEPA as "the ratio of dissolved solids in the recirculated water versus that in the make-up water" (USEPA, 2014).

Combustion Emissions

All replacement electricity to compensate for parasitic losses and backpressure energy penalty during the operations period, and during the hypothetical cooling tower tie-ins (marginal increase) are assumed to be from fossil-fuel-fired power plants [104].

Combustion of fossil fuel produces a range of air pollutants of concern that includes nitrogen oxides (NO_X), sulfur dioxide (SO_2), and carbon dioxide (CO_2). While stack emissions are real, there is significant uncertainty in the emissions rates because the specific fuel mix (e.g., coal, gas), and the specific composition of each fuel (i.e., the relative abundance of impurities in the fuel) that would be used to generate additional power are unknown. Additionally, many of these pollutants are captured by the various emissions control technologies installed at fossil-fuel stations (Dixon *et al.*, 2003). In addition, the location of additional/replacement power generation is not known with certainty.

PM from a MDCT is emitted from a height of approximately 60 ft. Because of their emission height and particle weight, dispersion and deposition of PM from a MDCT would be relatively local. Combustion stacks emit NO_X, SO_2, and CO_2 from a height of approximately 150 ft (for combined-cycle units) or 500 ft (for conventional coal plant), and each emissions particle is positively[105] or neutrally buoyant. Therefore, emissions particles are carried longer distances than PM. The following sections quantify the potential increases in off-site combustion stack emissions resulting from a cooling tower retrofit for PBNP; owing to the uncertainties in sources and dispersion of these emissions, potential impacts (if any) are not quantified.

Off-site combustion stack emissions due to a cooling tower retrofit at PBNP may occur in two forms: (1) one-time emissions during cooling tower tie-ins and PBNP unit outages and (2) recurring emissions from producing all or some of the replacement electricity to compensate for generation inefficiencies at PBNP (owing to parasitic losses and backpressure energy penalty see subsection 12.3.1).

[104] Nuclear power plants are already base-loaded and cannot generally increase their instantaneous generation rates any further. Hydroelectric power plants are operated on an as needed basis depending on energy demand based on available water supply, and as a result, their ability to offset base load generation needs is limited. In the future other newer renewable sources of energy may enter this mix.
[105] Owing to heat.

CO_2

While CO_2 is not a criteria pollutant under the National Ambient Air Quality Standards (NAAQS), it is a pollutant of concern as a greenhouse gas. Subsection 12.3.2.2 quantifies the annual recurring CO_2 emissions from the additional power consumed to operate fans, pumps, and other cooling tower-related equipment and the backpressure energy penalty, assuming that replacement off-site power would be represented by fossil fuel facilities throughout Wisconsin.

SO_2

The burning of fossil fuels by power plants and other industrial facilities has contributed SO_2 emissions to the atmosphere which contribute to acid rain; the United States Environmental Protection Agency (USEPA) has promulgated regulations to limit their emissions (USEPA, 2016a). Subsection 12.3.2.2 quantifies the annual recurring SO_2 emissions due to the additional power consumed to operate fans, pumps, and other cooling tower-related equipment and the backpressure energy penalty. Replacement off-site power is assumed to come from fossil fuel facilities throughout Wisconsin.

NO_x

Burning of fossil fuels and vehicular emissions are the primary sources of NO_X, an emissions particle that irritates the respiratory system. Similar to SO_2, NO_X reacts with water and oxygen in the atmosphere to form acid rain which, in turn, can impact ecosystems. It is also known to create haze and pose a hazard to driving. USEPA has developed emissions limits for NO_X (USEPA, 2016b). Subsection 12.3.2.2 quantifies the annual recurring NO_X emissions from the additional power consumed to operate fans, pumps, and other cooling tower-related equipment and the backpressure energy penalty, assuming that replacement off-site power would be represented by fossil fuel facilities throughout Wisconsin.

Human Health

Health-related impacts are a function of the change in emissions, dispersion, deposition, human population density relative to the emissions, and the sensitivity of those populations. While increased emissions may have environmental and human health impacts, emissions are regulated by each power plant's emissions permit (operating permits issued under Title V of the Clean Air Act). Emissions standards and allowances are based on the cumulative impacts caused by most

emissions sources; therefore, a facility's allowable emissions, as specified by the Title V permit, are determined with the general protection of the surrounding populations in mind. This means that if a power plant is allowed to generate, its emissions are not expected to cause undue harm.

12.3.2.2 Quantification

This section provides approximate estimates of particulate matter, CO_2, SO_2 and NO_x using energy penalty values calculated in Section 12.3.1, water quality data and emissions rates from facilities throughout Wisconsin and publicly available sources. Estimates provided in this report are meant to provide a sense of the increase in emissions and should not be misconstrued as permit application values. These estimates would be refined during detailed design if the hypothetical MDCTs were to be determined BTA for entrainment reduction.

Estimated Cooling Tower Particulate Matter Emissions

Evaporation and drift are the primary emissions from the MDCTs that could result in potential environmental effects on receptors. A receptor is assumed to be any point of reception (e.g., residential dwellings or business, buildings, environment) that is impacted from PM emissions. Evaporation adds pure water vapor to the atmosphere. Droplets of water that become entrained in the air traveling through the cooling tower are called drift. Drift droplets contain the same types and concentrations of solids (i.e., sodium, calcium, chlorides, and sulfates) as contained in the water flowing through the cooling tower that can then be converted to airborne emissions. Drift droplets also contain organic matter (e.g., bacteria, spores, insects and vegetation) entrained into the towers by the fans (EPRI, 2011). Unless the circulating water is treated to remove solids, the concentration of solids (suspended and dissolved) entrained in cooling tower drift is proportional to the concentration of solids in the circulating water, which, by definition, is the product of the COC of the cooling tower and source water solids concentration, as well as any maintenance chemicals (e.g., pH adjustment, biocides, anti-scalants) added to the cooling water[106].

To reduce drift from cooling towers, drift eliminators can be incorporated into the tower design to remove water droplets from the exiting air stream. The drift eliminators used in cooling towers rely on inertial separation, caused by directional changes, while passing through the eliminators.

[106] Allowable cycling and allowable quantities of chemical additives would be governed by the WPDES permit.

The most efficient drift eliminator currently available, and assumed for the hypothetical cooling tower retrofit at PBNP, can limit the drift rate to 0.0005 percent of the circulating water flow rate.

Source Water Data

Lake Michigan is freshwater. Accordingly, TDS in the PBNP source water can vary between 154 parts per million (ppm) – 169 ppm (Chapra *et al.,* 2012).

Particulate Matter Estimations Method

In the hypothetical PBNP system, make-up water would originate from Lake Michigan with the solids concentrations reported previously. The engineering evaluation in Section 10 assumed that the cooling tower would operate at 5 COC. The amount of TS (total dissolved solids and total suspended solids) in the circulating water (TS_{CT}) is the product of the TS intake concentration, the COC, and any addition of operational chemicals[107], resulting in a TS concentration in the circulating water ranging from 920 and 995 ppm.

The total PM lost is calculated as the product of the cooling water circulation rate per unit (Q_{CT}), the drift eliminator efficiency (DE), and TS_{CT}. Drift eliminators act to reduce the amount of drift lost from a cooling tower system by providing multiple airflow direction changes to enhance capture of larger water droplets. The variables at PBNP are listed in Table 12-2.

[107] Quantities and concentrations of allowable chemicals would be governed by the WPDES permit.

Table 12-2. Point Beach Nuclear Plant Variables for PM Emissions

Variable	*Units*	Unit 1	Unit 2
Q_{CT}	gpm	373,584	377,416
Drift Loss (percent of Q_{CT})	%	0.0005	0.0005
TS_{CT}	ppm	920-995	920-995

Estimated Particulate Matter Emissions from the Cooling Tower Retrofit

Hypothetical MDCT PM emissions were calculated as an estimated maximum rate for Unit 1 and Unit 2, and also as a function of the estimated CUR for each unit. When converted to pounds per hour (lb/hr), the maximum total PM emissions were approximately 0.9 lb/hr for each unit. The magnitude of a specific PM size (PM_{10} and $PM_{2.5}$) emissions in drift is influenced by the number and size of drift water droplets produced within the hypothetical MDCTs. The relative magnitudes of PM_{10} and $PM_{2.5}$ emissions were estimated by incorporating a drift droplet size distribution per Reisman and Frisbie (2002). The estimated PM emissions are summarized in Table 12-3 for Unit 1 and Unit 2. Detailed PM calculations are provided in Appendix 12-C.

Table 12-3. Estimated Particulate Matter Emissions Due to the Operation of the Hypothetical MDCTs

Particulate Matter Emissions	Unit 1	Unit 2
Maximum PM Emissions Rate		
Total PM (lb/hr):	0.9	0.9
Total PM (tons/year):	3.8 - 4.1	3.8 - 4.1
PM_{10} (lb/hr):	0.7 - 0.8	0.7 - 0.8
PM_{10} (tons/year):	3.1 - 3.4	3.2 - 3.4
$PM_{2.5}$ (lb/hr):	0.3 - 0.4	0.3 - 0.4
$PM_{2.5}$ (tons/year):	1.4 - 1.6	1.4 - 1.6
PM Emissions Rate Based on CUR [108,109]		

[108] CUR is the capacity utilization rate, a ratio of actual generation to generation capacity. This value has been estimated to be approximately 93.9 percent on average for Unit 1 and approximately 95.5 percent on average for Unit 2 at Point Beach Nuclear Plant (between January 2015 and December 2019), but the actual value will vary with time and generation.

[109] During the final quality assurance review, it was noted that the generation data for Units 1 and 2 were reversed for part of the data record. The actual Unit 1 CUR for the period Jan 1, 2015, through Dec 31, 2019, was 94.6 percent (as opposed to 93.9 percent used above). The actual Unit 2 CUR for the same period was 94.7 percent (as opposed to 95.5 percent used above). Given the 0.8 percent higher value for Unit 1 and 0.8 percent lower value for

Particulate Matter Emissions	Unit 1	Unit 2
Total PM (tons/year):	3.5	3.6
PM_{10} (tons/year):	2.9 - 3.2	3.0 - 3.3
$PM_{2.5}$ (tons/year):	1.3	1.4

It is important to note that the COC in Section 10 was selected based on the freshwater source. PBNP's surroundings are in attainment for all PM species[110], therefore PBNP would not need to perform a NSR; but it would need to comply with PSD (USEPA, 2020b). Figure 12-4 shows the area surrounding PBNP that could potentially be impacted by PM emissions. Population densities are shown in the background. Based on low population, overall impact to residents would likely be low. Additional modeling and evaluations would be needed to more accurately assess the potential impact area.

Unit 2, the overall impact on PBNP operations and maintenance costs and impacts remain the same. Therefore, the reports were not updated in their entirety.

[110] A portion of Manitowoc County is in nonattainment for ozone; however, cooling towers do not emit ozone.

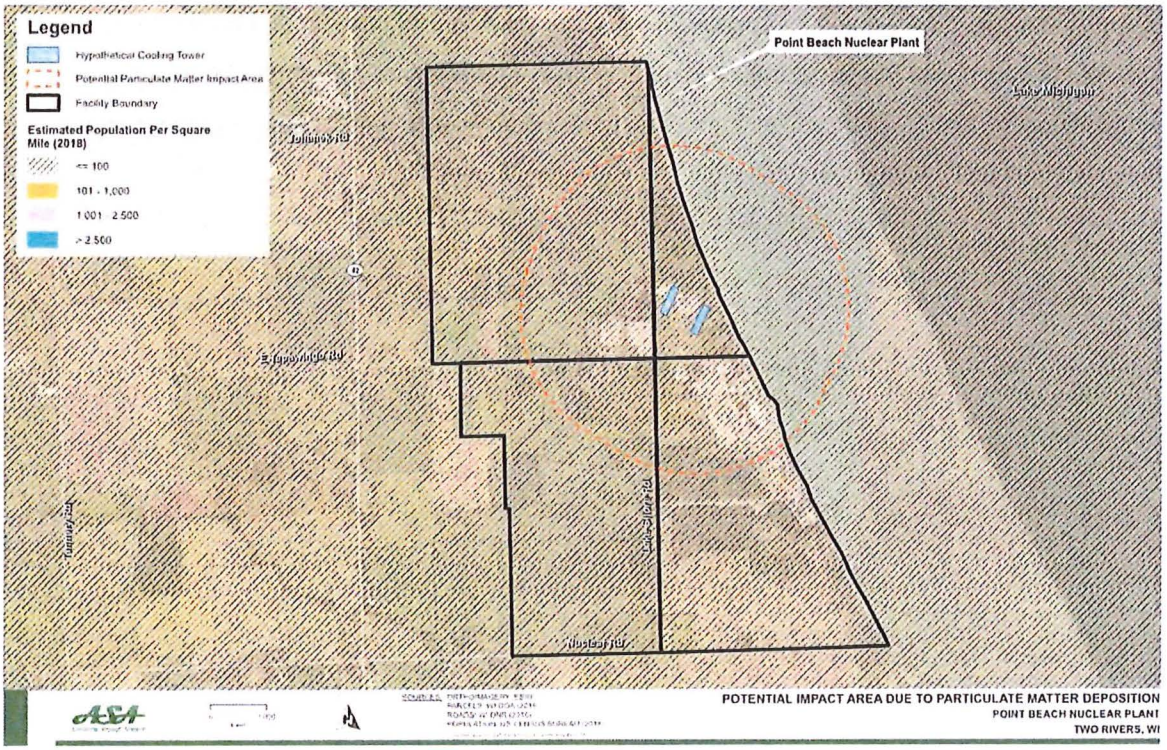


Figure 12-4. Area Potentially Impacted by PM Deposition

CO_2 Estimation Method

This section discusses the additional amount of CO_2 that would be produced as a result of the hypothetical MDCT construction and operation at PBNP. See Appendix 12-D for CO_2 emissions calculations.

Estimated CO_2 Emissions from the Cooling Tower Retrofit

CO_2 production is directly related to energy production when generated by fossil fuel-fired generators and varies with fuel type. The recurring annual energy requirement for operating the hypothetical MDCTs was previously estimated to be approximately 229,226 MWhr/year for Unit 1 and 231,277 MWhr/year for Unit 2 assuming continuous operations, or 215,137 MWhr/year and 220,855 MWhr/year when accounting for average CUR for Units 1 and 2, respectively (see Section 12.3.1.2).

Energy requirements are converted into total carbon emissions based on a carbon dioxide emission factor for RFC West Subregion. In 2018, non-baseload facilities within this subregion emitted approximately 0.91 tons of CO_2 per MWhr of energy generated (USEPA, 2020a).

This calculation incorporates the non-baseload fuel mix likely to represent the fuels used to generate the replacement energy. The maximum annual increase in CO_2 emissions due to operation of new pumps and fans, and including the backpressure energy penalty related to the operation of the cooling towers is estimated to be approximately 420,900 tons per year.

Table 12-4 presents the estimated annual quantities of CO_2 that would be emitted from fossil-fueled plants to make up for parasitic losses and the backpressure energy penalty if the hypothetical MDCTs were operated at PBNP. See Appendix 12-D for detailed CO_2 emissions calculations.

Table 12-4. Estimated CO_2 Emissions Due to the Operation of the Hypothetical MDCTs

CO_2 Emissions	Unit 1	Unit 2
Maximum CO_2 Emissions Rate (tons/year):	209,513	211,387
CO_2 Emissions Rate Based on CUR (tons/year):	196,636	201,862

During the 8-week tie-ins related downtime (estimated in Section 10), non-baseload plants in this subregion would emit approximately 1,668,050 tons of CO_2 to makeup for lost capacity at PBNP. See Appendix 12-D for detailed CO_2 emissions calculations. Summary results are presented in Table 12-5

Table 12-5. Estimated CO_2 Emissions from Non-Baseload Plants during MDCT Tie-ins Related Downtime

CO_2 Emissions	Unit 1	Unit 2
Maximum CO_2 Emissions (tons):	831,356	836,694
CO_2 Emissions Based on CUR (tons):	780,258	798,992

SO_2 Estimation Method

The SO_2 estimation method is similar to the CO_2 estimation method described above, except that the emissions factor for SO_2, which includes the impact of emissions control technologies, was used (instead of CO_2). In 2018, RFC West subregion emitted approximately 1.4 pounds of SO_2 when generating one MWhr of energy (USEPA, 2020a). See Appendix 12-E for more information on methods of estimating SO_2 emissions.

Estimated SO_2 Emissions from the Cooling Tower Retrofit

Table 12-6 presents the estimated annual quantities of SO_2 that would be emitted from non-baseloaded fossil-fueled plants to make up for parasitic losses and backpressure energy penalty if hypothetical MDCTs were operated at PBNP. See Appendix 12-E for detailed SO_2 emissions calculations.

Table 12-6. Estimated SO_2 Emissions Due to the Operation of the Hypothetical MDCTs

SO_2 Emissions	Unit 1	Unit 2
Maximum SO_2 Emissions Rate (tons/year):	164.7	166.2
SO_2 Emissions Rate Based on CUR (tons/year)	154.6	158.7

During the 8-week tie-ins related downtime, non-baseload plants in this subregion would emit approximately 1,311 tons of SO_2 to makeup for lost capacity at PBNP. See Appendix 12-E for detailed SO_2 emissions calculations. Summary results are presented in Table 12-7.

Table 12-7. Estimated SO_2 Emissions from Non-Baseload Plants during MDCT Tie-ins Related Downtime

SO_2 Emissions	Unit 1	Unit 2
Maximum SO_2 Emissions (tons):	654	658
SO_2 Emissions Based on CUR (tons):	613	628

NO_x Estimation Method

The NO_X estimation method is similar to CO_2 estimation method described above, except that the emissions factor for NO_X, which includes the impact of emissions control technologies, was used (instead of CO_2). In 2018, non-baseloaded plants in RFC West subregion emitted 1.37 pounds of NO_X per one MWhr electricity generated (USEPA, 2020a). See Appendix 12-F for calculation details.

Estimated NO_x Emissions from the Cooling Tower Retrofit

Table 12-8 presents the estimated quantities of NO_X that would be emitted by fossil-fuel power plants to make up for parasitic losses and backpressure energy penalty if the hypothetical MDCTs were operated at PBNP. See Appendix 12-F for detailed NO_X emissions calculations.

Table 12-8. Estimated NO_X Emissions Due to the Operation of the Hypothetical MDCTs

NO_X Emissions	Unit 1	Unit 2
Maximum NO_X Emissions Rate (tons/year):	156.4	157.8
NO_X Emissions Rate Based on CUR (tons/year)	146.8	150.7

During the 8-week tie-ins related downtime, non-baseload plants in this subregion would emit approximately 1,246 tons of NO_X to makeup for lost capacity at PBNP. See Appendix 12-F for detailed NO_X emissions calculations. Summary results are presented in Table 12-9.

Table 12-9. Estimated NO_X Emissions from Non-Baseload Plants during MDCT Tie-ins Related Downtime

NO_X Emissions	Unit 1	Unit 2
Maximum NO_X Emissions (tons):	621	625
NO_X Emissions Based on CUR (tons):	583	597

12.3.2.3 Impact Mitigation Methods (122.21(r)(12)(vii))

The design of this hypothetical system already assumes that the cooling towers would include the best control technology by way of drift eliminators with a 0.0005 percent drift rate.

12.3.2.4 Uncertainty

The key sources of uncertainty associated with the emissions estimates include the following:

4. PM and drift are driven by water quality, and the actual TDS concentrations may change naturally. Therefore, the PM emissions would also change. The calculation estimated high and low values to bracket the potential emissions rates.
5. Emissions factors today may not be representative of emissions in the future due to changes in fuel mix, emissions controls, etc.
6. Changes in regulations could impact emissions and or costs of trade.
7. This section provides approximate estimates of PM, CO_2, SO_2 and NO_x using energy penalty values calculated in Section 12.3.1, water quality data and emissions rates from Wisconsin and publicly available sources. Estimates provided in this report are meant to provide a sense of the increase in emissions and should not be misconstrued as permit application values. These estimates would be refined during detailed design if the hypothetical MDCT were to be determined BTA for entrainment reduction.

12.3.3 Noise (122.21(r)(12)(iii))

12.3.3.1 Description

The operation of hypothetical MDCTs could add to the noise generated at PBNP. If hypothetical cooling towers were to be installed and operated, falling water and operation of pumps, fans, and other appurtenances would create additional noise not otherwise generated at PBNP. Pile driving,

demolition, vehicular traffic, and other construction activities would also add to the noise during the construction period. The actual noise level resulting from a hypothetical cooling tower retrofit depends on the combination (superimposition) of existing noise level and the additional noise level due to the retrofit.

Depending on the sound level of the noise source, noise can be considered an annoyance to receptors nearby. For the purposes of this report, a noise source is assumed to be falling water and any equipment (e.g. fans, pumps, and related appurtenances) that generates noise at PBNP, and a noise receptor is assumed to be any point of reception (e.g., residential dwellings or business) where extraneous noise and/or vibration are perceived.

Because there are no federal regulations limiting environmental noise levels[111], the USEPA released a document that provided a basis for state and local governments' judgment in setting standards for noise levels (USEPA, 1974; USEPA, 2014). Noise exposure goals for various locations depend on the noise sensitivities of its surroundings, and areas zoned for residential use usually have more stringent noise exposure limits than industrial or agricultural areas. Similarly, specific institutions, such as places of worship, schools, hotels, hospitals, and libraries, may also have more stringent noise sensitivities.

Noise pollution can generally fall into two groups: acute sound levels that can lead to hearing impairment, and nuisance sounds that impact the well-being of surrounding communities. Acute noise (such as from construction work) is often controlled but nuisance noise is not. The USEPA states that a noise level of 55 decibels (dBA) is satisfactory in protecting the public health and welfare and does not create an annoyance in most cases[112] (USEPA, 2014).

[111] The USEPA (2017) defines its role regarding noise pollution as: "Under the Clean Air Act, the EPA administrator established the Office of Noise Abatement and Control (ONAC) to carry out investigations and studies on noise and its effect on the public health and welfare. Through ONAC, the EPA coordinated all federal noise control activities, but in 1981 the Administration concluded that noise issues were best handled at the state and local level. As a result, ONAC was closed and primary responsibility of addressing noise issues was transferred to state and local governments. However, EPA retains authority to investigate and study noise and its effect, disseminate information to the public regarding noise pollution and its adverse health effects, respond to inquiries on matters related to noise, and evaluate the effectiveness of existing regulations for protecting the public health and welfare, pursuant to the Noise Control Act of 1972 and the Quiet Communities Act of 1978."

[112] A decibel is a logarithmic unit of base 10 expressing the ratio of two physical quantity values, such as noise.

There are no statewide noise regulations applicable for the operation of PBNP. However, PBNP is subject to county noise ordinances. PBNP is located in the Town of Two Creeks, Manitowoc County.

Manitowoc County

Manitowoc County includes restrictions against loud noise at Section 14.140, which is part of Chapter 14, Offenses Against Public Policy, Safety, Morals, and Peace of the Manitowoc Municipal Code. This section of the municipal code states (Manitowoc County, 2020):

> *Whoever in a public or private place engages in or permits on premises owned or rented by such person or under the control of such person unreasonably loud noise under circumstances in which such noise tends to cause or provoke a disturbance shall be guilty of violating this section.*

12.3.3.2 Quantification

The quantification of noise levels within and outside the property would require noise propagation modeling with considerations for topography, noise level of each point source, barriers (such as buildings), and atmospheric conditions. These data are not available; therefore, noise propagation modeling was not conducted as a part of this effort.

While noise propagation modeling was not completed, the USEPA states that power plants usually do not result in off-site levels of noise more than 10 A-weighted decibels (dBA) above background[113] (USEPA, 2014). Table 12-10 lists noise level from common noise sources.

[113] A dBA is a sound level measured with an instrument in order to account for the relative loudness to a human ear.

Table 12-10. Common Noise Levels (Cowan, 1988)

Sound Source	(dBA)
Military jet, air raid siren	130
Amplified rock music	110
Jet takeoff at 500 meters	100
Freight train at 30 meters	
Train horn at 30 meters	90
Heavy truck at 15 meters	
Busy city street, loud shout	80
Busy traffic intersection	
Highway traffic at 15 meters, train	70
Predominantly industrial area	60
Light car traffic at 15 meters, city or commercial areas or residential areas close to industry	
Background noise in an office	50
Suburban areas with medium density transportation	
Public library	40
Soft whisper at 5 meters	30
Threshold of hearing	0

The USEPA further states (as cited in SPX, 2009) that a facility might expect cooling towers to have a typical noise level of approximately 70 dBA approximately 50 ft from the tower (USEPA, 2014). When started at 70 dBA, sound levels diminish approximately 5 dBA every doubled distance away from the source (Table 12-11). Therefore, a distance of 400 ft between a typical cooling tower and a residential property is sufficient to provide for natural noise abatement at most sites, and this value has been used in this evaluation (USEPA, 2014).

As Manitowoc County does not have numerical noise limits, this section compares the USEPA noise level reference of 55 dBA to typical cooling tower noise levels. A noise level of 55 dBA is

similar to the sound of rainfall or normal conversation and is not considered to be noise pollution (USEPA, 2014).

Table 12-11. Noise Level Compared to Distance

Distance from Noise Source (ft.)	Noise Level at Receptor (dBA)
50	70
100	65
200	60
400	**55**

Figure 12-5 shows the approximate hypothetical cooling tower location (Location A discussed in Section 10), and the anticipated distances to the 70 dBA, 65 dBA, 60 dBA, and 55 dBA contours. PBNP owns property surrounding the Plant, and all sound limit contours are expected to be located within the property boundaries. The sound contours extend into Lake Michigan; however that section is within the restricted navigation zone. Therefore, potential impacts on recreational users of Michigan Lake may be negligible.

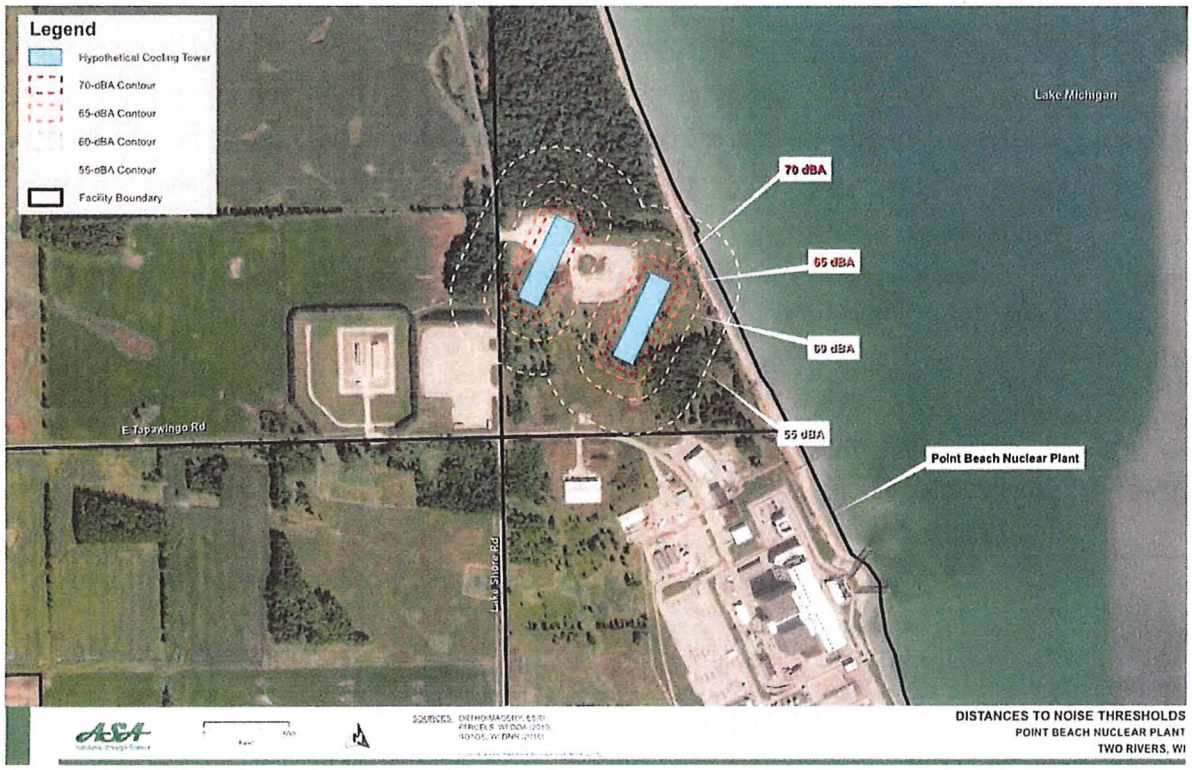


Figure 12-5. Hypothetical MDCT Location and Estimated Distances to Noise Thresholds

12.3.3.3 Impact Mitigation Methods (122.21(r)(12)(vii))

Natural attenuation of cooling tower noise appears to be sufficient to meet applicable noise requirements. If closed-cycle cooling were found to be BTA, additional noise evaluations would be performed during detailed design phase. If required, a noise barrier may be constructed to achieve compliance. This cost is not included in Section 10.

12.3.3.4 Uncertainty

Key sources of uncertainty are:

- Many factors can influence the sound perceived by noise receptors such as topography, line-of-sight, equipment location, and equipment proposed to be installed. Existing noise sources and their specific locations, and the actual sound levels generated through the use of cooling towers and received at off-site receptors are not known at this time. Superimposing cooling tower-related noise over existing noise could increase overall noise level and potentially increase mitigation costs. In the event that the hypothetical MDCTs were found to be BTA at PBNP, detailed noise studies would be conducted at higher cost.

- The noise levels quantified in Section 12.3.3.2 use the USEPA's general assumption of 70 dBA for noise generated at cooling towers. In addition, the 5 dBA reduction per doubled distance starting from 70 dBA from an initial 50 ft separation distance from the source (as presented in Table 12-11) is an approximation that assumes an open terrain between the noise sources and noise receptors and may vary depending on specific site conditions, such as orientation of the cooling towers and presence and height of buildings or other PBNP equipment.

12.3.4 Safety (122.21(r)(12)(iv))

12.3.4.1 Description

Per 40 CFR Part 122.21(r)(12)(iv), this section provides a discussion of impacts to safety at PBNP, owing to the potential for plumes, ice, and availability of emergency cooling water.

Plumes and Fogging

Evaporation from the cooling towers and high humidity in the atmosphere can produce a visible plume near cooling towers. A plume is an exhaust airstream saturated with water vapor. Depending on atmospheric conditions, the plume can condense and become visible as a fog. The plume condenses due to the cooler, ambient air not having as much moisture-assimilating

capacity (SPX, 2012). The plume is more visible during cooler conditions, when the difference between the cool, ambient atmosphere and the warm exhaust air is the greatest.

When the cooling tower plume is cooled, its buoyancy decreases. It is possible that in adverse wind conditions, the plume can remain at very low levels until dissipated, resulting in ground level fogging (SPX, 2012). Plumes and fogging have incidental consequences due to loss of visibility downwind of the towers. Loss of visibility can impact public health and safety of the surrounding area.

As described in Section 10, wind direction can change at any time. Therefore local roads within and surrounding the site could potentially be impacted during cooler months. The predominant wind direction is often seasonal. During cooler months, the predominant wind is from the south-southwest to west directions (see the discussion on wind roses in Section 10, and wind rose embedded in Figure 12-6), therefore the plume and icy conditions on Lake Michigan could get exacerbated during winter months. Major highways are more than 3 miles west of the Plant, therefore the impact of plume and ice originating at the Plant would likely be low. Lakeshore Drive, located approximately 500 ft from PBNP, could experience greater impacts owing to its proximity.

PBNP is located in a rural area and the closest public airport is Manitowoc County Airport located approximately 11 nautical miles away, and the closest private airport is Goins Airport located approximately 7.4 nautical miles away. There are also two private heliports located approximately 10 nautical miles away from PBNP. Airplanes and helicopters landing at or taking off from these airports could potentially see the PBNP MDCT plumes, but it is unlikely that they would be impacted by the plumes given the distances between the airports and PBNP. Figure 12-7 shows that there are no airports or major highways within 3 miles of PBNP.

Solar arrays are expected to be installed in several hundred acres around PBNP. Depending on the specific wind direction and specific location of the solar arrays, power generation efficiency of some arrays may be compromised because of the blockage of the sun by the MDCT plume.

Icing

Icing occurs in freezing weather when moisture from the plume of a cooling tower causes frost or ice crystals to form on nearby surfaces and/or structures. Ice within the Plant's property boundaries and on adjacent roads, transmission lines, and switchyard can potentially impact the health and safety of the public, as well as the security and reliability of the Plant. Ice impacts would likely be found in areas of the direction of the prevailing winter winds.

Potential ice could affect the State and local roadways in these areas (Figure 12-6) and present a hazard to drivers. Because the predominant wind in the winter blows from south-southwest to west directions, Lake Michigan may experience ice resulting from the cooling tower plume.

Ice can also have an adverse impact on the health and safety of personnel and security at the Plant. Ice makes walking surfaces and conditions slippery, thus increasing the potential for slips, trips, and falls related to personnel walking on ice.

12.3.4.2 Quantification

Plumes and fogging

Weather conditions recorded at Green Bay, WI (WMO Station Number 726450) were evaluated for fog conditions. Data indicates that fogging conditions[114] occur most predominantly in the summer and winter months of August, September, and December, with approximately 17.4, 12.0, and 16.1 percent, respectively, of all reported days with fog occurring within these months. However, all months experienced some level of fogging.

Installation and operation of cooling towers will likely increase the fogging incidence/duration by short periods of time (EPRI, 2011) of typical foggy days noted in Table 12-12. Figure 12-6 shows the 1-mile and 2-mile contours around the MDCTs. Not the entire area within the 1-mile and 2-mil intervals would get impacted at any one time. Depending on the wind speed, areas downwind of the MDCTs would get impact. During a light breeze, the impact area would be downwind and within the 1-mile interval; during heavy winds, the impact areas would be downwind with the plume extending to the 2-mile interval. But heavy winds would also help disperse the plume more rapidly.

[114] For the purposes of this report, fogging conditions are defined as any period of time where the presence of fog was recorded and does not include haze, smoke, dust, mist, ash, spray, or any other obscuration type.

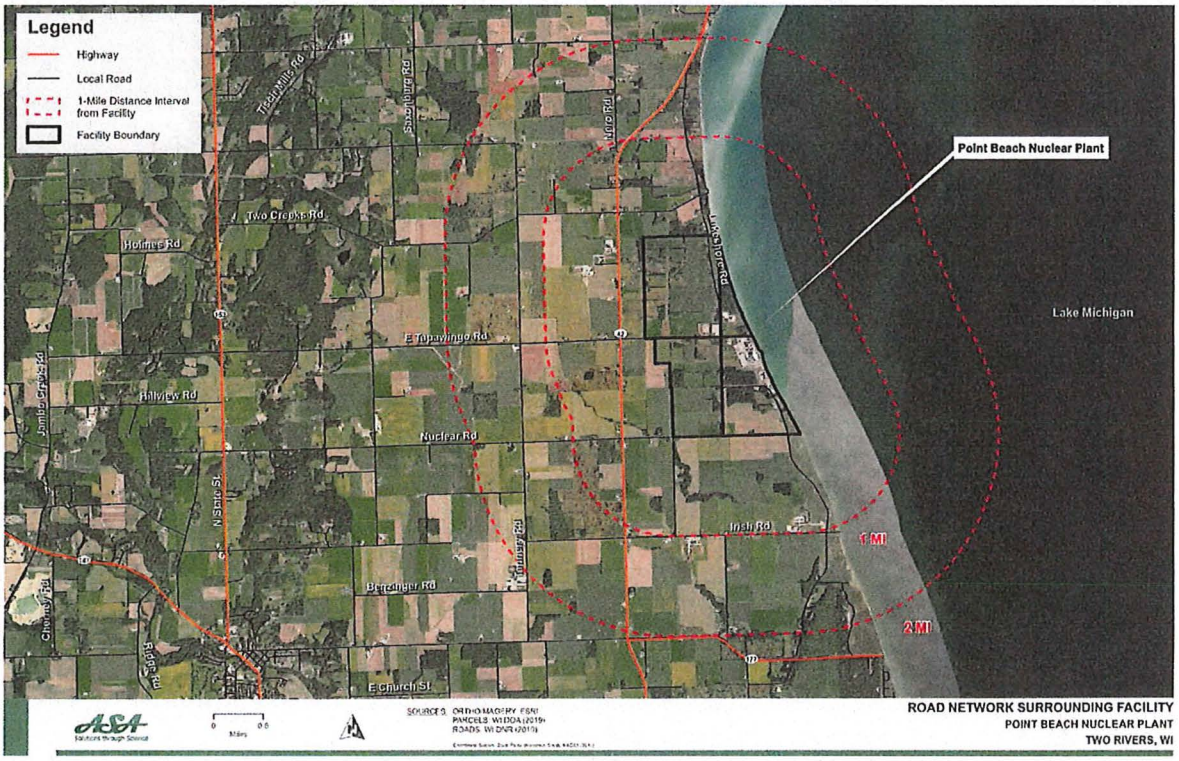


Figure 12-6. Road Network Surrounding Point Beach Nuclear Plant

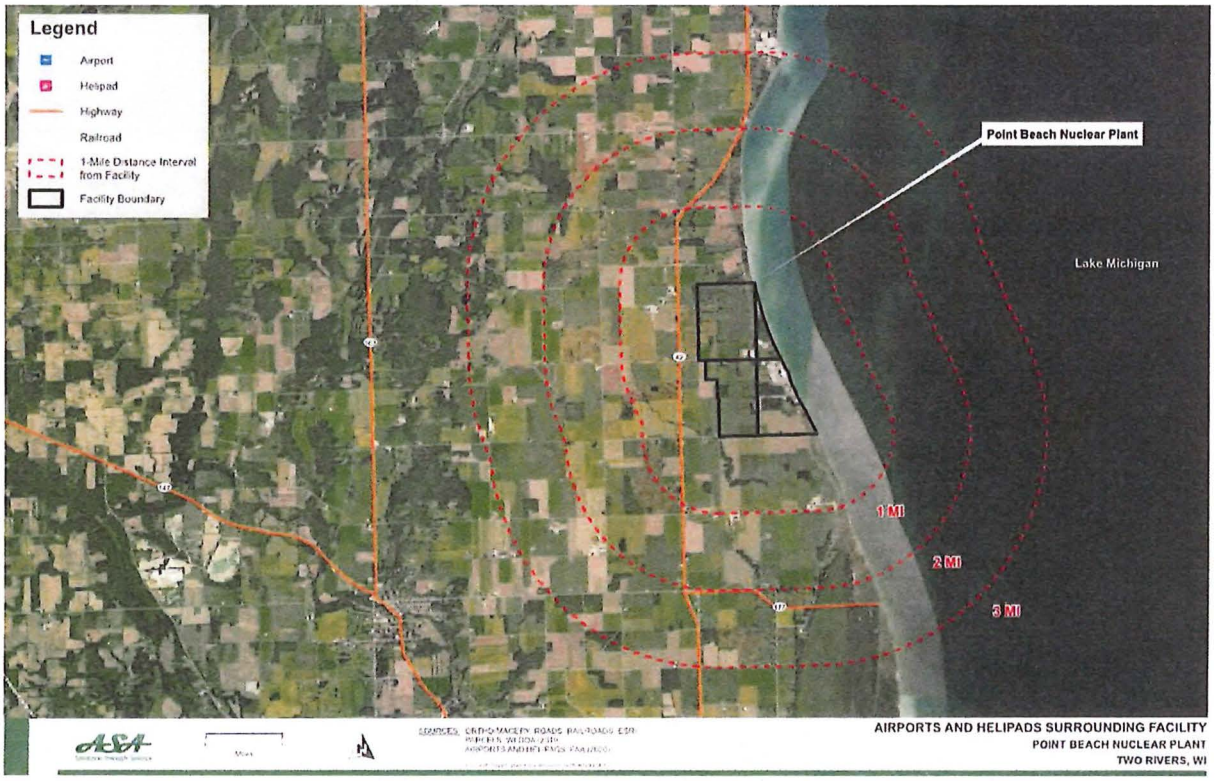


Figure 12-7. Airports, Helipads and Major Highways Surrounding Point Beach Nuclear Plant

Table 12-12. Days with Recorded Fogging Conditions at Green Bay, WI Between January 2015 and December 2019

Month	Number of Days in Record with Foggy Conditions*	Average Number of Foggy Days per Month	Percent of Total Foggy Days for Period†	Percent of Total Days in Month with Foggy Conditions
January	17	3	9.9	11.0
February	15	3	8.7	10.6
March	17	3	9.9	11.0
April	15	3	8.7	10.0
May	8	2	4.7	5.2
June	6	1	3.5	4.0
July	8	2	4.7	5.2
August	27	5	15.7	17.4
September	18	4	10.5	12.0
October	7	1	4.1	4.5
November	9	2	5.2	6.0
December	25	5	14.5	16.1
Total‡	**172**	**Average = 3**	**100**	**Average = 9.4**

Note:
*Data is assuming all incidence of fogging has been reported between January 1, 2015 and December 31, 2019.
†May include rounding errors
‡ Total number of data points (Hourly Present Weather Type) between January 1, 2015 and December 31, 2019 is 16,165.
Source: (NOAA, 2020)

Icing

The possibility for ice can be predicted with forecasted freezing temperatures in the region. Dry bulb temperatures less than 32°F at Green Bay, WI are assumed to be indicative of icy conditions at PBNP. Air temperature recorded at Green Bay, WI has been reviewed for days with a recorded minimum temperature of less than or equal to 32°F (Table 12-13).

The days with freezing temperatures recorded indicate that freezing conditions[115] occur predominantly in the months of November, December, January, February, and March, with approximately 90 percent of all reported freezing days occurring within these months. As

[115] For the purposes of this report, freezing conditions are defined as any period of time when a recorded temperature was at or below the freezing temperature of 32°F.

anticipated, there is consistent freezing in the shoulder months, and no recorded freezing conditions in the summer months of June through September.

PBNP already takes significant safety precautions during winter to prevent slipping or skidding on ice. Installation and operation of cooling towers will likely increase the ice incidents and duration on typical freezing days noted in Table 12-13 (EPRI, 2011), necessitating extending the durations when precautionary measures would be needed.

Table 12-13. Days with Recorded Freezing Conditions at Green Bay, WI Between January 2015 and December 2019

Month	Number of Days in Record with Freezing Conditions*	Average Number of Freezing Days per Month	Percent of Total Freezing Days for Period†	Percent of Total Days in Month with Freezing Conditions
January	144	29	21.0	92.9
February	131	26	19.1	92.9
March	120	24	17.5	77.4
April	51	10	7.4	34.0
May	2	0	0.3	1.3
June	0	0	0.0	0.0
July	0	0	0.0	0.0
August	0	0	0.0	0.0
September	0	0	0.0	0.0
October	18	4	2.6	11.6
November	90	18	13.1	60.0
December	131	26	19.1	84.5
Total‡	**687**	**Average = 11.5**	**100**	**Average = 37.6**

12.3.4.3 Impact Mitigation Methods (122.21(r)(12)(vii))

Because cooling towers produce a saturated plume and can increase the potential incidence of ice, MDCTs can adversely impact the health and safety of the public as well as personnel at PBNP. One potential mitigation method would be the installation of dry air-cooled condensers (ACC). However, due to insufficient space at PBNP to locate ACCs, and incompatibility of ACC design parameters with Unit 1 and Unit 2 condensers, ACCs were deemed infeasible/unnecessary for PBNP in this evaluation.

12.3.4.4 Uncertainty

The key sources of uncertainty associated with the safety evaluation include the following:

- Fogging and icing discussions were based on long-term average atmospheric data at the Green Bay weather station. Weather can be localized. The actual potential impact would need to be evaluated more closely if the hypothetical MDCTs were determined to be BTA at PBNP;

- While the wind roses provide data on long-term average wind speed and direction, specific wind speeds have not been reviewed against the number of recorded days with fogging or freezing conditions. Therefore, it is important to note that fogging or ice can occur in any direction from the Plant and will follow the prevailing wind direction at the time;

- In addition, because fogging and ice formation is dependent upon a number of atmospheric and ground conditions that can vary over a large region, it cannot be assumed that fogging and freezing conditions reported at a weather station will be representative of a location several miles away. However, fogging and freezing conditions reported at the weather station is an indicator that these conditions could potentially occur at the Plant; and,

- Past weather data may not necessarily represent the future. Occurrence of fogging or freezing conditions may be significantly higher or lower than presented within this evaluation.

12.3.5 Plant Reliability (122.21(r)(12) (v))

12.3.5.1 Description

Plant reliability refers to instances when PBNP can or cannot produce power when its regional transmission organization requires it to provide power. The hypothetical MDCTs used in this evaluation have been designed for the upper 99th percentile wet-bulb temperature obtained from the World Meteorological Organization (WMO) meteorological data station in Green Bay, WI, (WMO Station No. 726450; WMO, 2020), which explicitly means that the cooling towers would not be fully available, on average, for one percent of the time. Each year, for approximately 88 hours with the highest wet-bulb temperatures, PBNP may need to be de-rated. The highest

percentile wet bulb temperature occurs during the late afternoons in July or August when the electricity demand is at its annual peak.

For the duration of the tie-ins related outage, both units would be unavailable to generate and supply the grid; this could impact the reliability of the grid.

Additionally, warm water recirculation during winter months is critical for reliable operation of the intake structure. As discussed in Section 10, the estimated total maximum blowdown rate for the two hypothetical MDCTs would be approximately 3,200 gpm; even if the blowdown were from the hot side, this flow rate would be insufficient to control ice at the intake. The existing crib would not be used during normal operations, but is expected to be maintained for potential bypass or emergencies. Loss of sufficient warm water would challenge appropriate maintenance of the crib during winter months; the intake structure itself could also freeze in the absence of additional warm water. All this would erode system reliability. As discussed in Section 10, the closed-cycle system could potentially be modified to route larger quantities of warm water to the crib and the intake structure. The implications to cycles of concentration and the additional cost of piping and modifications were not included in the evaluation.

12.3.5.2 Quantification

Based on the design parameters, PBNP would need to de-rate for approximately 88 hours[116] per year during the warmest and most humid periods. The actual magnitude of the percent reduction in power would depend on specific meteorological conditions.

Assuming a 20 percent de-rate for 88 hours per year amounts to approximately 21,900 MWhr[117] in annual lost generation for PBNP due to the retrofit of the hypothetical cooling towers (see Appendix 12-B).

The MDCT tie-ins related outage would result in a 30,000 MWhr energy loss per day, and 1,800,000 MWhr energy loss total to the grid; as discussed above, it is likely that this loss would be made up by fossil-fueled peaking units.

[116] Assuming 100 percent utilization.
[117] This is equivalent to the annual power consumption of approximately 2,100 homes, assuming 10.4 MWhr average consumption reported by EIA (2018).

Quantifying the reduction in PBNP reliability due to lack of warm water to the crib and intake is beyond the purview of this study.

12.3.5.3 Impact Mitigation Methods (122.21(r)(12)(vii))

Designing the cooling towers for the maximum ambient wet bulb temperature (with an allowance for recirculation) would decrease the likelihood of de-rating PBNP, but such towers would be significantly costlier and would require a larger footprint. The higher parasitic loss would likely eliminate any gains to PBNP. This evaluation, therefore, does not assume that the cooling towers would be upsized compared to the criteria presented in Section 10.

The evaluation assumed that a hypothetical MDCT tie-in would be coordinated with Midcontinent ISO West subregion to minimize the potential impact/instability due to the generation drop at PBNP. PBNP could schedule the tie-in outage for the fall or spring, which this evaluation has attempted to do, to reduce the potential impact[118], however, PBNP cannot mitigate for the loss of generation.

Additional modifications to hot water piping to enable routing of larger quantities of hot water to the crib and intake structure during winter months could help improve the reliability of the system during winter months. These modifications were not evaluated here; nor were their costs included in Section 10. Such modifications would add to the costs and or make the retrofit further infeasible.

12.3.5.4 Uncertainty

Key uncertainties with the reliability evaluation include:

- The conceptual design used the 99th percentile wet bulb temperature, which means that the actual wet bulb temperature would exceed the design value approximately one percent of the time each year, but this is a long-term indicator. There may be some years when the actual wet bulb temperature would not exceed the design value, and other years when it is exceeded more frequently.

[118] Generally winter and summer electricity demands are higher than fall and spring electricity demand.

- This evaluation assumes that the demand for electricity would remain approximately the same. If the demand increases or decreases differently from the present forecast, or if one or more regulations were to cause several power plants to operate differently, the actual impacts could be different than discussed above.
- Equipment (mechanical/electrical) failure could further reduce facility reliability.
- The evaluation has attempted to schedule the tie-in outage for September and October of 2026 to minimize the impact. But the actual tie-in related outage, if the MDCT were found to be entrainment BTA, would depend on construction work flow. Summer or winter-time outage would result in greater impact to the grid. A longer tie-in outage or unanticipated additional outages would also result in greater impacts.
- The loss in reliability of the cooling system (which includes the service water system) stemming from the lack of warm water recirculation was not evaluated.

12.3.6 Consumptive Water Use (122.21(r)(12)(vi))

12.3.6.1 Description

Changes in the consumption of water are primarily attributable to the difference between evaporative losses from once-through cooling and CCRSs. Evaporation occurs naturally in surface waterbodies and is affected by the stored energy in water. A number of variables factor into surface water evaporation, including incoming solar radiation, ambient water temperatures, and psychrometric[119] and atmospheric conditions at the location. When heated water is discharged to a surface waterbody, the evaporation rate in the waterbody is increased because of the added heat (measured in British thermal units, Btu). The increase in evaporation due to the thermal discharge is referred to as forced evaporation, and depends directly on the additional heat being routed to the receiving waterbody. The additional heat added to the waterbody can be estimated using both the temperature differential across the condenser and the condenser water flow rate.

[119] Psychrometrics is the field of study relating to physical and thermodynamic properties of gas-vapor mixtures. Typical psychrometric parameters include dry-bulb, wet-bulb, and dew point temperatures.

Evaporation is also the cooling mechanism utilized by cooling towers, where a small amount of water (relative to the volume of a once-through cooling withdrawal), is consumed through evaporation to cool the water circulating through the cooling towers. The flow rate through the cooling towers and the difference in cold and hot water temperatures are the primary functions relating to cooling tower evaporation.

12.3.6.2 Quantification

Forced Evaporation

The forced evaporation due to the thermal discharge from once-through facilities has been estimated using the Edinger-Geyer Method[120]. A series of papers by Edinger and Geyer presented a consumptive water loss estimation method based on a basic heat budget (Maulbetsch and DiFilippo, 2008; Davis, 1979; USEPA, 2008). The heat removal rate of circulating water from condensers is a function of the quantity and temperature of the condensed steam and the condenser efficiency.

Heat exchange between a waterbody and the atmosphere is governed by atmospheric radiation, conduction, convection, and evaporation (Solley *et al.*, 1998). The majority of heat loss from a waterbody is through evaporation, which is dependent upon the latent heat of evaporation. The forced evaporation rate (*Eq. 12-1*) induced by a thermal discharge is calculated by multiplying a facility's heat rejection rate (*Eq. 12-2*) by an evaporative loss coefficient. Edinger and Geyer (1965) developed the method to calculate the evaporative loss coefficient (*Eq. 12-3Eq. 12-3*). The formulae and variables are included as follows:

$$EE = H_r \times C \qquad \textit{Eq. 12-1}$$

Where,

EE = Forced Evaporation, cubic feet per second (cfs)

H_r = Heat Rejection Rate, Btu/hr

C = Evaporative Loss Coefficient due to Thermal Discharge, cfs/10^9 Btu/hr

[120] The Edinger-Geyer Method terms Forced Evaporation as "in-stream evaporative water loss". The term Forced Evaporation is being used in lieu of the Edinger-Geyer terminology to be consistent within this document.

$$H_r = \rho \times Q \times c \times \Delta T$$ ***Eq. 12-2***

Where,

ρ = Density of Water, lbm/ft^3 (Approximate value of 62.37 lbm/ft^3 was used)

Q = Design Circulating Water Flow Rate, cfs

c = Specific Heat of Water, Btu/lbm/°F (Approximate value of 1 Btu/lbm/°F was used)

ΔT = Temperature Differential across the Condenser, °F (constant for specific generating unit)

$$C = \left(\frac{4450}{L}\right)\frac{B(K - 15.7)}{(0.26 + B)K}$$ ***Eq. 12-3***

Where,

L = Latent Heat of Vaporization, $L = 1093 - 0.56T_s$

B = Slope of Saturated Water Vapor Pressure, mmHg/°F

$B = 0.255 - 0.0088T + 0.000204T^2$

K = Surface Heat Exchange Coefficient, Btu/ft^2/°F, $K = 15.7 + (B + 0.26)f(u)$

T = Temperature Function, $T = {}^1/_2\,(T_s + T_d)$

T_d = Dew Point Temperature, °F

T_s = Background Temperature of Receiving Waterbody, °F

f(u) = Function of Wind, $f(u) = 70 + 0.7u^2$

u = Wind Speed, mph

This method has been tested and applied at several facilities in Pennsylvania that use freshwater. The results have been checked against benchmarks in power industry literature (EPRI, 2011). The key data used for calculating the heat rejection rate was the circulating water flow rate and condenser temperature rise during a given time interval.

The below forced evaporation values have been calculated using meteorological data for the period January 2015 through December 2019. See Appendix 12-G for engineering calculations. The average PBNP capacity utilization rates for Unit 1 and Unit 2 are estimated to be 94.6 percent and 94.7 percent, respectively. Actual forced evaporation rates may be lower or higher than values presented in Table 12-14 and Table 12-15. To be consistent, the cooling tower evaporation calculations in the next section also use these design conditions.

Table 12-14. Estimated Monthly Forced Evaporation at Point Beach Nuclear Plant Unit 1 Assuming Meteorological Conditions Between January 2015 and December 2019, and Maximum Thermal Discharge Rate for Design and Actual Flow Conditions

Month	Design Flow		Actual Flow	
	Maximum Evaporation Rate[121] (MGD)	Average Evaporation Rate (MGD)	Maximum Evaporation Rate (MGD)	Average Evaporation Rate (MGD)
January	5.24	5.02	3.38	3.26
February	5.26	5.06	3.39	3.28
March	5.22	4.99	3.47	2.73
April	5.52	4.01	3.89	2.97
May	4.49	4.21	4.49	4.16
June	5.29	4.83	5.29	4.83
July	5.72	4.29	5.72	4.29
August	5.90	4.43	5.90	4.43
September	5.26	4.02	5.26	4.02
October	4.76	3.14	4.76	2.83
November	3.74	2.81	3.74	2.77
December	4.52	3.28	3.46	2.61

[121] Maximum evaporation rate is the maximum value in a particular month over the several years of record; the average is the average over the many years on record for that month.

Table 12-15. Estimated Monthly Forced Evaporation at Point Beach Nuclear Plant Unit 2 Assuming Meteorological Conditions Between January 2015 and December 2019, and Maximum Thermal Discharge Rate for Design and Actual Flow Conditions

Month	Design Flow		Actual Flow	
	Maximum Evaporation Rate (MGD)	Average Evaporation Rate (MGD)	Maximum Evaporation Rate (MGD)	Average Evaporation Rate (MGD)
January	5.03	4.82	3.21	3.10
February	5.08	4.87	3.24	3.13
March	5.19	4.87	3.37	2.93
April	5.22	3.80	3.49	2.87
May	3.94	3.60	3.81	3.57
June	4.37	4.24	4.36	4.24
July	4.93	3.64	4.93	3.64
August	4.88	3.80	4.88	3.80
September	4.61	3.48	4.61	3.48
October	3.93	2.08	3.93	1.73
November	3.61	2.51	3.50	2.49
December	4.73	3.14	3.21	2.52

Cooling Tower Evaporation

MDCTs are evaporative-type towers[122], which utilize evaporation as the primary means of cooling. The cooling tower evaporative water loss, as a result of the cooling effect, is governed by latent heat transfer and the direct contact of water and air in the tower. This direct contact is designed to expose a maximum amount of water surface to a maximum flow of air for the greatest amount of heat transfer with respect to structural and operational feasibilities (SPX, 2009). Thus, the rate of evaporation (*Eq. 12-4*) and other water losses can be estimated using the following formulae and variables[123].

$$E = 0.0008 \times R \times Q_{CT}$$ ***Eq. 12-4***

[122] Other types of towers include dry towers where heat is transferred directly to the atmosphere through dry surface fins; there is no direct contact between air and water (SPX, 2009).
[123] The formulae and variables are detailed in SPX (2009).

Where,
E = Rate of Evaporation, gpm
R = Condenser Range, °F
Q_{CT} = Cooling Tower Water Flow Rate, gpm

Drift is a water loss and occurs as circulating water, in the form of liquid droplets, becomes entrained in the exhaust air stream (SPX, 2009) (*Eq. 12-5*).

$$D = DE \times Q_{CT}$$ ***Eq. 12-5***

Where,
D = Drift Flow Rate, gpm
DE = Drift Eliminator Efficiency, %

Blowdown is the water discharged from the system to control the concentrations of salts and other impurities in the circulating water and is a function of evaporation, COC, and drift (SPX, 2009) (*Eq. 12-6*).

$$B = \frac{(E - [(C-1) \times D])}{(C-1)}$$ ***Eq. 12-6***

Where,
B = Blowdown Flow Rate, gpm
C = Cycles of Concentration

Make-up water is the water that is needed to replenish the circulating water due to losses from evaporation, blowdown, and drift.

$$M = E + B + D$$ ***Eq. 12-7***

Where,
M = Make-up Flow Rate, gpm

Using the aforementioned equations, evaporation from the hypothetical MDCT at PBNP has been estimated at 6,605 gpm for Unit 1 and 6,673 gpm for Unit 2, drift from the hypothetical MDCTs would be approximately 1.9 gpm per tower; these values are presented in Table 12-16. The total blowdown rate for the hypothetical MDCTs would be approximately 3,316 gpm, and total make-up water withdrawal rate would be approximately 16,597 gpm. See Appendix 12-H

for engineering calculations. The cooling tower evaporation is compared to the forced evaporation in the following section.

Table 12-16. Estimated Cooling Tower Evaporation, Drift, Blowdown, and Make-up Rates for Point Beach Nuclear Plant

Estimated Water Flow Rates		*Units*	Hypothetical MDCTs	
			Unit 1	Unit 2
Cooling Tower Evaporation Rate	E	gpm	6,605	6,673
Drift Flow Rate	D	gpm	1.9	1.9
Blowdown Flow Rate	B	gpm	1,649	1,666
Make-up Flow Rate	M	gpm	8,256	8,341

Change in Consumptive Water Use

Cooling towers, as part of closed-cycle cooling, use evaporation as the main cooling method; therefore, the consumptive use of water is typically higher compared to that of forced evaporation resulting from once-through cooling. The increase in evaporation due to the closed-cycle retrofit is estimated as the percent increase in evaporation compared to the anticipated forced evaporation rate from PBNP (as shown in *Eq. 12-8*).

$$Increase\ in\ Evaporation = \frac{CT\ evap - Forced\ evap}{Forced\ evap} \times 100 \qquad \textbf{Eq. 12-8}$$

The increase in evaporation due to a closed-cycle cooling tower retrofit is presented in Table 12-17. Cooling tower evaporation for PBNP has been estimated to increase by between 76 and 232 percent for each unit.

Table 12-17. Hypothetical Increase in Evaporation if Point Beach Nuclear Plant were Converted to MDCTs, using Meteorological Conditions for the Period January 2015 Through December 2019

Month	Unit 1			Unit 2		
	Forced Evaporation (MGD)	MDCT Evaporation (MGD)	Percent Increase (%)	Forced Evaporation (MGD)	MDCT Evaporation (MGD)	Percent Increase (%)
January	3.3	9.1	179%	3.1	8.6	179%
February	3.3	9.1	176%	3.1	8.6	176%
March	2.7	7.2	165%	2.9	7.7	162%
April	3.0	7.1	140%	2.9	7.0	142%
May	4.2	8.5	105%	3.6	7.3	105%
June	4.8	8.5	76%	4.2	7.5	76%
July	4.3	8.5	97%	3.6	7.3	101%
August	4.4	8.5	92%	3.8	7.3	92%
September	4.0	8.4	110%	3.5	7.4	112%
October	2.8	7.1	151%	1.7	4.8	180%
November	2.8	8.2	197%	2.5	7.4	198%
December	2.6	8.7	232%	2.5	8.4	232%

Even though the use of the hypothetical MDCTs would increase evaporation in all months of the year, the total water withdrawn from Lake Michigan would decrease in each month.

Percent Reduction of Water Withdrawal

The potential use of the hypothetical MDCTs at PBNP would no longer require the existing withdrawal volume of once-through water from Waters of the United States; instead, a smaller volume of make-up water would be withdrawn to replenish evaporative, blowdown, and drift losses.[124]

> Because make-up water would be withdrawn from the source waterbody after the hypothetical MDCTs come online, this flow rate can be subtracted from the existing withdrawal rate to find the potential reduction in water withdrawal if PBNP were converted to a CCRS (*Eq. 12-9*).

[124] The existing once-through flow rate would be assumed to be the same flow requirement for circulating water and service water.

$$Q_R = Q_O - M \qquad \textit{Eq. 12-9}$$

Where,

Q_R = Water Withdrawal Reduction, gpm

Q_O = Once-Through Flow Rate, gpm

M = Water Withdrawal Rate in Hypothetical CCRS Retrofit, gpm

The potential reduction in water withdrawal can be expressed as a percent when compared to the once-through flow rate (*Eq. 12-10*).

$$PR = \frac{Q_R}{Q_O} \times 100 \qquad \textit{Eq. 12-10}$$

Where,

PR = Percent Reduction, %

Based on the results of the estimated cooling tower evaporation in Table 12-16, the reduction in water withdrawal due to a hypothetical cooling tower retrofit is presented in Table 12-18.

Table 12-18. Estimated Percent Reduction in Water Use

Estimated Reduction		*Units*	Unit 1	Unit 2
Once-Through System Water Withdrawal Rate	Q_O	gpm	373,584	377,416
Make-up Water Withdrawal Rate	M	gpm	8,256	8,341
Reduction in Cooling Water Withdrawal Rate	Q_R	gpm	365,328	369,075
Percent Reduction in Cooling Water Withdrawal Rate	PR_c	%	97.8%	97.8%
Percent Reduction in Water Withdrawal Rate	PR_t	%	95.5%	95.5%

The potential reduction in water withdrawal rate if the hypothetical MDCTs were constructed and operated as compared to the operation of PBNP under existing conditions would be approximately 95.5 percent; this value incorporates cooling water and service water flows. The potential reduction in cooling water withdrawal rate compared to current once-through cooling water flow rate would be approximately 97.8 percent.

12.3.6.3 Impact Mitigation Methods (122.21(r)(12)(vii))

Evaporation is critical to the cooling process in a MDCT; therefore, mitigation measures that would reduce evaporative losses would not be incorporated into a potential design for the use of MDCTs.

12.3.6.4 Uncertainty

Key uncertainties associated with evaporation are listed below:

- Actual evaporation rates are dependent on psychrometrics and ambient conditions at any given time. Local meteorological conditions can influence evaporation characteristics.
- The forced evaporation estimation method assumed a well-mixed thermal discharge. It is unknown if the Plant's existing once-through discharge conforms to the characteristics of that assumed in the calculation.

12.4 Fine-Mesh Screens

As discussed in the Section 10 and 11 reports, 0.5-mm mesh would likely be needed to effectively exclude eggs and larvae entrainment at PBNP. The Section 10 analysis found that it would be necessary to build a new expanded intake structure upstream of the existing structure and install 0.5-mm fine-mesh modified traveling water screens (MTWS) to operate at least seasonally; the expanded intake with additional fine-mesh MTWS would help maintain through-screen velocity (at most 2 fps). It was also found that fine slot wedgewire screens were infeasible due to issues of reliability related to head loss through the system. Therefore, adoption of fine-mesh MTWS as the hypothetical approach to FMS is an accommodation to improve facility reliability and safety. See the discussion in Section 10 for additional information. This section discusses the change in energy use, change in emissions, safety, noise, and plant reliability.

12.4.1 Energy Consumption (122.21(r)(12)(i))

12.4.1.1 Description

A fine-mesh MTWS retrofit would increase the energy requirements of the Plant both directly and indirectly. Per the discussion in Section 10, a mesh size of 0.5-mm has been selected for evaluation at PBNP.

The new fine-mesh MTWS and a fish return system upstream of the existing structure would require the continuous or near-continuous operation of the fine-mesh screens, low-pressure screen wash system to wash off aquatic organisms and a high-pressure screen wash system to clean screens whenever the fine-mesh screens are in place. The existing coarse-mesh traveling water screens would continue to operate as before. The operation of these additional equipment would increase the system's power consumption.

12.4.1.2 Quantification

The incremental annual energy usage for the new MTWS configuration was estimated to be 1,301 MWhr. Both the facility level cost and social cost associated with potential changes in energy consumption are reported in the Section 10. Unless both units are in outage, all screens would need to be operated. Given the low likelihood of both units being in an outage, the

evaluation assumes that all screens would be operated continuously or near-continuously. This additional energy draw would commence in September 2027 and terminate in March 2053.

Table 12-19. Increase in Energy Use Due to a Fine-Mesh Traveling Water Screen Retrofit

Hypothetical Fine-Mesh MTWS	Unit 1	Unit 2	*Units*
Total Increase in Annual Energy Use	651	651	MWhr/year

12.4.1.3 Impact Mitigation Methods (122.21(r)(12)(vii))

Use of variable speed motors for MTWS, which is incorporated into the design, would help reduce the additional energy consumption. Regular maintenance and inspection of spray wash nozzles, which are also incorporated into the design, would help reduce nozzle clogging and over-working the spray wash system. Both of these mitigation measures are already incorporated into the conceptual design in Section 10; therefore, no additional mitigation measures are included.

12.4.1.4 Uncertainty

PBNP experiences significant debris loading. The evaluation presented in Section 10 recommended further evaluations to characterize the type, size, and volume of debris at PBNP to assess the feasibility of installing fine-mesh MTWS and potential impacts on Plant operations. Depending on those findings, the MTWS may need to be rotated slower or faster, and spray washes may need to operate more or less frequently. Any change in the actual operating mode that deviates from the scenario assumed in this report would change the actual energy needs.

12.4.2 Air Pollutant Emissions, Environmental Impacts and Human Health (122.21(r)(12)(ii))

12.4.2.1 Description

The increase in energy use to operate the fine-mesh MTWS would result in a corresponding increase in combustion emissions offsite. In addition, offsite non-baseload facilities would need to makeup generation lost at PBNP when its two units need retrofit/tie-in downtime. This section estimates the increase in emissions associated with downtime and increase in power consumption.

12.4.2.2 Quantification

Annual increase in CO_2, NO_X and SO_2 emissions from operating fine-mesh MTWS in addition to the existing coarse-mesh traveling water screens is provided in Table 12-20, and has been estimated using methods discussed in Section 12.3.2. Engineering calculations are provided in Appendices 12-I, 12-J, and 12-K.

Table 12-20. Estimated Increase in Emissions Due to the Hypothetical Fine-Mesh MTWS Retrofit at Point Beach Nuclear Plant Unit 1 and Unit 2

Emissions Increase Due to Fine-Mesh MTWS Installation	Unit 1	Unit 2	
Annual CO_2 Emissions Increase	595	595	tons per year
Annual SO_2 Emissions Increase	0.47	0.47	tons per year
Annual NO_X Emissions Increase	0.44	0.44	tons per year

As discussed in Section 10, PBNP will need 7 months of outage to construct and tie-in the new expanded intake structure. During that time, non-baseload plants would need to makeup generation lost at PBNP. These emissions are summarized in Table 12-21.

Table 12-21. Estimated Emissions During the Hypothetical Fine-Mesh MTWS Retrofit Downtime

Emissions Due to Fine-Mesh MTWS Related Downtime	Unit 1	Unit 2	
CO_2 Emissions	2,909,746	2,928,429	tons
SO_2 Emissions	2,287	2,302	tons
NO_X Emissions	2,173	2,187	tons

12.4.2.3 Impact Mitigation Methods (122.21(r)(12)(vii))

Mitigation measures discussed in Section 12.4.1.3 apply here as well. Optimal use of power would facilitate reductions in emissions.

12.4.2.4 Uncertainty

Key sources of uncertainty include:

- Current emissions factors may not be representative of emissions in the future due to changes in fuel mix, emissions controls, etc.
- Changes in regulations may impact emissions and/or costs of trade.

12.4.3 Noise (122.21(r)(12) (iii))

Owing to additional pumps and fine-mesh MTWS at the existing CWIS, the operation of fine-mesh MTWS would increase the noise level at the site. It is unlikely that the increase in noise would have any off-site effects given the location of the existing and expanded intakes with respect to existing Plant surroundings, so potential noise impacts due to the fine-mesh MTWS retrofit are not discussed further.

12.4.4 Safety (122.21(r)(12) (iv))

The fine-mesh MTWS are assumed to be rotated and cleaned continuously or near-continuously to avoid excessive debris loading which could trigger a potential screen collapse. Constructing an expanded intake upstream of the existing intake and installing fine-mesh MTWS in the outer intake per se is not expected to substantially impact the safe operation of PBNP, or the safety of plant personnel or surroundings.

The existing spray wash pumps are installed in the service water bay, which is chlorinated. Use of chlorinated spray wash water helps keep screens clean, allowing unimpeded water flow to circulating water pumps and service water pumps. The fish return system would necessitate the spray wash water to take suction from an unchlorinated bay. In addition to the increased cost, use of unchlorinated water could potentially reduce the cleaning ability of the spray wash system. The service water system is nuclear safety related. Any compromise of water flow to the service water bay could impact plant safety and is viewed as unacceptable to PBNP and the NRC.

12.4.5 Plant Reliability (122.21(r)(12) (v))

Plant reliability refers to instances when PBNP can or cannot produce power when its regional transmission organization requires it to provide power. Even with continuous or near-continuous MTWS rotation, debris from Lake Michigan could potentially impact plant operations and impacts can be exacerbated when MTWS are equipped with fine-mesh[125]. If water is unable to flow through the MTWS or if MTWS are structurally damaged or collapse due to large differential pressures from clogging and blinding, the Plant's reliability could be adversely

[125] Retrofit with 0.5 mm fine-mesh would reduce the aperture of mesh opening from 90.7 mm^2 (i.e., $(3/8\ in)^2 * (25.4\ mm/in)^2$) to 0.25 mm^2 (i.e., 0.5 mm x 0.5 mm) or a reduction of 99.7%. Such a reduction will greatly increase the probability of plugging the aperture. It is this same reduction in aperture that excludes (and potentially protects) eggs. While the smaller aperture is effective at excluding eggs, it is inefficient at managing debris.

impacted. The existing coarse-mesh traveling water screens that are assumed to remain in place would mitigate impacts to a great degree. Cooling system-related impacts to reliability stem from unplanned reduction or complete loss of cooling water, which could occur due to:

- Damage to the traveling water screens and/or their supporting structures;
- Loss of nuclear safety-related cooling water;
- Pump cavitation;
- Damage to circulating water pumps due to the debris; or
- Clogging of condenser tubes.

Florida Power & Light Company, a subsidiary of NextEra Energy, Inc., has experience with screen collapses and pump damage due to excessive debris loading at one or more facilities along the Florida East Coast; all those traveling water screens had coarse mesh. Retrofitting to fine-mesh MTWS could exacerbate the failure possibility. Therefore, understanding the potential for fine-mesh MTWS to affect the CWIS performance and PBNP reliability is of great importance. Fine debris could clog the MTWS; larger debris and trash could cut through the fine-mesh.

> A key element of the hypothetical fine-mesh MTWS retrofit is the installation and operation of two sets of traveling water screens in series to provide for redundant debris control. This is the configuration used at Tampa Electric's Big Bend facility (Big Bend) for its Units 3 and 4. A key aspect of the fine-mesh traveling water screens at Big Bend is that the mesh is very light (i.e., nylon mesh) so that under heavy debris loading, the mesh fails, allowing water to pass downstream to the coarse mesh traveling water screens and the cooling system[126]. Therefore, coarse mesh traveling water screens provide protection for the cooling system while the fine-mesh traveling water screens do not have the strength to bear substantial blockage and the resulting attenuation of cooling water to the pumps and condensers.
>
> While the conceptual design employed at PBNP in Section 10 attempts to capture these elements, achieving such a balance at PBNP to ensure debris control and facility reliability would require careful design and pilot testing. As noted in Section 10, because of prior experience with debris-related intake failure, NextEra is very concerned about the issue of cooling system reliability relative to fine-mesh deployment and it could not commit to its use at PBNP until reliability is demonstrated. While the fine-mesh MTWS defined in Section 10 has been considered as a reasonable model to estimate the costs and benefits of such a system, given its setting in Lake Michigan, NextEra considers the fine-mesh MTWS configuration presented in Section 10 to be

[126] Big Bend's NPDES permit allows for operation of the units with the fine-mesh traveling water screens in mesh failure mode up to a certain frequency and subject to reporting.

"first in kind" at a NextEra plant and "first in kind" in Wisconsin or Lake Michigan. Additional study could find this configuration to be either infeasible at PBNP due to unreliability, or improving reliability may cost significantly more than estimated in Section 10.

Generating units need maintenance outages. The regional transmission organization allows for rotations of maintenance outages. PBNP units are rated for over 1,200 MW. It could potentially be challenging to have both units in outage for 7 months. Significant additional coordination would be needed to maintain grid reliability during the fine-mesh retrofit outage. Similar to the discussion in Section 12.3.5, the fine-mesh retrofit-related tie-in would result in approximately 30,000 MWhr generation loss (supply to the grid) per day and approximately 6,300,000 MWhr supply loss over the 7-month outage period. The fine-mesh retrofit-related outage is assumed to occur in March and April 2026 and April through August of 2027. Midcontinent ISO West may be challenged to makeup this significant electricity loss during summer months.

12.4.6 Consumptive Water Use

A hypothetical retrofit from coarse-mesh screens to fine-mesh MTWS would not impact the Plant's consumptive use of water. Therefore, this is not discussed further.

12.5 Alternate Water Sources

The evaluation in Section 10 found no viable alternate water sources within a 5-mile radius. The following is a brief description of the results of the water source evaluation.

If the use of an alternate water source (whether groundwater or reclaimed water) were viable, then energy consumption would increase owing to additional pumping, and emissions would increase correspondingly. Depending on PBNP's dependence on the alternate water source and fraction of water provided by the alternate source, the reliability of PBNP operations could also be compromised.

12.6 Other Technologies

12.6.1 Winter Flow Reduction and Warm Water Recirculation

PBNP already employs flow reduction and water recirculation in the winter season, which can reduce withdrawals by approximately 20 percent. Therefore, there would not be any additional impacts if this technology were determined to be BTA.

12.6.2 Variable Speed Pumps

The evaluation in Section 10 found that variable speed pumps would not reduce flow or entrainment at PBNP in a meaningful way. Therefore, potential impacts are not discussed.

12.7 Summary of Plant Findings

Key findings from Section 10 and Section 12 evaluations are summarized in Table 12-22. Impacts of the technologies reviewed are summarized in Table 12-23 and Table 12-24.

Table 12-22. Summary of Findings

Technology	Hypothetical Mechanical Draft Cooling Towers	Fine-Mesh Modified Traveling Water Screens
Anticipated Year when Commissioned	November 2026	September 2027
Anticipated Outage	Yes, 8 weeks in Sep-Oct 2026 outage/downtime. Outage duration is highly uncertain given challenges inherent in the construction.	Yes, 7 months (in March-April 2026, and April – August 2027). Outage duration is highly uncertain given challenges inherent in the construction.
Capital Costs (in 2020 $M)	$630	$148
Annual Operational and Maintenance Costs (in 2020 $M)[127]	$5 – non-electricity $39.3 - electricity	$0.78 – non-electricity $0.11 - electricity[128]
Parasitic (and Backpressure) Energy Losses (MWhr/year)[129]	460,503	1,301
Increase in Emissions (tons/year)[130] **during operations period:** **$PM_{2.5}$** **PM_{10}** **CO_2** **SO_2** **NO_X**	 2.8 - 3.1 6.3 – 7.0 420,900 330.9 314.3	 - - 1,189 0.93 0.89
Emissions (tons) during tie-in downtime: **CO_2** **SO_2** **NO_X**	 1,668,050 1,311 1,246	 5,838,175 4,589 4,359
Increase in Noise	Yes, due to fans and cascading water	Negligible increase

[127] Annual operational and maintenance costs presented here were calculated assuming continuous Plant operation.
[128] This captures the additional cost of operating the hypothetical fine-mesh screens installed in the hypothetical expanded intake during the entrainment season. This does not include the potential additional cost of maintaining a superstructure that would protect the screens, or associated additional equipment (such as heating, ventilation or heat-tracing, ice control, etc. that could likely be needed in an environment such as at PBNP).
[129] Energy losses presented here were calculated assuming continuous Plant operation.
[130] Increase in emissions presented here were calculated assuming continuous Plant operation.

Technology	Hypothetical Mechanical Draft Cooling Towers	Fine-Mesh Modified Traveling Water Screens
Impact on Facility Reliability	Yes, negative impact due to an annual 88-hour de-rate. The MDCT tie-in outage would result in 30,000 MWhr per day loss of generation, or total 1,800,000 MWhr over the anticipated 2-month outage period.	Potential for impact from clogging would need to be evaluated to ensure reliability and maintenance of a net positive suction head to avoid pump cavitation. The fine-mesh retrofit-related outage would result in 30,000 MWhr per day loss of generation, or total 6,300,000 MWhr over the anticipated 7-month outage period.
Increase in Consumptive Water Use	Evaporation would increase by between 76 and 232 percent. When compared to the existing once-through system, surface water withdrawal rate would decrease by approximately 95.5 percent.	No change

Table 12-23. Summary of Impacts for Mechanical Draft Cooling Tower Implementation at Point Beach Nuclear Plant

Impact	Nature of Impact	Notes
Energy consumption	Increase.	Additional electricity use at PBNP is assumed to be made up within Wisconsin. The increase in electricity use would likely not impact electricity availability in Wisconsin or RFC West Subregion.
Air Pollutant Emissions	Increase in PM emissions on-site; Increase CO_2, SO_2, and NO_x emissions off-site.	The increases in CO_2, SO_2, and NO_X emissions would be distributed across Wisconsin and RFC West Subregion, and would not be localized. With respect to the evaluation in this report, no appreciable health impacts are anticipated. Additional offsite increase in combustion emissions during tie-in outage.

Impact	Nature of Impact	Notes
Noise	Noise increase at Plant property.	The continuous operation of cooling tower fans and pumps would increase the noise levels within the property. The minor increase in noise at the shoreline would likely not impact surrounding residents as it is a restricted navigation zone.
Safety	Minor impact to safety.	Operation of cooling towers could increase the incidents of fog along local roads, pose a safety hazard onsite, and reduce the efficiency of a few future solar arrays.
Reliability	Reduction in reliability.	The cooling towers would be less effective for approximately 88 hours each year, reducing plant output. Midcontinent ISO West would need to coordinate with other generators to replace the 1,800,000 MWhr of generation that would be lost during the MDCT tie-ins related outage. Peaking generators would need to replace the 30,000 MWhr lost each day.
Consumptive Use of Water	Evaporation increase.	A CCRS for PBNP is anticipated to increase the evaporative loss of water between approximately 76 and 232 percent. Installing and operating the hypothetical cooling towers would reduce the water withdrawal rate, as compared to the existing once-through cooling system, by approximately 95.5 percent.

Table 12-24. Summary of Impacts from a Fine-Mesh MTWS Retrofit at PBNP

Impact	Nature of Impact	Notes
Energy consumption	Increase marginally.	Continuous or near-continuous rotation of fine-mesh MTWS and daily exercising of the coarse mesh screens would increase energy consumption.
Air Pollutant Emissions	Increase.	The increase in CO_2, SO_2, and NO_X emissions associated with the increased energy consumption is expected to be small. These impacts (if any) would be distributed across Wisconsin and would not be localized. Offsite combustion emissions during the retrofit-related plant downtime is considerable.
Noise	Minor increase.	The operation of modified-traveling screens and screen wash pumps in both intakes would increase the noise levels at the site; however, the increase would be small.
Safety	No appreciable impact.	The installation and operation of fine-mesh MTWS per se are expected to have minimal impacts on the safety of the Plant. If the screen wash pumps need to use unchlorinated water, the cleaning cycle may be less effective. Any potential impacts to the service water system could impact plant safety.

Impact	Nature of Impact	Notes
Reliability	Uncertain. Likely reduction in reliability.	Given the ice and elements, FMS would likely be unsuitable at PBNP. If the retrofitted FMS were to foul and clog as a result of debris or aquatic organism loading and prevent the flow of water to the condensers, this retrofit could potentially impact the Plant's reliability. The 7-month downtime could potentially impact grid reliability as well. Midcontinent ISO West may be challenged to replace the 6,300,000 MWhr of generation that would be lost during the fine-mesh retrofit-related outage, especially during the months of June, July and August of 2027 when most peaking generators would already be online. Grid reliability could be impacted if the 30,000 MWhr per day during summer months cannot be replaced.
Consumptive Use of Water	No impact.	No impact.

13.0 Peer Review 40 CFR 122.21(r)(13)

In the Code of Federal Regulations (CFR), Title 40, Part 122.21(r)(13), Peer Review, the regulations state:

> *If the application is required to submit studies under paragraphs (r)(10) through (12) of this section, the application must conduct an external peer review of each report to be submitted with the permit application.*

NextEra was required to prepare the 40 CFR (r)(10) through (r)(12) reports because the Point Beach Nuclear Plant (PBNP) has a DIF greater than 125 MGD (see Section 10.0); as such, NextEra was also required to conduct an external peer review of each report.

The regulation goes on to state:

> *The applicant must select peer reviewers and notify the Director in advance of the peer review. The Director may disapprove of a peer reviewer or require additional peer reviewers. The Director may confer with EPA, Federal, State and Tribal fish and wildlife management agencies with responsibility for fish and wildlife potentially affected by the cooling water intake structure, independent system operators, and state public utility regulatory agencies, to determine which peer review comments must be addressed. The applicant must provide an explanation for any significant reviewer comments not accepted. Peer reviewers must have appropriate qualifications and their names and credential must be included in the peer review report.*

This section introduces the peer reviewers, summarizes the peer review process, and provides the results of peer review as required by the Final Rule.

13.1 Selection of Peer Reviewers

Careful consideration was taken when deciding upon the appropriate peer reviewers for this project. Each reviewer was selected as an expert in their field of study, familiar with the Clean Water Act (CWA) 316(b) process, and available to provide the necessary level of peer review when needed.

A peer reviewer was chosen for each of the key disciplines necessary to evaluate approaches to entrainment BTA under the Final Rule: aquatic ecology, economics, and engineering. The individual peer reviewers were selected to provide expert-level assessment and guidance on Section 316(b)-related issues within their discipline. The selected peer reviewers are independent of NextEra's team of contractors and NextEra itself. The peer reviewers chosen to review the 40 CFR (r)(10) through (12) reports are as follows:

- Dr. Steven Layman of Kleinschmidt Associates provided the peer review for biological assessments associated with the report prepared to address 40 CFR 122.21(r)(10), Technology Costs and Feasibility, and 40 CFR 122.21 (r)(11), Benefits Assessment.
- Mr. James Cuchens, P.E., retired from Southern Company, provided the review of the engineering assessment documented in the report prepared to address 40 CFR 122.21(r)(10) and the assessment of other environmental impacts as called for in 40 CFR 122.21(r)(12).
- Dr. Paul Jakus of Utah State University reviewed the economics assessment presented in the Technology Costs and Feasibility report, 40 CFR 122.21(r)(10), and the Benefits Assessment, 40 CFR 122.21(r)(11).

The resumes of these peer reviewers are included in Appendix 13-A.

13.2 Peer Review Process

Prior to beginning the entrainment BTA process, peer reviewers were identified and contacted. In a letter dated July 27, 2018, NextEra submitted its selected peer reviewers' qualifications to the Wisconsin Department of Natural Resources (WDNR) in a letter addressed to Mr. Keith Pierce, Water Quality Bureau, WDNR (Appendix 13-B). Mr. Pierce formally approved the selected peer reviewers in an email to NextEra's Mr. Jason Knutson on September 10, 2018 (Appendix 13-C).

In November of 2020, the peer reviewers were presented with the draft 40 CFR 122.21(r)(10) through (r)(12) report documents. With the documents, each reviewer was presented with charge

questions that requested the peer reviewer's opinion on the methodology, results, and assumptions of the analysis on the sections of the draft documents that pertained to them. The questions were intended to ensure that the analyses not only addressed the requirements of the Final Rule but also that the assessment was both adequate and reasonable for purposes of making an entrainment BTA determination. If the peer reviewer deemed the evaluation of a topic to be either unreasonable or inadequate, they were requested to provide specific comments that would allow the facility to address the issue of concern.

Following the receipt of the peer reviews of the draft documents, a team which included NextEra and the relevant NextEra consultants responsible for the various portions of the draft documents completed a response to comments. As necessary, some back and forth was undertaken to fully address all the comments to the satisfaction of each peer reviewer. The peer reviewers were then asked to confirm the Team's responses adequately addressed the peer reviewer comments. This process (i.e., charge questions, peer response and comments, NextEra response to comments, and peer sign-off on the responses) is documented for each peer reviewer in Section 13.3.

NextEra notes that the Final Rule requires that it provide, as part of this report, any peer review comments that were not resolved and an explanation for the lack of resolution. NextEra was able to resolve all peer review comments to the satisfaction of each peer reviewer. Because NextEra believes that it is useful to document all comments received and their resolution, the complete dialogue is presented in Section 13.3.

13.3 Peer Review Results

This section provides documentation of the peer review charge questions, the peer reviewers' comments, and NextEra's responses for the draft documents. The process is reviewed separately for each discipline. For each review, the stages of each peer review are documented in a single table.

13.3.1 Engineering Reports

As documented in Table 13-1, Mr. Cuchens agreed that all comments pertaining to the engineering of the entrainment BTA analysis were addressed.

13.3.2 Biology Reports

As documented in Table 13-2, Dr. Layman concluded that all of his comments related to the biology of the entrainment BTA analysis were addressed.

13.3.3 Economics Reports

As documented in Table 13-3, Dr. Jakus concluded that all of his comments related to the economics of the entrainment BTA analysis were addressed.

Table 13-1. Engineering Peer Review Comments and Responses

Question Number	40 CFR 122.21(r)(10), (12)	Response	Comments (if any)	NextEra Response	Peer Reviewer Response
Closed-Cycle Cooling Evaluation					
1)	Does 122.21(r)(10) clarify the size and nature of the system being evaluated – the location of the facility, the number of units, the flow rates associated with the cooling water system and the service water system, the existing intake structure including the offshore intake and buried intake pipes, intake and discharge structure, the fundamentals of the existing cooling system?	Yes	The cooling system(s) and/or compliance options being evaluated was clearly identified with explicit details including the number of units, cooling water and service water flow rates, intake and discharge structures issues (design, construction, & operation) associated piping network. The fundamentals of the existing cooling system design were also clearly defined with respect to performance, potential issues of construction and operation.	No further action required.	Agreed
2)	Does the document consider the range of entrainment control measures required by the Rule?	Yes	The evaluation included all and all entrainment control measures required by the rule including modification of existing screens, installation of wedgewire screens, aquatic filter barriers, porous dike system, closed cycle recirculating cooling system, operations with flow reductions, variable speed/frequency drives for pumps, and alternate water sources.	No further action required.	Agreed
3)	The Rule requires that all cooling tower types be evaluated. The report provided a simple review of all cooling tower types and selected the least cost/impact option from the potentially feasible types for additional evaluation. Were the justifications provided to eliminate other cooling towers reasonable?	Yes	The report included consideration of all types of cooling towers including mechanical draft, natural draft, plume abated and dry cooling. The report included discussion of technology cost and technical feasibility including space, performance, operations & maintenance (O&M), construction, and environmental/social impact. The report/study clearly stated the basis for including/eliminating tower technologies for further consideration. Justifications for eliminating tower technologies are considered appropriate and reasonable.	No further action required.	Agreed

Table 13-1. Engineering Peer Review Comments and Responses (Continued, Page 2 of 14)

Question Number	40 CFR 122.21(r)(10), (12)	Response	Comments (if any)	NextEra Response	Peer Reviewer Response
4)	Does the closed-cycle system evaluation incorporate site-specific meteorological, Lake Michigan water quality information, local geotechnical conditions, and the facility's condenser water flow rate and temperature differential?	Yes	The closed cycle cooling system evaluation included consideration of site meteorological data in the thermal design/performance along with condenser water flow rates in sizing system components. The closed cycle cooling system also included consideration of water chemistry from lake Michigan as well as service water requirements and piping design/construction issues. Geotechnical conditions were a primary consideration in structural design issues for system components.	No further action required.	Agreed
5)	Does the evaluation consider the challenges of constructing new structures within a nuclear station, acknowledge the complexity of construction within and outside the Protected Area, and does it consider practicable locations for the new cooling towers?	Yes	The evaluation included consideration of the complexity in construction of new structures and/or components in proximity with the nuclear station protected area. The location of the cooling towers was selected based on best available location to meet all the essential practical design considerations (space, wind direction, piping configuration, etc.).	No further action required.	Agreed
6)	Did the conceptual design size the hot and cold water pipes appropriately and route them in a reasonable fashion between the cooling towers and condensers? Did the pipeline routes consider existing buried and overhead infrastructure, the density and integrity of material that pipes would be installed in, and depth to bedrock to the extent appropriate for the concept design? Do you agree that the 'soft' material between 13 ft and 65 ft at this site increases retrofit complexity and costs?	Yes	The conceptual design/route of the new hot and cold water pipes was reasonable to consider pipeline flow rates/velocities, pressure drop, and reliability. The new conceptual design included consideration of buried and overhead infrastructures including depth of sub-surface materials to ensure integrity of the system. Sub-surface materials between 13 and 65 feet would substantially increase the system cost/complexity and possible induce additional reliability and maintenance issues.	No further action required.	Agreed

Table 13-1. Engineering Peer Review Comments and Responses (Continued, Page 3 of 14)

Question Number	40 CFR 122.21(r)(10), (12)	Response	Comments (if any)	NextEra Response	Peer Reviewer Response
7)	The report presents the major cost components included in the final capital cost. The report aims to develop a +50% / -30% cost estimate. Are the major cost components reasonable for developing a +50% / -30% estimate?	Yes	Cost estimates presented in the report/study included all major cost components. The cost for all major components is well within +50% / -30%. The level of detail presented was more than adequate to establish major component costs to ensure a conceptual design cost estimate of +50% / -30%.	No further action required.	Agreed
8)	Are the costs presented reasonable for this location and work? If not, how are they not?	Yes	The costs presented in the report cost estimates appeared reasonable and appropriate for the site location. Material and components costs were considered appropriate based on costs for almost any site within proximity of Point Beach area. Labor costs considerations were also appropriate based on costs within the general area of the plant site/state.	No further action required.	Agreed
9)	Is the level of accuracy or uncertainty presented appropriately? If not, list key uncertainties or inaccuracies that should be specifically discussed.	Yes	The level of uncertainty is appropriate for identified known influences. There are potential inaccuracies associated with the design/construction of structural infrastructures for piping/tower components due to subsurface conditions.	No further action required.	Agreed
10)	Does the report discuss O&M measures and associated costs to the extent required in §122.21(r)(10) and provide a reasonable estimate of facility costs?	Yes	The report adequately identifies O&M costs which including labor, power requirements, and component replacement costs for each technology considered. The evaluation included a reasonable assessment of impact on facility cost. Power cost to operate each technology was assumed to be $52.66/MWhr.	No further action required.	Agreed

Table 13-1. Engineering Peer Review Comments and Responses (Continued, Page 4 of 14)

Question Number	40 CFR 122.21(r)(10), (12)	Response	Comments (if any)	NextEra Response	Peer Reviewer Response
11)	Cooling towers have been installed and operated at facilities of similar size, including other nuclear stations. However, owing to significant challenges, to-date, no other nuclear station in the US has retrofitted its cooling system from once-through to closed-cycle. Owing to the 'soft' material between 13 ft and 65 ft, the need for in-water tie-ins, the loss in margin of safety in the service water system, the shorter in-water construction period (due to weather), and the need for very long pipes, this evaluation concluded that a cooling system retrofit to operate with two 30-cell mechanical draft cooling towers was not practical or feasible at this facility. Do you agree with the conclusion? If not, why not?	Yes	The conceptual design of a closed cycle recirculating cooling system is considered a viable concept with the exception of the design/construction of the infrastructure to support the cooling tower and/or piping systems due to the "soft" subsurface material. The cost of the infrastructure (tower pilings & deep piping system) is anticipated to be substantial and will also necessitate additional constraints on operations (outage time) and plant security (proximity to secure areas). As such, I would agree that a closed cycle recirculating system with cooling towers would NOT be a feasible and/or practical retrofit at Point Beach Facility.	No further action required.	Agreed

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Table 13-1. Engineering Peer Review Comments and Responses (Continued, Page 5 of 14)

Question Number	40 CFR 122.21(r)(10), (12)	Response	Comments (if any)	NextEra Response	Peer Reviewer Response
12)	Considering the durations needed for NPDES permit issuance, technology design, obtain construction permits, equipment procurement, bidding, construction/installation, coordination with NRC, and cold-weather constraints at this location, is the project schedule presented for closed-cycle cooling towers reasonable (even though the construction and operation of closed-cycle cooling towers would be impractical/infeasible)? If not, why not?	Yes	The report includes what I consider to be a reasonable assessment of project schedules associated with implementation of CCS including engineering, procurement, site modifications, construction, and permitting. However, given the uncertainty of design/construction of the infrastructure for the CCS, I would conclude that the project schedule properly identifies the schedule as a hypothetical projection.	No further action required.	Agreed
13)	Were all impacts required to be identified by 40 CFR §122.21(r)(12) appropriately identified and described? If not, list the impacts that need further consideration and nature of additional consideration. Were all reasonable attempts to mitigate each of these impacts discussed to the extent required in §122.21(r)(12)? If not, list impacts that need additional mitigation measures and nature of those mitigation measures.	Yes	All of the impacts identified by 40 CFR §122.21(r)(12) were identified including energy consumption, emissions/air pollutants, environmental and health, noise and safety, facility reliability, and water consumption. The report also included discussion of potential methods for mitigation of impacts identified. Further consideration of impacts and/or mitigation may include hydraulic model studies of intake/piping systems.	No further action required.	Agreed

Table 13-1. Engineering Peer Review Comments and Responses (Continued, Page 6 of 14)

Question Number	40 CFR 122.21(r)(10), (12)	Response	Comments (if any)	NextEra Response	Peer Reviewer Response
14)	Are the methods employed to assess energy penalty (auxiliary load), backpressure energy penalty, and downtime-related energy loss reasonable for the purposes of the 122.21(r)(12) requirements?	Yes	The energy requirements and associated penalties were accurately identified for the CCRS (cooling tower fans, pumps, etc.) as well as fine mesh screen technologies. The energy penalty assessed for each technology was based on a cost of $52.66/MWhr. Outage/downtime time is anticipated to be significant for CCRS implementation resulting in substantial loss of revenues. The methods used to assess condenser backpressure penalties of 8.8 Mw per unit were appropriate and technically conservative.	No further action required.	Agreed
15)	Are the methods used to assess increases in emissions loss reasonable for the purposes of the 122.21(r)(12) requirements? Do you agree that there would be significant offshore stack emissions during the tie-in outage?	Yes	Emissions from the cooling towers included consideration of noise, plume, and particulate (PM10). The potential areas of impact surrounding the cooling tower(s) was identified with regard to seasonal fogging/icing, noise, and particulate/PM10. The level of particulate emissions from the cooling tower is a function of water quality (suspended/dissolved solids) and cycles of concentration (COC). During tie-in, alternate energy sources (fossil fuel) would be required to offset energy losses from Point Beach resulting in an increase in stack emissions accordingly.	No further action required.	Agreed
16)	Are the methods used to assess the increase in evaporation reasonable for the purposes of the 122.21(r)(12) requirements?	Yes	Heat rejection from conventional evaporative cooling tower occurs primarily through evaporation (latent heat of evaporation) with a smaller degree of sensible heat transfer. The study properly evaluated and assessed the quantity of evaluation (water loss) at design heat load and meteorological conditions (full unit load operation). Makeup and blow-down flows were also properly assessed coincident with full load unit operation and the respected cycles of concentration (COC). Plume abated tower operations were evaluated to quantify reduction in evaporation as well as water consumption.	No further action required.	Agreed

Table 13-1. Engineering Peer Review Comments and Responses (Continued, Page 7 of 14)

Question Number	40 CFR 122.21(r)(10), (12)	Response	Comments (if any)	NextEra Response	Peer Reviewer Response
17)	Are the discussions on noise, safety, facility reliability associated with cooling towers reasonable for the purposes of the 122.21(r)(12) requirements?	Yes	The study examined the level of noise from the cooling towers which primarily consist of falling water noise and/or fan operating noise. The study included consideration of plant background noise levels, construction noise, and proximity of the cooling towers. Fan noise levels were anticipated to be somewhat higher. The study also examined cooling tower emissions (fogging, icing, etc.). The impact on facility reliability was properly assessed based on the cooling tower wetbulb exceedance condition and corresponding impact on unit capability/reliability. The potential impact on Point Beach solar power project in proximity of the cooling tower was not evaluated.	No further action required.	Agreed
Fine-Mesh Modified Traveling Screen Evaluation					
18)	Does the evaluation of fine-mesh screens adequately consider alternate fine-mesh screen configurations? If not, what other fine-mesh screen configurations should this section include?	Yes	The report included evaluation of two alternative fine mesh screen technologies including narrow-slot cylindrical wedgewire screens and traveling water screens with various configurations. The evaluation of fine mesh screens included consideration of TSV impact on entrainment of aquatic organisms. The evaluation of FMS including consideration for maintaining low TSV through the fine mesh screens to enhance protection of aquatic species. The evaluation included consideration of any consequential impact on hydraulics & pump head and related adverse impact on performance.	No further action required.	Agreed

Table 13-1. Engineering Peer Review Comments and Responses (Continued, Page 8 of 14)

Question Number	40 CFR 122.21(r)(10), (12)	Response	Comments (if any)	NextEra Response	Peer Reviewer Response
19)	Does the fine-mesh screen evaluation consider the facility's intake rate and location; the offshore intake crib along with intake pipes and intake/discharge structure; water quality; ice and frazil ice; and potential for debris and biofouling when evaluating potential screen sizes, configurations, and locations?	Yes	The evaluation of fine mesh screens included consideration of the existing facility's intake location, intake flow rates, piping system, water depth, sweeping currents, infrastructure, and the potential for debris, icing, and biofouling. The evaluation of potential improvements and/or modifications to the existing intake system included consideration of through screen velocity (TSV) with variation in mesh sizes and/or configurations to provide effective reduction in entrainment. The evaluation of fine mesh screens included consideration of maintenance issues and winter operation to ensure system/unit reliability.	No further action required.	Agreed
20)	Because the existing system includes an intake crib, the wedgewire screen retrofit assumed that the crib would be fed by wedgewire screens that would route water to a sheetpile enclosure that would surround the crib. The wedgewire screen system would consist of 30 screens. Do you agree that this hypothetical wedgewire screen location and configuration represents a sound concept on which to assess feasibility, (even though the evaluation ultimately found that the wedgewire screen retrofit to be infeasible)?	Yes	A total of 27 – 84" Diameter wedge wire tee-screens with 1.75 mm slot openings would be required according to study results. While the design concept (location, flow rates, TVS, configuration, sweeping currents) would appear technically viable, the lack of experience with such designs and large flow rates presents a high level of uncertainty for being feasible concept.	No further action required.	Agreed

Table 13-1. Engineering Peer Review Comments and Responses (Continued, Page 9 of 14)

Question Number	40 CFR 122.21(r)(10), (12)	Response	Comments (if any)	NextEra Response	Peer Reviewer Response
21)	The existing offshore crib and intake pipes serve the existing traveling screens, circulating water pumps and service water pumps. Do you agree that the modifications discussed in the wedgewire screen retrofit in this evaluation could have a direct impact on the service water system that should be considered in the assessment of feasibility?	Yes	The existing circulating water pumps provide both cooling water (condenser) and service water. Other offshore intakes on Lake Michigan with cribs similar to that at Point Beach have been susceptible to frazil ice. Point Beach recirculates hot water to manage ice at its crib to maintain reliability during winter operations. I would agree that modifications associated with retrofitting a wedgewire screen system retrofit should include assessment of direct impact on service water system.	No further action required.	Agreed
22)	Does the feasibility evaluations of 0.5-mm mesh modified traveling water screens incorporate biological recommendation for fine-mesh sizes based on aquatic organisms intended to be protected by the fine-mesh retrofit? For fine-slot wedgewire screens, a 1.75 mm slot size was considered as an illustration of concept. Because of uncertainty in quantifying the biological benefit of slot size, less emphasis was given to the organism sizes and rates of exclusion. Are these reasonable approaches?	Yes	Both fine mesh screen technologies (TWS & wedgewire screens) have varying exclusion rates subject to site specific conditions, screen mesh size, and aquatic organisms. The approach used in this report was appropriate in consideration of mesh size along and through screen velocity given uncertainties of the benefits in slot size on exclusion of organisms.	No further action required.	Agreed
23)	Are the site and construction constraints presented valid and reasonable for the fine-mesh screen retrofit project discussed?	Yes	The construction constraints presented/discussed in the report associated with retrofit of fine-mesh screens in the existing off-shore intake system were valid and reasonable/real concerns to be of significant relevance in viability of the compliance option.	No further action required.	Agreed

Table 13-1. Engineering Peer Review Comments and Responses (Continued, Page 10 of 14)

Question Number	40 CFR 122.21(r)(10), (12)	Response	Comments (if any)	NextEra Response	Peer Reviewer Response
24)	Do the reports incorporate applicable considerations (e.g., through-screen velocity, headloss, metallurgy, location and construction of the organism return, organism survival) that should be incorporated into the fine-mesh traveling screen evaluation? If not, please list other considerations that should be included in the comments sections.	Yes	The report contains an accurate and applicable assessment of through screen velocity impact on head loss and entrainable organism survival. The report also included appropriate consideration of screen metallurgy (water quality), screen location, and construction for compliance options examined. The study did not include consideration of a blockage factor (not required by rule) with implementation of FMS that in reality would need to be considered for appropriate FMS design margin.	Agreed. No further action required.	Agreed
25)	Owing to lack of suitable configuration and potential for frazil ice this evaluation concluded that fine-slot wedgewire screens would be infeasible at this facility. Do you agree with the conclusions? If not, why not?	Yes	The use of 27 - 84 inch wedgewire screens at PB included a fouling factor or 15% and 3 additional screens for flow balancing. The selected design was based on actual experience even though an application of this nature has not been implemented at a nuclear facility, especially in the conditions in Lake Michigan at PBNP . I would concur that wedgewire screens would not be feasible with consideration of frazil ice conditions impacting water levels to prevent reliable/safe operating conditions.	No further action required.	Agreed
26)	Do you agree that the duration and challenges of construction amongst the components of the operating CWIS, the potential for debris blocking/damaging screens, and uncertainty relative to issues of construction and operation make installing and operating fine mesh modified traveling water screens (FM MTWS) impractical and potentially infeasible at this facility? If not, why not?	Yes	I would agree that the challenges and duration of construction associated with implementation of CWIS are paramount especially with uncertainties of constructability. Duration of construction is somewhat subjective if not optimistic to imply viability of actual construction within ranges of estimates presented.	No further action required.	Agreed

Table 13-1. Engineering Peer Review Comments and Responses (Continued, Page 11 of 14)

Question Number	40 CFR 122.21(r)(10), (12)	Response	Comments (if any)	NextEra Response	Peer Reviewer Response
27)	Considering the durations needed for NPDES permit issuance, technology design, obtain construction permits, equipment procurement, bidding, and construction/installation, is the fine-mesh modified traveling screen project schedule presented reasonable and realistic? If not, why not?	Yes	The study included a fair assessment of timeline for NPDES permits as well as construction/installation schedule for modified traveling water screens. As such, the schedule presented is considered reasonable subject to unknowns associated with site conditions.	No further action required.	Agreed
28)	The report considers several factors in assessing the site-specific feasibility of the potential off-shore wedgewire array and fine mesh traveling screens. Do you agree that neither technology is feasible based on the weight of evidence summarized in those sections? If not, why not?	Yes	I would concur that neither FM wedgewire or FM traveling water screening compliance options would appear to be feasible based on site specific considerations including but not limited to off-shore construction, impact on unit reliability, duration of construction, outage time and implementation costs.	No further action required.	Agreed
29)	Were all impacts required to be identified by 40 CFR §122.21(r)(12) for fine-mesh screens appropriately identified and described? If not, list the impacts that need further consideration and nature of additional consideration.	Yes	All of the impacts associated with FM screens were appropriately identified and discussed including energy consumption, operations and maintenance (debris, ice, variable speed, etc.), air pollution, noise, safety, and plant reliability.	No further action required.	Agreed
30)	Does the peer reviewer agree that evaporation rates would remain unaffected due to a fine-mesh screen retrofit?	Yes	Evaporation is primarily a function of unit heat load and since unit operating conditions are not changing (heat rejected to water), evaporation rates would not as well regardless of type/mesh of screens.	No further action required.	Agreed

Table 13-1. Engineering Peer Review Comments and Responses (Continued, Page 12 of 14)

Question Number	40 CFR 122.21(r)(10), (12)	Response	Comments (if any)	NextEra Response	Peer Reviewer Response
Other Technologies					
31)	Are the discussions on noise, safety, facility reliability associated with fine-mesh screens reasonable for the purposes of the 122.21(r)(12) requirements?	Yes	I would concur that noise levels from the off-shore fine-mesh MTWS would impact noise level at the plant site. Safety and reliability concerns associated with service water system reliability were appropriately addressed. Reliability issues associated with debris (clogging & binding) were also addressed.	No further action required.	Agreed
Alternate Water Sources Evaluation					
32)	The evaluation considered groundwater and reclaimed water from sources in the vicinity, but found that none was viable based on volume, reliability, and proximity as replacement or supplemental sources. Do you agree with this finding? If not, which of these water sources is viable at this facility and why?	Yes	Given the need for near-constant and reliable cooling water flow rates (and service water), I would concur with the study results that there are no viable alternate water resources available in proximity of the PBNP.	No further action required.	Agreed
Other Technologies					
33)	Based on historical cooling water flow rates, the baseload facility, and allowable pump actuation cycles this evaluation found that variable speed pumps to be impractical at this facility. Do you agree with this finding?	Yes	I would concur that the use of variable speed pumps would not be feasible at the PBNP. The volume of cooling water flow is a major factor in efficient condenser performance. Reduction of cooling water flow (via use of variable speed pumps) would significantly impair condenser performance (heat rejection) at any time. As such, reducing flow at any time for any reason including environmental compliance will adversely impact overall unit performance and reliability (heat rate and Kw). Reduced condenser tube velocity in a marine water quality will also result in severely degraded performance (enhanced fouling) without installation of a permanent on-line tube cleaning system. As such, I would agree that variable speed pumps are impractical for this facility.	No further action required.	Agreed

Table 13-1. Engineering Peer Review Comments and Responses (Continued, Page 13 of 14)

Question Number	40 CFR 122.21(r)(10), (12)	Response	Comments (if any)	NextEra Response	Peer Reviewer Response
34)	Based on the hydrogeology for this location and past experience at the City of Manitowoc, do you agree that Ranney wells are not viable as an alternative water supply at PBNP?	Yes	I would concur that hydrogeological conditions at this site are not conducive to support use of Ranney Wells as a viable alternative water supply especially with consideration as confirmed form previous at the City of Manitowoc.	No further action required.	Agreed
Overall Assessment					
35)	Is the rigor of evaluation in these engineering reports sufficient for the purposes of the 316(b) evaluation? If not, clarify which sections need more rigorous evaluations and the nature of those evaluations.	Yes	This site presented a significant number of challenges as presented in the report. The report included a substantial level of detail to conclude that the examination of 316(b) compliance technologies was a thorough evaluation of cost major considerations including equipment, energy requirements, construction requirements, O&M requirements, and plant/unit performance/reliability.	No further action required.	Agreed
36)	If an entrainment control technology was rejected because it was determined to be technically infeasible or impractical, does the report provide sufficient justification for such rejection? If not, in your opinion, based on available information, is that technology feasible and practical?	Yes	Any entrainment technology that was rejected was based on sound reasoning of technical viability, economic feasibility, and practicality including industry experience and site-specific considerations.	No further action required.	Agreed

Table 13-1. Engineering Peer Review Comments and Responses (Continued, Page 14 of 14)

Question Number	40 CFR 122.21(r)(10), (12)	Response	Comments (if any)	NextEra Response	Peer Reviewer Response
37)	Does the Peer Reviewer have additional comments and input on the engineering sections of 122.21(r)(10) and (12) reports not already discussed above? If so, please provide a narrative.	Yes	The EPA recognizes that fine mesh screening (FMS) technologies may enhance impingement of aquatic life if TSV is not appropriately evaluated to minimize impingement mortality. Depending on site conditions FMS may also enhance biofouling and/or organic growth/propagation with lower screen velocities. Replacing course mesh screens with fine mesh screens in itself may actually enhance impingement mortality. The PB study includes appropriate consideration of prudent through screen velocities which are not included in the rule to minimize impingement mortality. The use of FMS typically enhances macro-fouling (debris impingement) and aquatic growth (barnacles, etc.) requiring additional maintenance and/or equipment for removal and disposal of increased quantity of debris subject to seasonal variation, storm influence, etc. The rule does not require any assessment of debris removal systems, debris subjectivity, or design margin associated with screen fouling (blockage factor).	No further action required.	Agreed

Source: ECT, 2020.

Table 13-2. Biology Peer Review Comments and Responses

Number	40 CFR 122	Question	Response	Comments (if any)	NextEra's Response	Peer Review Response
Social Costs §122.21(r)(10)						
1)	(r)(10)	Is the information describing the potential use of fine mesh screen technologies at PBNP adequate and reasonable to support the biological assessment implemented in (r)(11)?	Yes	I find the information describing potential use of fine-mesh screen technologies at PBNP, including narrow-slot wedgewire screens and fine-mesh modified traveling water screens with a fish return system, to be adequate and reasonable. The analysis provides substantial justification for the technology configurations presented and evaluates their technical feasibility with appropriate consideration of the site-specific physical, operational, and maintenance constraints, as well as the available literature on their biological performance. Evaluating a fine-mesh modified traveling water screen system similar in configuration to the operating Prairie Island Nuclear Generating Plant system is reasonable based on its operational history using 0.5-mm mesh screens, relative proximity in the upper Midwest, overlap or similarity in entrained taxa, and availability of study data for estimating post-exclusion survival. I offer the following comments for consideration for improving the description and evaluation of FMS screen technologies in the final report.		
				(1-1) Section 10.5.1.3, Feasibility Discussion, Sweeping Currents and Debris: In the first paragraph, the fourth sentence suggests that while sweeping velocity is not essential to reducing entrainment, it is necessary for improving entrainment survival. I believe you mean to say "post-exclusion survival' rather than entrainment survival.	That is correct. This statement has been edited.	Satisfied

Table 13-2. Biology Peer Review Comments and Responses (Continued, Page 2 of 6)

Number	40 CFR 122	Question	Response	Comments (if any)	NextEra's Response	Peer Review Response
				(1-2) Section 10.5.1.3, Feasibility Discussion, Sweeping Currents and Debris, and Dredging and Sediment: Consider incorporating into your analysis of sweeping currents and dredging/sediment any relevant information or maintenance trends from the use of coarse-mesh wedgewire screens the Oak Creek Power Plant on Lake Michigan, if available.	NextEra anticipates that issues of sedimentation and sweeping velocity were considered at Oak Creek/Elm Road but is unaware of any findings relative to ongoing maintenance due to these factors. We also note that the Oak Creek/Elm Road system is a coarse-slot one, making the potential constraints different. Finally, the report notes that both sedimentation and sweeping velocity would require additional study and that the key constraint on fine slot wedgewire feasibility are frazil ice and the head loss through the newly installed system itself. Therefore, NextEra will limit the changes to note that should additional study of sedimentation and sweeping velocity be necessary, attempts will be made to gain perspective from Oak Creek/Elm Road.	Satisfied
				(1-3) Section 10.5.1.3, Feasibility Discussion, Biofouling: The first paragraph under the Biofouling discussion refers to two anti-fouling measures but only one measure seems to be described. Some clarification is needed.	This paragraph was only intended to discuss one anti-fouling measure and has been edited to remove the reference to two measures.	Satisfied
				(1-4) Section 10.5.1.3, Feasibility Discussion, Organism Attraction: The analysis would benefit from identifying the types of fish or shellfish species and life stages that could be attracted to the habitat structure provided by the screen arrays, bulkhead wall, and access pier and spawn and/or rear young near the intake. One example could be the Gammarus sp. amphipods already attracted to the intake crib, as described in Section 11.	Agreed. Information on the types of organisms, including *Gammarus* sp., that could be attracted to the habitat provided by the screen arrays has been added to this section.	Satisfied

Table 13-2. Biology Peer Review Comments and Responses (Continued, Page 3 of 6)

Number	40 CFR 122	Question	Response	Comments (if any)	NextEra's Response	Peer Review Response
				(1-5) Section 10.5.2.3, Selected FMS Scenario: Would the new intake structure for the FMS scenario use dual-flow screens? If so, I suggest introducing that in this section. Summary Table 10-29 at the end of Section 10 makes the first mention of dual-flow screens.	Section 10.5.2.3 assumes 8 through-flow FMS screens in front of the existing coarse mesh screens. Table 10-29 has been corrected to remove the reference to dual-flow.	Satisfied
2)	(r)(11)	Are the characterizations of potential changes in absolute losses adequate and reasonable to support an entrainment BTA determination?	Yes	The estimation of absolute losses under baseline conditions and the incremental changes in absolute losses due to the candidate entrainment technologies of a closed-cycle recirculating system (closed-cycle cooling) and FMS are adequate and reasonable to support an entrainment BTA determination. Sample event densities obtained from two one-year study periods at the PBNP site were applied to the actual intake flow of the PBNP to derive annual estimates of baseline entrainment losses. The assumptions made were clearly stated and tended to be conservative on the side of overestimating social benefits. The efficacy of closed-cycle cooling was appropriately considered proportional to the reductions in flow that would result from the installation of mechanical draft cooling towers. Characterizing potential changes in absolute losses with the use of FMS by estimating exclusion efficiency based on site-specific measurements, where possible, and estimating rates of post-exclusion survival using available data from the Prairie Island and Somerset sites was reasonable. I offer the following suggestions for revisions to improve the final report:		

Table 13-2. Biology Peer Review Comments and Responses (Continued, Page 4 of 6)

Number	40 CFR 122	Question	Response	Comments (if any)	NextEra's Response	Peer Review Response
Benefits Valuations §122.21(r)(11)						
				(2-1) Section 11.2.1.5, Estimating Efficacy of FMS: The fifth paragraph describes that rates of live return were taken from studies at Prairie Island Nuclear Generating Plant and Somerset Station. From Section 10, it is clear that Prairie Island is on the Mississippi River in Minnesota. It would also be helpful to identify in this section where Somerset Station is located.	Information on where these facilities are located has been added to this section.	Satisfied
				(2-2) Section 11.2.1.5, Estimating Efficacy of FMS: The fifth paragraph describes the three studies used from the Prairie Island and Somerset sites and the survival rates (initial, latent, overall) estimated by each. Further brief explanation as to which survival rates were prioritized for use would be helpful in the text or as a footnote to Table 11-2.	An explanation of which survival rates from the studies were used in the analysis has been added.	Satisfied
				(2-3) Section 11.2.1.5, Estimating Efficacy of FMS: The sixth paragraph describes the use of surrogate species. I suggest also stating in this section that the rates of live return for fish eggs and Gammarids were conservatively assumed to be 100% due to lack of available data in the literature. This will help to clarify the assumptions of 100% survival used in Table 11-2.	Agreed. These assumptions have been added to Section 11.2.1.5.	Satisfied
				(2-4) Section 11.2.1.5, Estimating Efficacy of FMS: Table 11-3 shows the rate of live return for larvae of three taxa as 0% even though their rates of post-exclusion survival were greater than 0% (Table 11-2). Is that due to the larvae not being excluded by 0.5 mm mesh? A brief explanation would be helpful.	Two of the three taxa in question were incorrectly reported in the tables and have been corrected. The 3rd is due to the larvae not being excluded by 0.5 mm mesh.	Satisfied

Table 13-2. Biology Peer Review Comments and Responses (Continued, Page 5 of 6)

Number	40 CFR 122	Question	Response	Comments (if any)	NextEra's Response	Peer Review Respons e
3)	(r)(11)	Are the characterizations of potential changes in stock sizes and harvest levels adequate and reasonable to support an entrainment BTA determination?	Yes	I find the characterization of potential changes in stock sizes and harvest levels to be adequate and reasonable to support an entrainment BTA determination. The biological modeling approach used for assessing changes in fish stocks and harvest is consistent with that used by EPA in the rulemaking process. In addition, the biological uncertainties in the assessment and their potential effects on the benefits valuation are comprehensively and reasonably considered. I recommend revisions to the final report that consider and address the following comments and questions:		
				(3-1) Section 11.2.2., Basis for Estimates of Changes in Stock Size or Harvest Levels: The sixth paragraph describes the transfer of production foregone to Chinook Salmon. I suggest further describing Chinook Salmon as an introduced sport fish in Lake Michigan that feeds heavily on Alewife and is maintained by extensive stocking of fingerlings, although WDNR has documented some natural reproduction in tributaries.	A description of Chinook salmon within Lake Michigan has been added to this section.	Satisfied
				(3-2) Section 11.2.2., Basis for Estimates of Changes in Stock Size or Harvest Levels: The ninth paragraph (top of p. 11-14) describes how forage biomass was transferred to Chinook Salmon and converted into EAs using the average weight of an age 3 Chinook Salmon. However, Table 11-4 indicates that age 2 was used as the age of equivalence for Chinook Salmon, so this statement should be checked.	The top of pg 11-14 incorrectly states age-3. It has been corrected to be consistent with the table.	Satisfied

Table 13-2. Biology Peer Review Comments and Responses (Continued, Page 6 of 6)

Number	40 CFR 122	Question	Response	Comments (if any)	NextEra's Response	Peer Review Response
				(3-3) Section 11.4.1.1, Changes in Fish and Shellfish: In Table 11-7, and also in Tables 11-12 and 11-17 for closed-cycle cooling and FMS, respectively, I suggest adding a row for total entrainment by year.	Total entrainment has been added to these tables.	Satisfied
				(3-4) Section 11.4.1.2, Changes in Stocks and Harvest: The fourth paragraph (top of p. 11-29) refers to Table 11-8 for the average total annual foregone fishery yield. Additional description of Table 11-8 would be helpful for orienting the reader to key points about the model results. For example, you might mention that direct losses of C/R fish represented the majority of total foregone fishery yield in year 1, whereas production foregone of Chinook Salmon from fish and shellfish represented the majority in year 2. This would help to explain the species differences in plots of fishery yield benefit between year 1 and year 2 in the figures that follow.	Additional description of Table 11-8 has been added to Section 11.4.1.2.	Satisfied
				(3-5) Section 11.4.1.2, Changes in Stocks and Harvest: In the fourth paragraph (top of p. 11-29), the last sentence states that foregone fishery yield represents approximately 0.44 percent of the annual commercial yield. This percentage needs checking, as it appears that it should read 0.60 percent.	That is correct. The text has been edited.	Satisfied
				(3-6) Section 11.4.2.2, Changes in Stocks and Harvest: For easier direct comparison to the baseline condition, I suggest adding a sentence stating that the average total annual foregone fishery yield is estimated as 7,073 kg, and adding an analogous statement in Section 11.4.3.2 for FMS.	These statements have been added in Section 11.4.2.2 and 11.4.3.2.	Satisfied

Source: ECT, 2020.

Table 13-3. Economics Peer Review Comments and Responses

Question Number	Question	Response	Comments (if any)	NextEra Response	Peer Review Response
Social Costs §122.21(r)(10)					
1)	If a facility were to be retrofitted with closed-cycle cooling, the social costs can vary depending on the facility's location, it' s role in the relevant power system market, and the nature and use of adjacent land (i.e., urban, suburban, rural/agricultural, native vegetation or parkland).				
	a) Was the list of social impacts considered reasonable?	Yes	See comments below		
	b) Were the methods used to quantify and/or monetize the social costs of these impacts appropriate?	Yes	See comments below		
	c) In your professional opinion, do you think the social cost information is both reasonable and adequate for the NPDES permitting authority to make the entrainment BTA determination?	Yes	See comments below		
2)	Were the methods used to generate social costs reasonable and adequate?	Yes	See comments below		
3)	In your professional opinion, do you think the social cost information is both reasonable and adequate for the NPDES permitting authority to make the entrainment BTA determination?	Yes	See comments below		

Table 13-3. Economics Peer Review Comments and Responses (Continued, Page 2 of 8)

Question Number	Question	Response	Comments (if any)	NextEra Response	Peer Review Response
Major Comments			1) P. 10-15: The text uses a 2019 NextEra reference to justify the 8.5% interest rate used for capital costs. Given the low interest rates prevailing in the current market, a short footnote outlining the basic rationale for this relatively high rate would be useful.	Eight and one-half percent (8.5%) is the internal interest rate used by NextEra Point Beach for its planning purposes and provided to us for use in the evaluation.	Satisfied
			2) I can't match up the cost tables at the end of r(10) (Tables 10-21 through 10-23) with the figures appearing in Table 10-30. My understanding is that O&M appearing in Table 10-22 are an incremental FMS cost if used to supplement the existing CWIS, so it really doesn't factor into Table 10-30. The capital costs of Table 10-21 ($148.5M) plus the indirect costs of the pre-project studies (Table 10-23, $16.8M) sum to $165.2M, not the $164.5 reported in Table 10-30. O&M costs are consistent across the tables. What's happening here?	The capital cost for FMS has been made consistent across reports.	Satisfied
			3) P. 24, Appendix 10-A: the energy penalty at Point Beach is substantial—about 5-6% of rated capacity. The penalty relies heavily upon Step 4 in the process, where the relationship between intake water temperature and generation is calculated. The linear OLS model yields a statistically significant coefficient on the temperature parameter, but the model has very poor explanatory power (adjusted R-square<1%). Is the issue associated with the functional form that was selected? Should separate models have been estimated for each unit? A scatter plot of MW-Water temperature would be informative. At the very least, a discussion of the uncertainty introduced at this step would be warranted, especially given the large power system costs reported in Table 10-30 of r(10).	A discussion of uncertainty related to the derived relationship between water temperature and output has been added to the text.	Satisfied

Table 13-3. Economics Peer Review Comments and Responses (Continued, Page 3 of 8)

Question Number	Question	Response	Comments (if any)	NextEra Response	Peer Review Response
			4) Externality costs due to CCRS retrofit may be overestimated for two reasons. First, the plume moves away from homes and recreation areas, so that the number of homes/trips affected is likely to be much smaller than the number used in the calculation. Unfortunately, I can offer no clearly superior alternative to what the authors have done, so perhaps a simple note to this effect will suffice. That said, a way of testing sensitivity would be to use the number of homes within the original "dissipation boundary" calculated by Anstine, namely, include properties within 1.2 miles instead of six miles. I'll leave the decision on which value is to be reported in Table 10-30, but the Anstine value could be reported in the text as sensitivity test.	A sensitivity analysis using Anstine's original geographical extent has been added to the text.	Satisfied
Minor Comments			1) P. 10-16, middle of first full paragraph: the text highlights three social costs, leaving one to assume that externality costs would not be quantified. In fact, they are quantified for the CCRS option.	The text has been clarified to include externality costs.	Satisfied
			2) Pp. 10-20 and 10-135 both state that government regulatory costs are estimated at 2% of direct capital costs. Table 3 of Appendix 10-A references an EPA document that puts costs at 0.02%, which is consistent with the value reported in the table. Which is it?	The permitting costs borne by taxpayers are considered to be social costs and are estimated as 0.02 percent of the direct capital costs, consistent with EPA's findings in the 2014 benefits assessment supporting the rule. The reference to 2 percent is a typographical error that will be corrected.	Satisfied

Table 13-3. Economics Peer Review Comments and Responses (Continued, Page 4 of 8)

Question Number	Question	Response	Comments (if any)	NextEra Response	Peer Review Response
			1) P. 10-53 (first full paragraph) and p. 10-55 (again, 1st full para.) seem contradictory. Are service waters to be routed through the CCRS or discharged to the lake?	Service water would be recirculated (for the purposes of this evaluation only) and not directly returned to the Lake. The sentence "Service water would be discharged to Lake Michigan and not returned to the MDCTs." in page 10-55 has been removed.	Satisfied
			2) P. 10-60: Figure 10-14 is discussed before Figure 10-13.	These figures have been rearranged so that they are discussed in the correct order.	Satisfied
			3) P. 10-106, 1st biofouling paragraph: are there two biofouling mitigation options? I see only one.	This paragraph was only intended to discuss one anti-fouling measure and has been edited to remove the reference to two measures.	Satisfied
			4) P. 10-125, bullet points 3 and 4: Both refer to "upstream" locations for FMS relative to the existing intake structure. I assumed this meant to the north (given longshore currents) but Figure 10-22 on p 10-130 makes the location more "lakeward". Some clarity would be helpful.	The text has been edited to replace "upstream" with "in front of".	Satisfied
			5) P. 10-101, last sentence of paragraphs 3: pipers?	The text has been changed to "pipes".	Satisfied
			6) Add TLOC and TWS to list of acronyms (page 10-vi)	These acronyms have been added.	Satisfied
			7) P. 10-106, line 1 of 2nd full paragraph: quagga	The text has been corrected.	Satisfied
			8) P. 11, Appendix 10-A, first sentence of 3rd full paragraph: United States.	The text has been revised.	Satisfied

Table 13-3. Economics Peer Review Comments and Responses (Continued, Page 5 of 8)

Question Number	Question	Response	Comments (if any)	NextEra Response	Peer Review Response
Social Benefits §122.21(r)(11)					
1)	Are the methods, analysis, and discussion of the monetization of the recreational, commercial, and nonuse benefits reasonable and adequate?	Yes	See comments below		
2)	In your professional opinion, do you think the information provided is both reasonable and adequate for the NPDES permitting authority to make the entrainment BTA determination?	Yes	See comments below		
Major Comments			1) There is a page numbering problem starting on what would be page 11-7 of r(11). Page 11-6 is followed by two pages labeled 11-1, after which pagination is back at 11-2, 11-3, …	The page numbers have been corrected.	Satisfied
	The next set of questions spill across both r(11) and Appendix 11-B. Page and figure numbers will refer to the appendix		2) P. 16, Figure 1.9: Why are there more recreation trips under the year 2 entrainment numbers (8000 trips at max) versus year 1 entrainment (about 5500 trips max)? These results could be related to a couple of different things: a. The change in expected catch is less in year 1 relative to year 2 (Figure 1.7) yet the percentage change in catch rate is greater in year 1 than year 2 (Figure 1.8). Further, both figures show more recreational species with improved catch rates in year 1, which made me expect a greater increase in trips in year 1 than in years 2. Why didn't we see this?	There is a larger transfer of forage biomass to Chinook salmon in Year 2 than in Year 1. Therefore, the change in expected catch for Chinook salmon is higher in Year 2 than in Year 1. Chinook salmon have a coefficient of 17.909 in the Melstrom and Lupi Model which is significantly higher than any other recreational species entrained in the model. This implies that each Chinook salmon is valued at a much higher rate than the other recreational species entrained at Point Beach. Because the change in catch for Chinook salmon is so much higher than the change in catch for other recreationally valuable entrained species and it is valued at such a high rate, the model predicts a greater change in trips in Year 2.	Satisfied

Table 13-3. Economics Peer Review Comments and Responses (Continued, Page 6 of 8)

Question Number	Question	Response	Comments (if any)	NextEra Response	Peer Review Response
			b. It's unclear how recreational species that are not explicitly included in the Melstrom & Lupi (M&L) model, such as brown bullhead and lake whitefish, were handled in the transfer exercise. Again, these species suggest a greater trip response in year 1.	Recreationally valuable species were grouped in the model based on the closest relation to the species included in the Melstrom and Lupi model. Chinook salmon are classified as Chinook salmon as that species is included in the Melstrom and Lupi model. Lake whitefish are classified as Lake trout and bluegill, brown bullhead, and common carp are classified as other and the coefficient for yellow perch is used. A footnote has been added to the report.	Satisfied
			3) P. 17, Figure 1.10. Sticking with the numbers presented in Figures 1.9 and 1.10, we see just under 8000 trips as the peak increase in year 1, yielding peak (undiscounted) benefits of about $95,000. This amounts to an incredibly low $12 per additional trip. M&L report benefits of about $30 per trip; M&L is the transfer model, so why didn't these calculations come out somewhere are $30.	Comment 4 notes that the difference in per-trip estimates between the simulation model developed for Point Beach and Melstrom and Lupi's model could come from specifying the catch rate variable as catch rate per trip in the simulation model rather than catch rate per hour in Melstrom and Lupi. We agree with this comment and have changed the catch rate specification to be catch per hour, which results in estimated per-trip values of slightly over $30.	Satisfied

Table 13-3. Economics Peer Review Comments and Responses (Continued, Page 7 of 8)

Question Number	Question	Response	Comments (if any)	NextEra Response	Peer Review Response
			4) Item #3 suggests a possible scaling problem in the numerator of the welfare calculation, and I think I've found it in the catch rate. M&L use catch per hour of effort whereas the authors use catch per trip. So I made up a simple version of an indirect utility function arising from this problem, and the adjustment needed to convert the catch rates to the scale used by M&L. Using the lake-nested model and lumping all other explanatory factors into a constant term for site j, utility at j is given by $$v_j = \alpha_j + 8.907 \times \left[\frac{Catch_j}{Hour\ of\ Effort}\right] \times \left[\frac{Hours\ of\ Effort}{Trip}\right]$$ Where the last term amounts to a scaling factor for the coefficient. Simply scale by an assumed # of hours per trip. The welfare estimates reported in this document are 60% lower than M&L; could this be what's going on?	The benefits have been re-estimated by changing the catch rate specification to be catch per hour.	Satisfied
Minor Comments			1) P. 11-2 (the second one): the equation at the top of the page is a proportion, not "the number of individuals"	The text has been edited.	Satisfied
			2) P. 11-7, Table 11-4: What is the unit used in the Total Stage Mortality column? The fact that the numbers are both greater and less than one. These can't be proportions, but then the percentages are too low (0.9% mortality for late stage fish?)	Stage Mortality (Z) is the instantaneous mortality rate for the life stage and population and is unitless. The mortality fraction is given by 1-e-Z; therefore, an instantaneous mortality of 0.9 corresponds with a mortality fraction of 59.3 percent.	Satisfied

Table 13-3. Economics Peer Review Comments and Responses (Continued, Page 8 of 8)

Question Number	Question	Response	Comments (if any)	NextEra Response	Peer Review Response
			3) P. 11-24, line 1: I don't think there's a bias associated with different technologies, at least not in any statistical sense. I think you might be referring to "complications".	The text has been edited.	Satisfied
			4) P. 11-26, Table 11-8: typo in the very last column (misplaced comma).	The text has been edited.	Satisfied
			5) P. 11-32: Place Table 11-9 after Figure 11-7.	The table has been moved.	Satisfied

Source: ECT, 2020.

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THE SIGMA GROUP
Single Source Sound Solutions

October 13, 2020

Project Reference #18722

Mr. Jason Wiesner
Senior Chemistry Analyst
Point Beach Nuclear Power Plant
6610 Nuclear Road
Two Rivers, Wisconsin 54241

Re: WPDES Permit Renewal Application Monitoring Results

Dear Mr. Wiesner:

Enclosed please find the laboratory analytical reports for the monitoring recently conducted by Sigma as required for the WPDES Permit renewal. Monitoring results have been entered into the e-Application in WAMS and are summarized in the attached tables.

Please contact me at (414) 643-4141 if you have any questions.

Sincerely,

THE SIGMA GROUP, INC.

Kristi L. Linsmeier, P.E., CHMM
Senior Engineer

Outfall Number 001/002

Pollutant	Results	Unit	Sample Type	Starting Date and Time	Ending Date and Time
pH	7.7	S.U.	Grab	09/01/20 12:00 P	--
pH	7.7	S.U.	Grab	09/04/20 11:30 A	--
pH	7.3	S.U.	Grab	09/09/20 1:30 P	--
pH	7.3	S.U.	Grab	09/17/20 12:00 P	--
Temperature	86	°F	Grab	09/01/20 12:00 P	--
Temperature	79	°F	Grab	09/04/20 11:30 A	--
Temperature	70	°F	Grab	09/09/20 1:30 P	--
Temperature	75	°F	Grab	09/17/20 12:00 P	--
BOD_5	<2.0	mg/L	FPC	08/31/20 12:00 P	09/01/20 12:00 P
COD	11.2	mg/L	FPC	09/16/20 12:00 P	09/17/20 12:00 P
TSS	3.5	mg/L	FPC	08/31/20 12:00 P	09/01/20 12:00 P
Hardness	129	mg/L	FPC	08/31/20 12:00 P	09/01/20 12:00 P
Hardness	129	mg/L	FPC	09/03/20 11:30 A	09/04/20 11:30 A
Hardness	144	mg/L	FPC	09/08/20 1:30 P	09/09/20 1:30 P
Hardness	130	mg/L	FPC	09/16/20 12:00 P	09/17/20 12:00 P
Oil & Grease (Hexane)	<1.5	mg/L	Grab	09/01/20 1:00 P	--
Chloride	12.4	mg/L	FPC	08/31/20 12:00 P	09/01/20 12:00 P
Total Residual Chlorine	0	ug/L	Grab	09/01/20 12:00 P	--
Total Recoverable Phenolics	<0.0041	mg/L	FPC	08/31/20 12:00 P	09/01/20 12:00 P
Ammonia Nitrogen	0.13	mg/L	FPC	08/31/20 12:00 P	09/01/20 12:00 P
Ammonia Nitrogen	<0.10	mg/L	FPC	09/03/20 11:30 A	09/04/20 11:30 A
Ammonia Nitrogen	0.12	mg/L	FPC	09/08/20 1:30 P	09/09/20 1:30 P
Ammonia Nitrogen	<0.10	mg/L	FPC	09/16/20 12:00 P	09/17/20 12:00 P
Nitrate Nitrite Nitrogen	0.23	mg/L	FPC	08/31/20 12:00 P	09/01/20 12:00 P
Kjeldahl Nitrogen	0.41	mg/L	FPC	08/31/20 12:00 P	09/01/20 12:00 P
Total Nitrogen	0.64	mg/L	FPC	08/31/20 12:00 P	09/01/20 12:00 P
Total Cyanide	<0.0030	mg/L	Grab	09/01/20 1:00 P	--
Amenable Cyanide	<0.0050	mg/L	Grab	09/01/20 1:00 P	--
Antimony	<0.0078	mg/L	FPC	08/31/20 12:00 P	09/01/20 12:00 P
Arsenic	<0.0042	mg/L	FPC	08/31/20 12:00 P	09/01/20 12:00 P

Beryllium	<0.0014	mg/L	FPC	08/31/20 12:00 P	09/01/20 12:00 P
Cadmium	<0.00097	mg/L	FPC	08/31/20 12:00 P	09/01/20 12:00 P
Chromium	<0.0044	mg/L	FPC	08/31/20 12:00 P	09/01/20 12:00 P
Hexavalent Chromium	<0.0032	mg/L	Grab	09/01/20 1:00 P	--
Copper	0.012	mg/L	FPC	08/31/20 12:00 P	09/01/20 12:00 P
Copper	0.0043	mg/L	FPC	09/03/20 11:30 A	09/04/20 11:30 A
Copper	<0.0035	mg/L	FPC	09/08/20 1:30 P	09/09/20 1:30 P
Copper	0.0036	mg/L	FPC	09/16/20 12:00 P	09/17/20 12:00 P
Lead	<0.0026	mg/L	FPC	08/31/20 12:00 P	09/01/20 12:00 P
Mercury	<0.000091	mg/L	FPC	08/31/20 12:00 P	09/01/20 12:00 P
Mercury	0.27	ng/L	Grab	09/01/20 1:00 P	--
Nickel	<0.0030	mg/L	FPC	08/31/20 12:00 P	09/01/20 12:00 P
Selenium	<0.0065	mg/L	FPC	08/31/20 12:00 P	09/01/20 12:00 P
Silver	<0.0021	mg/L	FPC	08/31/20 12:00 P	09/01/20 12:00 P
Thallium	<0.0046	mg/L	FPC	08/31/20 12:00 P	09/01/20 12:00 P
Zinc	0.0079	mg/L	FPC	08/31/20 12:00 P	09/01/20 12:00 P

Outfall #105

Pollutant	Results	Unit	Sample Type	Starting Date and Time	Ending Date and Time
pH	7.2	S.U.	Grab	09/01/20 1:00 P	--
pH	7.5	S.U.	Grab	09/04/20 12:00 P	--
pH	7.4	S.U.	Grab	09/09/20 1:00 P	--
pH	6.7	S.U.	Grab	09/17/20 12:30 P	--
Temperature	81	°F	Grab	09/01/20 1:00 P	--
Temperature	77	°F	Grab	09/04/20 12:00 P	--
Temperature	72	°F	Grab	09/09/20 1:00 P	--
Temperature	81	°F	Grab	09/17/20 12:30 P	--
Flowrate	133,500	gal/day	Grab	09/01/20 1:00 P	--
Flowrate	117,000	gal/day	Grab	09/04/20 12:00 P	--
Flowrate	142,000	gal/day	Grab	09/09/20 1:00 P	--
Flowrate	96,100	gal/day	Grab	09/17/20 12:30 P	--
BOD_5	3.0	mg/L	FPC	08/31/20 1:00 P	09/01/20 1:00 P
COD	12.7	mg/L	FPC	09/16/20 12:00 P	09/17/20 12:00 P
TSS	5.0	mg/L	FPC	08/31/20 1:00 P	09/01/20 1:00 P
Hardness	154	mg/L	FPC	08/31/20 1:00 P	09/01/20 1:00 P
Hardness	204	mg/L	FPC	09/04/20 12:00 P	09/04/20 12:00 P
Hardness	198	mg/L	FPC	09/08/20 1:00 P	09/09/20 1:00 P
Hardness	242	mg/L	FPC	09/16/20 12:30 P	09/17/20 12:30 P
Oil & Grease (Hexane)	<1.4	mg/L	Grab	09/01/20 1:00 P	--
Chloride	43.0	mg/L	FPC	08/31/20 1:00 P	09/01/20 1:00 P
Total Residual Chlorine	0	ug/L	Grab	09/01/20 1:00 P	--
Total Recoverable Phenolics	<0.0041	mg/L	FPC	08/31/20 1:00 P	09/01/20 1:00 P
Ammonia Nitrogen	0.69	mg/L	FPC	08/31/20 1:00 P	09/01/20 1:00 P
Ammonia Nitrogen	0.45	mg/L	FPC	09/04/20 12:00 P	09/04/20 12:00 P
Ammonia Nitrogen	0.93	mg/L	FPC	09/08/20 1:00 P	09/09/20 1:00 P
Ammonia Nitrogen	0.52	mg/L	FPC	09/16/20 12:30 P	09/17/20 12:30 P
Nitrate Nitrite Nitrogen	5.1	mg/L	FPC	08/31/20 1:00 P	09/01/20 1:00 P
Kjeldahl Nitrogen	1.2	mg/L	FPC	08/31/20 1:00 P	09/01/20 1:00 P
Total Nitrogen	6.3	mg/L	FPC	08/31/20 1:00 P	09/01/20 1:00 P

Total Cyanide	<0.0030	mg/L	Grab	09/01/20 1:00 P	--
Amenable Cyanide	<0.0050	mg/L	Grab	09/01/20 1:00 P	--
Antimony	<0.0078	mg/L	FPC	08/31/20 1:00 P	09/01/20 1:00 P
Arsenic	<0.0042	mg/L	FPC	08/31/20 1:00 P	09/01/20 1:00 P
Beryllium	<0.0014	mg/L	FPC	08/31/20 1:00 P	09/01/20 1:00 P
Cadmium	<0.00097	mg/L	FPC	08/31/20 1:00 P	09/01/20 1:00 P
Chromium	<0.0044	mg/L	FPC	08/31/20 1:00 P	09/01/20 1:00 P
Hexavalent Chromium	0.0036	mg/L	Grab	09/01/20 1:00 P	--
Copper	0.011	mg/L	FPC	08/31/20 1:00 P	09/01/20 1:00 P
Copper	0.011	mg/L	FPC	09/03/20 12:00 P	09/04/20 12:00 P
Copper	0.0072	mg/L	FPC	09/08/20 1:00 P	09/09/20 1:00 P
Copper	0.0078	mg/L	FPC	09/16/20 12:30 P	09/17/20 12:30 P
Lead	<0.0026	mg/L	FPC	08/31/20 1:00 P	09/01/20 1:00 P
Mercury	<0.000091	mg/L	FPC	08/31/20 1:00 P	09/01/20 1:00 P
Mercury	1.73	ng/L	Grab	09/01/20 1:00 P	--
Nickel	<0.0030	mg/L	FPC	08/31/20 1:00 P	09/01/20 1:00 P
Selenium	<0.0065	mg/L	FPC	08/31/20 1:00 P	09/01/20 1:00 P
Silver	<0.0021	mg/L	FPC	08/31/20 1:00 P	09/01/20 1:00 P
Thallium	<0.0046	mg/L	FPC	08/31/20 1:00 P	09/01/20 1:00 P
Zinc	0.016	mg/L	FPC	08/31/20 1:00 P	09/01/20 1:00 P

eurofins | Environment Testing America

ANALYTICAL REPORT

Eurofins TestAmerica, Chicago
2417 Bond Street
University Park, IL 60484
Tel: (708)534-5200

Laboratory Job ID: 500-187192-1
Client Project/Site: Point Beach Nuclear Plant
Revision: 1

For:
Sigma Group Inc., The
1300 West Canal Street
Milwaukee, Wisconsin 53233

Attn: Kristi Linsmeier

Authorized for release by:
11/23/2020 2:32:31 PM

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LINKS

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The test results in this report meet all 2003 NELAC, 2009 TNI, and 2016 TNI requirements for accredited parameters, exceptions are noted in this report. This report may not be reproduced except in full, and with written approval from the laboratory. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

Case Narrative

Client: Sigma Group Inc., The
Project/Site: Point Beach Nuclear Plant

Job ID: 500-187192-1

Job ID: 500-187192-1

Laboratory: Eurofins TestAmerica, Chicago

Narrative

Job Narrative
500-187192-1

Comments
No additional comments.

Revision
The report being provided is a revision of the original report sent on 9/17/2020. The report (revision 1) is being revised due to: Revision added due to erroneous H flag on Hexavalent Chromium,.

Receipt
The samples were received on 9/2/2020 10:00 AM; the samples arrived in good condition, and where required, properly preserved and on ice. The temperatures of the 2 coolers at receipt time were 1.6° C and 2.9° C.

Receipt Exceptions
A trip blank was submitted for analysis with these samples; however, it was not listed on the Chain of Custody (COC). Added to COC and logged in.

Revision added due to erroneous H flag on Hexavalent Chromium

GC/MS VOA
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

GC/MS Semi VOA
Method 625: The laboratory control sample (LCS) for preparation batch 500-559802 and analytical batch 500-560114 recovered slightly outside control limits for the following analyte: 2-Chloronaphthalene. All other were biased within the QC limits in the LCS; therefore, the data have been reported.

Method 625: The laboratory control sample (LCS) for preparation batch 500-560256 and analytical batch 500-561760 recovered slightly outside control limits for the following analyte: 2-Chloronaphthalene. All other analytes were within the QC limits in the LCS/LCSD; therefore, the data have been reported.

Method 625: The RPD of the laboratory control sample (LCS) and laboratory control sample duplicate (LCSD) for preparation batch 500-560256 and analytical batch 500-561760 recovered outside control limits for the following analytes: Hexachloroethane, 1,2,4-Trichlorobenzene, Hexachlorocyclopentadiene, Fluoranthene and Hexachlorobutadiene.

Method 625: The continuing calibration verification (CCV) associated with batch 500-561760 recovered above the upper control limit for Di-n-octyl phthalate, bis(1-chloroispropyl)ether, Bis(2-ethylhexyl) phthalate, Benzo[b]fluoranthene, Benzo[k]fluoranthene, Benzo[a]pyrene, Indeno[1,2,3-cd]pyrene, 1,2,5,6-Dibenzanthracene and 1,12-Benzoperylene. The samples associated with this CCV were non-detects for the affected analytes; therefore, the data have been reported.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Metals
Method 200.7 Rev 4.4: The low-level ICV at line 9 in 200.7 batch 500-560929 was above the method acceptance limits of 70-130% recovery for Selenium. The sample 105 (FPC) 8/31-9/1 (500-187192-1) and 001/002 (FPC) 8/31-9/1 (500-187192-2) was bracketed. The mid-range bracketing the data were all within the 90-110% recovery limits. The sample is a non-detect, therefore the data has been reported.

Method 200.7 Rev 4.4: The Initial calibration verification (ICV) in AD 500-559792 was slightly below the 95-105% control limits for antimony (89%). The affected samples 105 (FPC) 8/31-9/1 (500-187192-1) and 001/002 (FPC) 8/31-9/1 (500-187192-2) were all bracketed by continuing calibration verifications (CCV) which were within control limits. Low level QC also ran in this batch and not required by this particular method were also within control limits for antimony. All sample data has been qualified and reported.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Case Narrative

Client: Sigma Group Inc., The
Project/Site: Point Beach Nuclear Plant

Job ID: 500-187192-1

Job ID: 500-187192-1 (Continued)

Laboratory: Eurofins TestAmerica, Chicago (Continued)

General Chemistry
Method SM 3500 CR B: The following sample was analyzed immediately after the ICV and before an ICB to get the sample within holding time. The sample was analyzed before an ICB was analyzed. This samples was reanalyzed 2 minutes past the holding time to bracket it by the QC and confirm the results. The result from the original anlaysis has been reported. 001/002 (Grab) (500-187192-5)

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Subcontract non-Sister
See attached subcontract report.

Organic Prep
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Subcontract Work
Method Ultra Low Level Mercury: This method was subcontracted to Frontier GeoSciences, Inc. The subcontract laboratory certification is different from that of the facility issuing the final report.

Sample Summary

Client: Sigma Group Inc., The
Project/Site: Point Beach Nuclear Plant

Job ID: 500-187192-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received	Asset ID
500-187192-1	105 (FPC) 8/31-9/1	Water	09/01/20 13:00	09/02/20 10:00	
500-187192-2	001/002 (FPC) 8/31-9/1	Water	09/01/20 12:00	09/02/20 10:00	
500-187192-3	LL Hg Field Blank	Water	09/01/20 12:00	09/02/20 10:00	
500-187192-4	105 (Grab)	Water	09/01/20 13:00	09/02/20 10:00	
500-187192-5	001/002 (Grab)	Water	09/01/20 12:00	09/02/20 10:00	
500-187192-6	Incoming Water	Water	09/01/20 12:30	09/02/20 10:00	
500-187192-7	Trip Blank	Water	09/01/20 00:00	09/02/20 10:00	

Client Sample Results

Client: Sigma Group Inc., The
Project/Site: Point Beach Nuclear Plant

Job ID: 500-187192-1

Client Sample ID: 105 (FPC) 8/31-9/1

Date Collected: 09/01/20 13:00
Date Received: 09/02/20 10:00

Lab Sample ID: 500-187192-1

Matrix: Water

Method: 625 - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
1,12-Benzoperylene	<0.35		0.73	0.35	ug/L		09/04/20 13:57	1	AJD
1,2,4-Trichlorobenzene	<0.14		1.5	0.14	ug/L		09/04/20 13:57	1	AJD
1,2,5,6-Dibenzanthracene	<0.083		0.73	0.083	ug/L		09/04/20 13:57	1	AJD
1,2-Benzanthracene	<0.048		0.73	0.048	ug/L		09/04/20 13:57	1	AJD
1,2-Diphenylhydrazine	<0.49		3.7	0.49	ug/L		09/04/20 13:57	1	AJD
2,3,7,8-TCDD (Screen)	<7.3		7.3	7.3	ug/L		09/04/20 13:57	1	AJD
2,4,6-Trichlorophenol	<0.49		3.7	0.49	ug/L		09/04/20 13:57	1	AJD
2,4-Dichlorophenol	<0.87		7.3	0.87	ug/L		09/04/20 13:57	1	AJD
2,4-Dimethylphenol	<1.4		7.3	1.4	ug/L		09/04/20 13:57	1	AJD
2,4-Dinitrophenol	<0.77		15	0.77	ug/L		09/04/20 13:57	1	AJD
2,4-Dinitrotoluene	<0.15		0.73	0.15	ug/L		09/04/20 13:57	1	AJD
2,6-Dinitrotoluene	<0.072		0.73	0.072	ug/L		09/04/20 13:57	1	AJD
2-Chloronaphthalene	<0.12	*	1.5	0.12	ug/L		09/04/20 13:57	1	AJD
2-Chlorophenol	<0.46		3.7	0.46	ug/L		09/04/20 13:57	1	AJD
2-Nitrophenol	<1.1		7.3	1.1	ug/L		09/04/20 13:57	1	AJD
3,3'-Dichlorobenzidine	<0.48		3.7	0.48	ug/L		09/04/20 13:57	1	AJD
4,6-Dinitro-o-cresol	<1.3		15	1.3	ug/L		09/04/20 13:57	1	AJD
4-Bromophenyl phenyl ether	<0.38		3.7	0.38	ug/L		09/04/20 13:57	1	AJD
4-Chlorophenyl phenyl ether	<0.51		3.7	0.51	ug/L		09/04/20 13:57	1	AJD
4-Nitrophenol	<1.7		15	1.7	ug/L		09/04/20 13:57	1	AJD
Acenaphthene	<0.090		0.73	0.090	ug/L		09/04/20 13:57	1	AJD
Acenaphthylene	<0.099		0.73	0.099	ug/L		09/04/20 13:57	1	AJD
Anthracene	<0.14		0.73	0.14	ug/L		09/04/20 13:57	1	AJD
Benzidine	<15		29	15	ug/L		09/04/20 13:57	1	AJD
Benzo[a]pyrene	<0.055		0.73	0.055	ug/L		09/04/20 13:57	1	AJD
Benzo[b]fluoranthene	<0.060		0.73	0.060	ug/L		09/04/20 13:57	1	AJD
Benzo[k]fluoranthene	<0.12		0.73	0.12	ug/L		09/04/20 13:57	1	AJD
bis(1-chloroispropyl)ether	<0.13		1.5	0.13	ug/L		09/04/20 13:57	1	AJD
Bis(2-chloroethoxy)methane	<0.16		1.5	0.16	ug/L		09/04/20 13:57	1	AJD
Bis(2-chloroethyl)ether	<0.16		1.5	0.16	ug/L		09/04/20 13:57	1	AJD
Bis(2-ethylhexyl) phthalate	<1.7		7.3	1.7	ug/L		09/04/20 13:57	1	AJD
Butyl benzyl phthalate	<0.20		1.5	0.20	ug/L		09/04/20 13:57	1	AJD
Chrysene	<0.068		0.73	0.068	ug/L		09/04/20 13:57	1	AJD
Diethyl phthalate	<0.13		3.7	0.13	ug/L		09/04/20 13:57	1	AJD
Dimethyl phthalate	<0.12		3.7	0.12	ug/L		09/04/20 13:57	1	AJD
Di-n-butyl phthalate	<0.60		3.7	0.60	ug/L		09/04/20 13:57	1	AJD
Di-n-octyl phthalate	<1.2		7.3	1.2	ug/L		09/04/20 13:57	1	AJD
Fluoranthene	<0.15		0.73	0.15	ug/L		09/04/20 13:57	1	AJD
Fluorene	<0.12		0.73	0.12	ug/L		09/04/20 13:57	1	AJD
Hexachlorobenzene	<0.077		0.73	0.077	ug/L		09/04/20 13:57	1	AJD
Hexachlorobutadiene	<0.55		3.7	0.55	ug/L		09/04/20 13:57	1	AJD
Hexachlorocyclopentadiene	<1.4		15	1.4	ug/L		09/04/20 13:57	1	AJD
Hexachloroethane	<0.41		3.7	0.41	ug/L		09/04/20 13:57	1	AJD
Indeno[1,2,3-cd]pyrene	<0.056		0.73	0.056	ug/L		09/04/20 13:57	1	AJD
Isophorone	<0.13		1.5	0.13	ug/L		09/04/20 13:57	1	AJD
Naphthalene	<0.11		0.73	0.11	ug/L		09/04/20 13:57	1	AJD
Nitrobenzene	<0.15		0.73	0.15	ug/L		09/04/20 13:57	1	AJD
N-Nitrosodimethylamine	<1.0		7.3	1.0	ug/L		09/04/20 13:57	1	AJD
N-Nitrosodi-n-propylamine	<0.17		0.73	0.17	ug/L		09/04/20 13:57	1	AJD

Client Sample Results

Client: Sigma Group Inc., The
Project/Site: Point Beach Nuclear Plant

Job ID: 500-187192-1

Client Sample ID: 105 (FPC) 8/31-9/1

Date Collected: 09/01/20 13:00
Date Received: 09/02/20 10:00

Lab Sample ID: 500-187192-1
Matrix: Water

Method: 625 - Semivolatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
N-Nitrosodiphenylamine	<0.14		1.5	0.14	ug/L		09/04/20 13:57	1	AJD
Para-chloro-meta-cresol	<1.0		7.3	1.0	ug/L		09/04/20 13:57	1	AJD
Pentachlorophenol	<1.3		15	1.3	ug/L		09/04/20 13:57	1	AJD
Phenanthrene	<0.15		0.73	0.15	ug/L		09/04/20 13:57	1	AJD
Phenol	<0.46		3.7	0.46	ug/L		09/04/20 13:57	1	AJD
Pyrene	<0.17		0.73	0.17	ug/L		09/04/20 13:57	1	AJD

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Analyzed*	*Dil Fac*	*Analyst*
2,4,6-Tribromophenol	*105*		*40 - 145*	*09/04/20 13:57*	*1*	*AJD*
2-Fluorobiphenyl	*80*		*34 - 110*	*09/04/20 13:57*	*1*	*AJD*
2-Fluorophenol	*64*	*^c*	*27 - 110*	*09/04/20 13:57*	*1*	*AJD*
Nitrobenzene-d5	*74*		*36 - 120*	*09/04/20 13:57*	*1*	*AJD*
Phenol-d5	*42*		*20 - 110*	*09/04/20 13:57*	*1*	*AJD*
Terphenyl-d14	*126*		*40 - 145*	*09/04/20 13:57*	*1*	*AJD*

Method: 200.7 Rev 4.4 - Metals (ICP)

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
Antimony	<0.0078	^	0.020	0.0078	mg/L		09/11/20 08:05	1	JEF
Arsenic	<0.0042		0.010	0.0042	mg/L		09/10/20 18:58	1	EEN
Beryllium	<0.0014		0.0040	0.0014	mg/L		09/10/20 18:58	1	EEN
Cadmium	<0.00097		0.0020	0.00097	mg/L		09/10/20 18:58	1	EEN
Chromium	<0.0044		0.010	0.0044	mg/L		09/10/20 18:58	1	EEN
Copper	0.011		0.010	0.0035	mg/L		09/10/20 18:58	1	EEN
Lead	<0.0026		0.0050	0.0026	mg/L		09/10/20 18:58	1	EEN
Nickel	<0.0030		0.010	0.0030	mg/L		09/10/20 18:58	1	EEN
Selenium	<0.0065	^	0.010	0.0065	mg/L		09/10/20 18:58	1	EEN
Silver	<0.0021		0.0050	0.0021	mg/L		09/10/20 18:58	1	EEN
Thallium	<0.0046		0.010	0.0046	mg/L		09/10/20 18:58	1	EEN
Zinc	0.016	J	0.020	0.0073	mg/L		09/10/20 18:58	1	EEN

Method: 245.1 - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
Mercury	<0.000091		0.00020	0.000091	mg/L		09/08/20 07:47	1	MJG

Method: SM 2340B - Total Hardness (as CaCO3) by calculation

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
Hardness as calcium carbonate	154		0.91	0.46	mg/L		09/11/20 01:31	1	EEN

General Chemistry

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
Nitrogen, Nitrate Nitrite	5.1		0.50	0.21	mg/L		09/16/20 11:16	5	JJB
Phenolics, Total Recoverable	<0.0041		0.0050	0.0041	mg/L		09/16/20 13:15	1	PFK
Nitrogen, Kjeldahl	1.2		0.40	0.24	mg/L		09/16/20 11:24	1	JJB
Total Suspended Solids	5.0		5.0	1.9	mg/L		09/04/20 14:51	1	SMO
Chloride	43.0		2.0	1.0	mg/L		09/03/20 22:47	1	EAT
Chlorine, Total Residual	<200	HF	200	200	ug/L		09/04/20 07:14	1	PFK
Ammonia	0.69		0.20	0.10	mg/L		09/15/20 13:34	1	ACG1
Biochemical Oxygen Demand	3.0		2.0	2.0	mg/L		09/02/20 14:26	1	JGM
Nitrogen, Total	6.3		0.40	0.40	mg/L		09/16/20 14:10	1	JJB

Client Sample Results

Client: Sigma Group Inc., The
Project/Site: Point Beach Nuclear Plant

Job ID: 500-187192-1

Client Sample ID: 105 (FPC) 8/31-9/1

Lab Sample ID: 500-187192-1

Date Collected: 09/01/20 13:00
Date Received: 09/02/20 10:00

Matrix: Water

Method: Field Sampling - Field Sampling

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
Chlorine, Total Residual	0				ug/L		09/01/20 13:00	1	JMH
Field pH	7.2				SU		09/01/20 13:00	1	JMH
Field Temperature	81				Degrees F		09/01/20 13:00	1	JMH
Flow	133500				gal/day		09/01/20 13:00	1	JMH

Client Sample ID: 001/002 (FPC) 8/31-9/1

Lab Sample ID: 500-187192-2

Date Collected: 09/01/20 12:00
Date Received: 09/02/20 10:00

Matrix: Water

Method: 625 - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
1,12-Benzoperylene	<0.36	^c	0.74	0.36	ug/L		09/17/20 04:04	1	AJD
1,2,4-Trichlorobenzene	<0.14	*	1.5	0.14	ug/L		09/17/20 04:04	1	AJD
1,2,5,6-Dibenzanthracene	<0.084	^c	0.74	0.084	ug/L		09/17/20 04:04	1	AJD
1,2-Benzanthracene	<0.048		0.74	0.048	ug/L		09/17/20 04:04	1	AJD
1,2-Diphenylhydrazine	<0.50		3.7	0.50	ug/L		09/17/20 04:04	1	AJD
2,3,7,8-TCDD (Screen)	<7.4		7.4	7.4	ug/L		09/17/20 04:04	1	AJD
2,4,6-Trichlorophenol	<0.50		3.7	0.50	ug/L		09/17/20 04:04	1	AJD
2,4-Dichlorophenol	<0.89		7.4	0.89	ug/L		09/17/20 04:04	1	AJD
2,4-Dimethylphenol	<1.4		7.4	1.4	ug/L		09/17/20 04:04	1	AJD
2,4-Dinitrophenol	<0.78		15	0.78	ug/L		09/17/20 04:04	1	AJD
2,4-Dinitrotoluene	<0.15		0.74	0.15	ug/L		09/17/20 04:04	1	AJD
2,6-Dinitrotoluene	<0.073		0.74	0.073	ug/L		09/17/20 04:04	1	AJD
2-Chloronaphthalene	<0.12	*	1.5	0.12	ug/L		09/17/20 04:04	1	AJD
2-Chlorophenol	<0.47		3.7	0.47	ug/L		09/17/20 04:04	1	AJD
2-Nitrophenol	<1.1		7.4	1.1	ug/L		09/17/20 04:04	1	AJD
3,3'-Dichlorobenzidine	<0.49		3.7	0.49	ug/L		09/17/20 04:04	1	AJD
4,6-Dinitro-o-cresol	<1.3		15	1.3	ug/L		09/17/20 04:04	1	AJD
4-Bromophenyl phenyl ether	<0.39		3.7	0.39	ug/L		09/17/20 04:04	1	AJD
4-Chlorophenyl phenyl ether	<0.51		3.7	0.51	ug/L		09/17/20 04:04	1	AJD
4-Nitrophenol	<1.7		15	1.7	ug/L		09/17/20 04:04	1	AJD
Acenaphthene	<0.091		0.74	0.091	ug/L		09/17/20 04:04	1	AJD
Acenaphthylene	<0.10		0.74	0.10	ug/L		09/17/20 04:04	1	AJD
Anthracene	<0.14		0.74	0.14	ug/L		09/17/20 04:04	1	AJD
Benzidine	<15	*	30	15	ug/L		09/17/20 04:04	1	AJD
Benzo[a]pyrene	<0.056	^c	0.74	0.056	ug/L		09/17/20 04:04	1	AJD
Benzo[b]fluoranthene	<0.061	^c	0.74	0.061	ug/L		09/17/20 04:04	1	AJD
Benzo[k]fluoranthene	<0.13	^c	0.74	0.13	ug/L		09/17/20 04:04	1	AJD
bis(1-chloroispropyl)ether	<0.14	^c	1.5	0.14	ug/L		09/17/20 04:04	1	AJD
Bis(2-chloroethoxy)methane	<0.16		1.5	0.16	ug/L		09/17/20 04:04	1	AJD
Bis(2-chloroethyl)ether	<0.16		1.5	0.16	ug/L		09/17/20 04:04	1	AJD
Bis(2-ethylhexyl) phthalate	<1.7	^c	7.4	1.7	ug/L		09/17/20 04:04	1	AJD
Butyl benzyl phthalate	<0.20		1.5	0.20	ug/L		09/17/20 04:04	1	AJD
Chrysene	<0.069		0.74	0.069	ug/L		09/17/20 04:04	1	AJD
Diethyl phthalate	<0.13		3.7	0.13	ug/L		09/17/20 04:04	1	AJD
Dimethyl phthalate	<0.12		3.7	0.12	ug/L		09/17/20 04:04	1	AJD
Di-n-butyl phthalate	<0.61		3.7	0.61	ug/L		09/17/20 04:04	1	AJD
Di-n-octyl phthalate	<1.2	^c	7.4	1.2	ug/L		09/17/20 04:04	1	AJD
Fluoranthene	<0.15		0.74	0.15	ug/L		09/17/20 04:04	1	AJD
Fluorene	<0.12		0.74	0.12	ug/L		09/17/20 04:04	1	AJD

Client Sample Results

Client: Sigma Group Inc., The
Project/Site: Point Beach Nuclear Plant

Job ID: 500-187192-1

Client Sample ID: 001/002 (FPC) 8/31-9/1

Lab Sample ID: 500-187192-2

Date Collected: 09/01/20 12:00
Matrix: Water
Date Received: 09/02/20 10:00

Method: 625 - Semivolatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
Hexachlorobenzene	<0.078		0.74	0.078	ug/L		09/17/20 04:04	1	AJD
Hexachlorobutadiene	<0.56	*	3.7	0.56	ug/L		09/17/20 04:04	1	AJD
Hexachlorocyclopentadiene	<1.4	*	15	1.4	ug/L		09/17/20 04:04	1	AJD
Hexachloroethane	<0.41	*	3.7	0.41	ug/L		09/17/20 04:04	1	AJD
Indeno[1,2,3-cd]pyrene	<0.057	^c	0.74	0.057	ug/L		09/17/20 04:04	1	AJD
Isophorone	<0.13		1.5	0.13	ug/L		09/17/20 04:04	1	AJD
Naphthalene	<0.12		0.74	0.12	ug/L		09/17/20 04:04	1	AJD
Nitrobenzene	<0.16		0.74	0.16	ug/L		09/17/20 04:04	1	AJD
N-Nitrosodimethylamine	<1.0		7.4	1.0	ug/L		09/17/20 04:04	1	AJD
N-Nitrosodi-n-propylamine	<0.18		0.74	0.18	ug/L		09/17/20 04:04	1	AJD
N-Nitrosodiphenylamine	<0.14		1.5	0.14	ug/L		09/17/20 04:04	1	AJD
Para-chloro-meta-cresol	<1.0		7.4	1.0	ug/L		09/17/20 04:04	1	AJD
Pentachlorophenol	<1.3		15	1.3	ug/L		09/17/20 04:04	1	AJD
Phenanthrene	<0.16		0.74	0.16	ug/L		09/17/20 04:04	1	AJD
Phenol	<0.47		3.7	0.47	ug/L		09/17/20 04:04	1	AJD
Pyrene	<0.17		0.74	0.17	ug/L		09/17/20 04:04	1	AJD

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Analyzed*	*Dil Fac*	*Analyst*
2,4,6-Tribromophenol	*86*		*40 - 145*	*09/17/20 04:04*	*1*	*AJD*
2-Fluorobiphenyl	*59*		*34 - 110*	*09/17/20 04:04*	*1*	*AJD*
2-Fluorophenol	*45*		*27 - 110*	*09/17/20 04:04*	*1*	*AJD*
Nitrobenzene-d5	*67*		*36 - 120*	*09/17/20 04:04*	*1*	*AJD*
Phenol-d5	*42*		*20 - 110*	*09/17/20 04:04*	*1*	*AJD*
Terphenyl-d14	*89*		*40 - 145*	*09/17/20 04:04*	*1*	*AJD*

Method: 200.7 Rev 4.4 - Metals (ICP)

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
Antimony	<0.0078	^	0.020	0.0078	mg/L		09/11/20 08:21	1	JEF
Arsenic	<0.0042		0.010	0.0042	mg/L		09/10/20 19:15	1	EEN
Beryllium	<0.0014		0.0040	0.0014	mg/L		09/10/20 19:15	1	EEN
Cadmium	<0.00097		0.0020	0.00097	mg/L		09/10/20 19:15	1	EEN
Chromium	<0.0044		0.010	0.0044	mg/L		09/10/20 19:15	1	EEN
Copper	0.012		0.010	0.0035	mg/L		09/10/20 19:15	1	EEN
Lead	<0.0026		0.0050	0.0026	mg/L		09/10/20 19:15	1	EEN
Nickel	<0.0030		0.010	0.0030	mg/L		09/10/20 19:15	1	EEN
Selenium	<0.0065	^	0.010	0.0065	mg/L		09/10/20 19:15	1	EEN
Silver	<0.0021		0.0050	0.0021	mg/L		09/10/20 19:15	1	EEN
Thallium	<0.0046		0.010	0.0046	mg/L		09/10/20 19:15	1	EEN
Zinc	0.0079	J	0.020	0.0073	mg/L		09/10/20 19:15	1	EEN

Method: 245.1 - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
Mercury	<0.000091		0.00020	0.000091	mg/L		09/08/20 07:49	1	MJG

Method: SM 2340B - Total Hardness (as CaCO3) by calculation

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
Hardness as calcium carbonate	129		0.91	0.46	mg/L		09/11/20 01:31	1	EEN

General Chemistry

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
Nitrogen, Nitrate Nitrite	0.23		0.10	0.041	mg/L		09/16/20 11:17	1	JJB

Client Sample Results

Client: Sigma Group Inc., The
Project/Site: Point Beach Nuclear Plant

Job ID: 500-187192-1

Client Sample ID: 001/002 (FPC) 8/31-9/1

Lab Sample ID: 500-187192-2
Matrix: Water

Date Collected: 09/01/20 12:00
Date Received: 09/02/20 10:00

General Chemistry (Continued)

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
Phenolics, Total Recoverable	<0.0041		0.0050	0.0041	mg/L		09/16/20 13:17	1	PFK
Nitrogen, Kjeldahl	0.41		0.40	0.24	mg/L		09/16/20 11:27	1	JJB
Total Suspended Solids	3.5	J	5.0	1.9	mg/L		09/04/20 14:52	1	SMO
Chloride	12.4		2.0	1.0	mg/L		09/03/20 22:48	1	EAT
Chlorine, Total Residual	<200	HF	200	200	ug/L		09/04/20 07:14	1	PFK
Ammonia	0.13	J	0.20	0.10	mg/L		09/15/20 16:41	1	ACG1
Biochemical Oxygen Demand	<2.0		2.0	2.0	mg/L		09/02/20 14:43	1	JGM
Nitrogen, Total	0.64		0.40	0.40	mg/L		09/16/20 14:10	1	JJB

Method: Field Sampling - Field Sampling

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
Chlorine, Total Residual	0				ug/L		09/01/20 12:00	1	JMH
Field pH	7.7				SU		09/01/20 12:00	1	JMH
Field Temperature	86				Degrees F		09/01/20 12:00	1	JMH

Client Sample ID: 105 (Grab)

Lab Sample ID: 500-187192-4
Matrix: Water

Date Collected: 09/01/20 13:00
Date Received: 09/02/20 10:00

Method: 624 - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
1,1,1-Trichloroethane	<0.38		1.0	0.38	ug/L		09/10/20 23:14	1	JDD
1,1,2,2-Tetrachloroethane	<0.40		1.0	0.40	ug/L		09/10/20 23:14	1	JDD
1,1,2-Trichloroethane	<0.35		1.0	0.35	ug/L		09/10/20 23:14	1	JDD
1,1-Dichloroethane	<0.41		1.0	0.41	ug/L		09/10/20 23:14	1	JDD
1,1-Dichloroethene	<0.39		1.0	0.39	ug/L		09/10/20 23:14	1	JDD
1,2-Dichlorobenzene	<0.33		1.0	0.33	ug/L		09/10/20 23:14	1	JDD
1,2-Dichloroethane	<0.39		1.0	0.39	ug/L		09/10/20 23:14	1	JDD
1,2-Dichloropropane	<0.43		1.0	0.43	ug/L		09/10/20 23:14	1	JDD
1,3-Dichlorobenzene	<0.40		1.0	0.40	ug/L		09/10/20 23:14	1	JDD
1,4-Dichlorobenzene	<0.36		1.0	0.36	ug/L		09/10/20 23:14	1	JDD
2-Chloroethyl vinyl ether	<0.77		2.0	0.77	ug/L		09/10/20 23:14	1	JDD
Acrolein	<23		100	23	ug/L		09/10/20 23:14	1	JDD
Acrylonitrile	<4.5		20	4.5	ug/L		09/10/20 23:14	1	JDD
Benzene	<0.15		0.50	0.15	ug/L		09/10/20 23:14	1	JDD
Bromoform	0.49	J	1.0	0.45	ug/L		09/10/20 23:14	1	JDD
Bromomethane	<0.65		3.0	0.65	ug/L		09/10/20 23:14	1	JDD
Carbon tetrachloride	<0.38		1.0	0.38	ug/L		09/10/20 23:14	1	JDD
Chlorobenzene	<0.39		1.0	0.39	ug/L		09/10/20 23:14	1	JDD
Chlorodibromomethane	<0.49		1.0	0.49	ug/L		09/10/20 23:14	1	JDD
Chloroethane	<0.51		1.0	0.51	ug/L		09/10/20 23:14	1	JDD
Chloroform	5.6		2.0	0.37	ug/L		09/10/20 23:14	1	JDD
Chloromethane	<0.32		1.0	0.32	ug/L		09/10/20 23:14	1	JDD
cis-1,3-Dichloropropene	<0.42		1.0	0.42	ug/L		09/10/20 23:14	1	JDD
Dichlorobromomethane	0.43	J	1.0	0.37	ug/L		09/10/20 23:14	1	JDD
Ethylbenzene	<0.18		0.50	0.18	ug/L		09/10/20 23:14	1	JDD
Methylene Chloride	<1.6		5.0	1.6	ug/L		09/10/20 23:14	1	JDD
Tetrachloroethene	<0.37		1.0	0.37	ug/L		09/10/20 23:14	1	JDD
Toluene	<0.15		0.50	0.15	ug/L		09/10/20 23:14	1	JDD
trans-1,2-Dichloroethene	<0.35		1.0	0.35	ug/L		09/10/20 23:14	1	JDD

Client Sample Results

Client: Sigma Group Inc., The
Project/Site: Point Beach Nuclear Plant

Job ID: 500-187192-1

Client Sample ID: 105 (Grab)

Lab Sample ID: 500-187192-4
Matrix: Water

Date Collected: 09/01/20 13:00
Date Received: 09/02/20 10:00

Method: 624 - Volatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
trans-1,3-Dichloropropene	<0.36		1.0	0.36	ug/L		09/10/20 23:14	1	JDD
Trichloroethene	<0.16		0.50	0.16	ug/L		09/10/20 23:14	1	JDD
Vinyl chloride	<0.20		1.0	0.20	ug/L		09/10/20 23:14	1	JDD

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Analyzed*	*Dil Fac*	*Analyst*
1,2-Dichloroethane-d4 (Surr)	*94*		*71 - 127*	*09/10/20 23:14*	*1*	*JDD*
4-Bromofluorobenzene (Surr)	*116*		*71 - 120*	*09/10/20 23:14*	*1*	*JDD*
Toluene-d8 (Surr)	*101*		*75 - 120*	*09/10/20 23:14*	*1*	*JDD*

General Chemistry

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
HEM (Oil & Grease)	<1.4		5.4	1.4	mg/L		09/09/20 09:09	1	JSB
Chromium, hexavalent	**0.0036**	**J**	0.010	0.0032	mg/L		09/02/20 12:04	1	SJP
Cyanide, Total	<0.0030		0.010	0.0030	mg/L		09/14/20 14:23	1	MS
Cyanide, Amenable	<0.0050		0.010	0.0050	mg/L		09/14/20 14:19	1	MS

Client Sample ID: 001/002 (Grab)

Lab Sample ID: 500-187192-5
Matrix: Water

Date Collected: 09/01/20 12:00
Date Received: 09/02/20 10:00

Method: 624 - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
1,1,1-Trichloroethane	<0.38		1.0	0.38	ug/L		09/10/20 23:39	1	JDD
1,1,2,2-Tetrachloroethane	<0.40		1.0	0.40	ug/L		09/10/20 23:39	1	JDD
1,1,2-Trichloroethane	<0.35		1.0	0.35	ug/L		09/10/20 23:39	1	JDD
1,1-Dichloroethane	<0.41		1.0	0.41	ug/L		09/10/20 23:39	1	JDD
1,1-Dichloroethene	<0.39		1.0	0.39	ug/L		09/10/20 23:39	1	JDD
1,2-Dichlorobenzene	<0.33		1.0	0.33	ug/L		09/10/20 23:39	1	JDD
1,2-Dichloroethane	<0.39		1.0	0.39	ug/L		09/10/20 23:39	1	JDD
1,2-Dichloropropane	<0.43		1.0	0.43	ug/L		09/10/20 23:39	1	JDD
1,3-Dichlorobenzene	<0.40		1.0	0.40	ug/L		09/10/20 23:39	1	JDD
1,4-Dichlorobenzene	<0.36		1.0	0.36	ug/L		09/10/20 23:39	1	JDD
2-Chloroethyl vinyl ether	<0.77		2.0	0.77	ug/L		09/10/20 23:39	1	JDD
Acrolein	<23		100	23	ug/L		09/10/20 23:39	1	JDD
Acrylonitrile	<4.5		20	4.5	ug/L		09/10/20 23:39	1	JDD
Benzene	<0.15		0.50	0.15	ug/L		09/10/20 23:39	1	JDD
Bromoform	<0.45		1.0	0.45	ug/L		09/10/20 23:39	1	JDD
Bromomethane	<0.65		3.0	0.65	ug/L		09/10/20 23:39	1	JDD
Carbon tetrachloride	<0.38		1.0	0.38	ug/L		09/10/20 23:39	1	JDD
Chlorobenzene	<0.39		1.0	0.39	ug/L		09/10/20 23:39	1	JDD
Chlorodibromomethane	<0.49		1.0	0.49	ug/L		09/10/20 23:39	1	JDD
Chloroethane	<0.51		1.0	0.51	ug/L		09/10/20 23:39	1	JDD
Chloroform	<0.37		2.0	0.37	ug/L		09/10/20 23:39	1	JDD
Chloromethane	<0.32		1.0	0.32	ug/L		09/10/20 23:39	1	JDD
cis-1,3-Dichloropropene	<0.42		1.0	0.42	ug/L		09/10/20 23:39	1	JDD
Dichlorobromomethane	<0.37		1.0	0.37	ug/L		09/10/20 23:39	1	JDD
Ethylbenzene	<0.18		0.50	0.18	ug/L		09/10/20 23:39	1	JDD
Methylene Chloride	<1.6		5.0	1.6	ug/L		09/10/20 23:39	1	JDD
Tetrachloroethene	<0.37		1.0	0.37	ug/L		09/10/20 23:39	1	JDD
Toluene	**0.27**	**J**	0.50	0.15	ug/L		09/10/20 23:39	1	JDD

Client Sample Results

Client: Sigma Group Inc., The
Project/Site: Point Beach Nuclear Plant

Job ID: 500-187192-1

Client Sample ID: 001/002 (Grab)

Lab Sample ID: 500-187192-5
Matrix: Water

Date Collected: 09/01/20 12:00
Date Received: 09/02/20 10:00

Method: 624 - Volatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
trans-1,2-Dichloroethene	<0.35		1.0	0.35	ug/L		09/10/20 23:39	1	JDD
trans-1,3-Dichloropropene	<0.36		1.0	0.36	ug/L		09/10/20 23:39	1	JDD
Trichloroethene	<0.16		0.50	0.16	ug/L		09/10/20 23:39	1	JDD
Vinyl chloride	<0.20		1.0	0.20	ug/L		09/10/20 23:39	1	JDD

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Analyzed*	*Dil Fac*	*Analyst*
1,2-Dichloroethane-d4 (Surr)	*94*		*71 - 127*	*09/10/20 23:39*	*1*	*JDD*
4-Bromofluorobenzene (Surr)	*116*		*71 - 120*	*09/10/20 23:39*	*1*	*JDD*
Toluene-d8 (Surr)	*100*		*75 - 120*	*09/10/20 23:39*	*1*	*JDD*

General Chemistry

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
HEM (Oil & Grease)	<1.5		5.6	1.5	mg/L		09/09/20 09:09	1	JSB
Chromium, hexavalent	<0.0032		0.010	0.0032	mg/L		09/02/20 12:00	1	SJP
Cyanide, Total	<0.0030		0.010	0.0030	mg/L		09/14/20 14:23	1	MS
Cyanide, Amenable	<0.0050		0.010	0.0050	mg/L		09/14/20 14:19	1	MS

Client Sample ID: Trip Blank

Lab Sample ID: 500-187192-7
Matrix: Water

Date Collected: 09/01/20 00:00
Date Received: 09/02/20 10:00

Method: 624 - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
1,1,1-Trichloroethane	<0.38		1.0	0.38	ug/L		09/10/20 22:24	1	JDD
1,1,2,2-Tetrachloroethane	<0.40		1.0	0.40	ug/L		09/10/20 22:24	1	JDD
1,1,2-Trichloroethane	<0.35		1.0	0.35	ug/L		09/10/20 22:24	1	JDD
1,1-Dichloroethane	<0.41		1.0	0.41	ug/L		09/10/20 22:24	1	JDD
1,1-Dichloroethene	<0.39		1.0	0.39	ug/L		09/10/20 22:24	1	JDD
1,2-Dichlorobenzene	<0.33		1.0	0.33	ug/L		09/10/20 22:24	1	JDD
1,2-Dichloroethane	<0.39		1.0	0.39	ug/L		09/10/20 22:24	1	JDD
1,2-Dichloropropane	<0.43		1.0	0.43	ug/L		09/10/20 22:24	1	JDD
1,3-Dichlorobenzene	<0.40		1.0	0.40	ug/L		09/10/20 22:24	1	JDD
1,4-Dichlorobenzene	<0.36		1.0	0.36	ug/L		09/10/20 22:24	1	JDD
2-Chloroethyl vinyl ether	<0.77		2.0	0.77	ug/L		09/10/20 22:24	1	JDD
Acrolein	<23		100	23	ug/L		09/10/20 22:24	1	JDD
Acrylonitrile	<4.5		20	4.5	ug/L		09/10/20 22:24	1	JDD
Benzene	<0.15		0.50	0.15	ug/L		09/10/20 22:24	1	JDD
Bromoform	<0.45		1.0	0.45	ug/L		09/10/20 22:24	1	JDD
Bromomethane	<0.65		3.0	0.65	ug/L		09/10/20 22:24	1	JDD
Carbon tetrachloride	<0.38		1.0	0.38	ug/L		09/10/20 22:24	1	JDD
Chlorobenzene	<0.39		1.0	0.39	ug/L		09/10/20 22:24	1	JDD
Chlorodibromomethane	<0.49		1.0	0.49	ug/L		09/10/20 22:24	1	JDD
Chloroethane	<0.51		1.0	0.51	ug/L		09/10/20 22:24	1	JDD
Chloroform	<0.37		2.0	0.37	ug/L		09/10/20 22:24	1	JDD
Chloromethane	<0.32		1.0	0.32	ug/L		09/10/20 22:24	1	JDD
cis-1,3-Dichloropropene	<0.42		1.0	0.42	ug/L		09/10/20 22:24	1	JDD
Dichlorobromomethane	<0.37		1.0	0.37	ug/L		09/10/20 22:24	1	JDD
Ethylbenzene	<0.18		0.50	0.18	ug/L		09/10/20 22:24	1	JDD
Methylene Chloride	<1.6		5.0	1.6	ug/L		09/10/20 22:24	1	JDD
Tetrachloroethene	<0.37		1.0	0.37	ug/L		09/10/20 22:24	1	JDD

Client Sample Results

Client: Sigma Group Inc., The
Project/Site: Point Beach Nuclear Plant

Job ID: 500-187192-1

Client Sample ID: Trip Blank

Lab Sample ID: 500-187192-7

Date Collected: 09/01/20 00:00
Date Received: 09/02/20 10:00

Matrix: Water

Method: 624 - Volatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
Toluene	<0.15		0.50	0.15	ug/L		09/10/20 22:24	1	JDD
trans-1,2-Dichloroethene	<0.35		1.0	0.35	ug/L		09/10/20 22:24	1	JDD
trans-1,3-Dichloropropene	<0.36		1.0	0.36	ug/L		09/10/20 22:24	1	JDD
Trichloroethene	<0.16		0.50	0.16	ug/L		09/10/20 22:24	1	JDD
Vinyl chloride	<0.20		1.0	0.20	ug/L		09/10/20 22:24	1	JDD

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Analyzed*	*Dil Fac*	*Analyst*
1,2-Dichloroethane-d4 (Surr)	*95*		*71 - 127*	*09/10/20 22:24*	*1*	*JDD*
4-Bromofluorobenzene (Surr)	*118*		*71 - 120*	*09/10/20 22:24*	*1*	*JDD*
Toluene-d8 (Surr)	*100*		*75 - 120*	*09/10/20 22:24*	*1*	*JDD*

Accreditation/Certification and Definitions Summary

Client: Sigma Group Inc., The
Project/Site: Point Beach Nuclear Plant

Job ID: 500-187192-1

Laboratory: Eurofins TestAmerica, Chicago

Unless otherwise noted, all analytes for this laboratory were covered under each accreditation/certification below.

Authority	Program	Identification Number	Expiration Date
Wisconsin	State	999580010	08-31-21

The following analytes are included in this report, but accreditation/certification is not offered by the governing authority:

Analysis Method	Prep Method	Matrix	Analyte
625	625	Water	1,2-Diphenylhydrazine
Field Sampling		Water	Chlorine, Total Residual
Field Sampling		Water	Field pH
Field Sampling		Water	Field Temperature
Field Sampling		Water	Flow
Total Nitrogen		Water	Nitrogen, Total

Qualifiers

GC/MS VOA

Qualifier	Qualifier Description
J	Reported value was between the limit of detection and the limit of quantitation.

GC/MS Semi VOA

Qualifier	Qualifier Description
*	LCS or LCSD is outside acceptance limits.
*	RPD of the LCS and LCSD exceeds the control limits
^c	CCV Recovery is outside acceptance limits.

Metals

Qualifier	Qualifier Description
^	ICV,CCV,ICB,CCB, ISA, ISB, CRI, CRA, DLCK or MRL standard: Instrument related QC is outside acceptance limits.
J	Reported value was between the limit of detection and the limit of quantitation.

General Chemistry

Qualifier	Qualifier Description
HF	Field parameter with a holding time of 15 minutes. Test performed by laboratory at client's request.
J	Reported value was between the limit of detection and the limit of quantitation.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
1C	Result is from the primary column on a dual-column method.
2C	Result is from the confirmation column on a dual-column method.
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)

Accreditation/Certification and Definitions Summary

Client: Sigma Group Inc., The
Project/Site: Point Beach Nuclear Plant

Job ID: 500-187192-1

Glossary (Continued)

Abbreviation	These commonly used abbreviations may or may not be present in this report.
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
MPN	Most Probable Number
MQL	Method Quantitation Limit
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
NEG	Negative / Absent
POS	Positive / Present
PQL	Practical Quantitation Limit
PRES	Presumptive
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)
TNTC	Too Numerous To Count

Method Summary

Client: Sigma Group Inc., The
Project/Site: Point Beach Nuclear Plant

Job ID: 500-187192-1

Method	Method Description	Protocol	Laboratory
624	Volatile Organic Compounds (GC/MS)	40CFR136A	TAL CHI
625	Semivolatile Organic Compounds (GC/MS)	40CFR136A	TAL CHI
200.7 Rev 4.4	Metals (ICP)	EPA	TAL CHI
245.1	Mercury (CVAA)	EPA	TAL CHI
SM 2340B	Total Hardness (as CaCO3) by calculation	SM	TAL CHI
1664B	HEM and SGT-HEM	1664B	TAL CHI
353.2	Nitrogen, Nitrate-Nitrite	MCAWW	TAL CHI
420.4	Phenolics, Total Recoverable	MCAWW	TAL CHI
4500 NH3 H	Nitrogen, Total Kjeldahl	SM-Online	TAL CHI
SM 2540D	Solids, Total Suspended (TSS)	SM	TAL CHI
SM 3500 CR B	Chromium, Hexavalent	SM	TAL CHI
SM 4500 Cl- E	Chloride, Total	SM	TAL CHI
SM 4500 Cl F	Chlorine, Residual	SM	TAL CHI
SM 4500 CN E	Cyanide, Total	SM	TAL CHI
SM 4500 CN G	Cyanide, Amenable	SM	TAL CHI
SM 4500 NH3 G	Ammonia	SM	TAL CHI
SM 5210B	BOD, 5-Day	SM	TAL CHI
Total Nitrogen	Nitrogen, Total	EPA	TAL CHI
Field Sampling	Field Sampling	EPA	TAL CHI
Subcontract	Ultra Low Level Mercury	None	FrontierGe
1664B	HEM and SGT-HEM (SPE)	1664B	TAL CHI
200.7	Preparation, Total Metals	EPA	TAL CHI
245.1	Preparation, Mercury	EPA	TAL CHI
625	Liquid-Liquid Extraction	40CFR136A	TAL CHI
Distill/CN	Distillation, Cyanide	None	TAL CHI
Distill/Phenol	Distillation, Phenolics	None	TAL CHI
SM 4500 NH3 B	Distillation, Ammonia	SM	TAL CHI
SM4500Norg_C	Preparation, Nitrogen -Total Kjeldahl	SM	TAL CHI

Protocol References:

1664B = EPA-821-98-002

40CFR136A = "Methods for Organic Chemical Analysis of Municipal Industrial Wastewater", 40CFR, Part 136, Appendix A, October 26, 1984 and subsequent revisions.

EPA = US Environmental Protection Agency

MCAWW = "Methods For Chemical Analysis Of Water And Wastes", EPA-600/4-79-020, March 1983 And Subsequent Revisions.

None = None

SM = "Standard Methods For The Examination Of Water And Wastewater"

SM-Online = Standard Methods Online

Laboratory References:

FrontierGe = Frontier GeoSciences, Inc, 5755 8th Street E, Tacoma, WA 98424

TAL CHI = Eurofins TestAmerica, Chicago, 2417 Bond Street, University Park, IL 60484, TEL (708)534-5200

Eurofins TestAmerica, Chicago
2417 Bond Street
University Park, IL 60484
Phone. 708-534-5200 Fax. 708-534-5211

Chain of Custody Record

eurofins

Client Information
Client Contact: Dave Kuhtz / Kristi Lindmeier
Company: Sigma Group Inc., The
Address: 1300 West Canal Street
City: Milwaukee
State, Zip: WI, 53233
Phone: 414 - 643 - 4141
Email: dkuhtz@thesigmagroup.com
Project Name: Point Beach Nuclear Plant
Site:

Sampler: D. Kuhtz
Phone: 414 - 643 - 4148
Due Date Requested:
TAT Requested (days):
PO #: Purchase Order not required
WO #:
Project #: 50006599
SSOW#:

Lab PM: Fredrick, Sandie
E-Mail: sandra.fredrick@eurofinset.com
Carrier Tracking No(s):
COC No: 500-84762-38431 1
Page: Page 1 of 1
Job #: 500-187192

500-187192 COC

Analysis Requested — See Attachments

Preservation Codes: A - HCL, B - NaOH, C - Zn Acetate, D - Nitric Acid, E - NaHSO4, F - MeOH, G - Amchlor, H - Ascorbic Acid, I - Ice, J - DI Water, K - EDTA, L - EDA, M - Hexane, N - None, O - AsNaO2, P - Na2O4S, Q - Na2SO3, R - Na2S2O3, S - H2SO4, T - TSP Dodecahydrate, U - Acetone, V - MCAA, W - pH 4-5, Z - other (specify)
Other:

	Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (w=water, s=solid, o=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	353.2_Nitrogen, Total, SM4500_TKN_H, SM4500NH3_G	200.7_245.1, SM2340B	2540D_4500_Cl_F, 5210B, SM4500_Cl_E	1664B - HEM Oil and Grease	420.4 - Phenolics, Total Recoverable	4500_CN_E, 4500_Cn_G	3500_CR_B - Chromium, Hexavalent	624_5ml - Volatile Organic Compounds (GC/MS)	625 - Semivolatile Organic Compounds (GC/MS)	SUBCONTRACT - Ultra Low Level Mercury			Total Number of containers	Special Instructions/Note:
				Preservation Code:		X	X	S	D	N	S	S	B	N	A	N	N			X	
1	105 (FPC) 8/31 - 9/1	9/1/20	1:00P	C	Water			X	X	X		X				X					105 →
2	001/002 (FPC) 8/31 - 9/1	9/1/20	12:00P	G	Water			X	X	X		X				X					FLOW = 133,500 gpd
3	LL Hg Field Blank	9/1/20	12:00P	G	Water												X				Temp: 86°F
4	105 (grab)	9/1/20	1:00P	G	Water						X		X	X	X		X				pH: 7.2
5	001/002 (grab)	9/1/20	12:00P	G							X		X	X	X		X				Cl_2 = 0 mg/L
6	Incoming water	9/1/20	12:30P	G													X				
7	Trip Blank																				001/002 - Added by TA
																					Temp: 86°F
																					pH = 7.7
																					Cl_2 = 0 mg/L

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐ Radiological
Deliverable Requested: I, II, III, IV, Other (specify)

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month): ☐ Return To Client ☐ Disposal By Lab ☐ Archive For ____ Months
Special Instructions/QC Requirements:

Empty Kit Relinquished by: | Date: | Time: | Method of Shipment:

Relinquished by	Date/Time	Company	Received by	Date/Time	Company
[signature]	9/1/20		[signature]	9-1-20 15:05	TA
[signature]	9-1-20 17:00	TA	[signature]	9/2/20 1000	TA-CHI

Custody Seals Intact: Δ Yes Δ No | Custody Seal No.:
Cooler Temperature(s) °C and Other Remarks: 2.9, 0.6 → 1.6

Ver 01/16/2019

Attachment A
WDNR Required Effluent Monitoring

Common Pollutants (Outfall 001/002 and Sample Point 105)

- BOD_5, Total
- COD
- Chloride
- Chlorine, Total Residual
- Nitrogen, Ammonia (NH3-N) Total
- Nitrogen, Nitrite + Nitrate Total
- Nitrogen, Total Kjeldahl
- Nitrogen, Total
- Oil & Grease (Hexane)
- Suspended Solids, Total
- Copper, Total Recoverable

Metals, Cyanide, Hardness and Phenols (Outfall 001/002 and Sample Point 105)

- Antimony, Total Recoverable
- Arsenic, Total Recoverable
- Beryllium, Total Recoverable
- Cadmium, Total Recoverable
- Chromium +6
- Chromium, Total Recoverable
- Cyanide, Total
- Cyanide, Amenable
- Lead, Total Recoverable
- Mercury, Total Recoverable
- Nickel, Total Recoverable
- Selenium, Total Recoverable
- Silver, Total Recoverable
- Thallium, Total Recoverable
- Zinc, Total Recoverable
- Hardness, Total as CaCO3
- Phenols, Total

Volatile Organics (Sample Point 105)

Acid Extractable Compounds (Sample Point 105)

Department of Natural Resources

Enter Monitoring Results for Outfall 001

Code	Name	Sample Result	Units	QC Flag	LOD	LOQ	Analytical Method	Sample Collection Date	Sample Type	Lab ID
Volatile Organics										
6	Acrolein (107-02-8)		ug/L	☐						
8	Acrylonitrile (107-13-1)		ug/L	☐						
40	Benzene (71-43-2)		ug/L	☐						
174	Dichlorobromo-methane (bromo-dichloromethane) (75-27-4)		ug/L	☐						
80	Bromoform (75-25-2)		ug/L	☐						
93	Carbon tetrachloride (56-23-5)		ug/L	☐						
113	Chlorobenzene (108-90-7)		ug/L	☐						
115	Chlorodibromo-methane (124-48-1)		ug/L	☐						
117	Chloroethane (75003)		ug/L	☐						
118	Chloroform (67-66-3)		ug/L	☐						
584	1,3-Dichloropropylene (542-75-6)		ug/L	☐						
568	1,2-Dichloro-benzene		ug/L	☐						
581	1,3-Dichloro-benzene (541731)		ug/L	☐						
587	1,4-Dichloro-benzene (106-46-7)		ug/L	☐						
556	1,1-Dichloro-ethane (75-34-3)		ug/L	☐						
570	1,2-Dichloro-ethane (107-06-2)		ug/L	☐						
558	1,1-Dichloro-ethylene (75-35-4)		ug/L	☐						
576	1,2-trans Dichloroethylene (156-60-5)		ug/L	☐						
573	1,2-Dichloropropane (78-87-5)		ug/L	☐						
589	2-Chloroethyl vinyl		ug/L	☐						

	ether (110-75-8)									
200	Ethylbenzene (100414)		ug/L	☐						
82	Methyl bromide (74839)		ug/L	☐						
120	Chloromethane (74873)		ug/L	☐						
285	Methylene chloride (75092)		ug/L	☐						
565	1,1,2,2-Tetrachloro-ethane (79-34-5)		ug/L	☐						
490	Tetrachloroethylene (127-18-4)		ug/L	☐						
500	Toluene (108-88-3)		ug/L	☐						
561	1,1,1-Trichloro-ethane (71-55-6)		ug/L	☐						
563	1,1,2-Trichloro-ethane (79-00-5)		ug/L	☐						
508	Trichloro- ethylene (79-01-6)		ug/L	☐						
517	Vinyl chloride (75-01-4)		ug/L	☐						

Explanation of QC Flags

Save Close

Department of Natural Resources

Enter Monitoring Results for Outfall 001

Code	Name	Sample Result	Units	QC Flag	LOD	LOQ	Analytical Method	Sample Collection Date	Sample Type	Lab ID
Acid Extractable Compounds (Phenols)										
592	2-Chlorophenol (95-57-8)		ug/L	☐						
603	2,4-Dichlorophenol (120-83-2)		ug/L	☐						
604	2,4-Dimethyl-phenol (105-67-9)		ug/L	☐						
605	2,4-Dinitrophenol (51-28-5)		ug/L	☐						
349	P-Chloro-m-Cresol (3-methyl-4-chlorophenol) (59-50-7)		ug/L	☐						
593	2-Methyl-4,6-dinitrophenol (534521)		ug/L	☐						
596	2-Nitrophenol (88-75-5)		ug/L	☐						
624	4-Nitrophenol (100-02-7)		ug/L	☐						
368	Pentachloro-phenol (87-86-5)		ug/L	☐						
633	Phenol (108-95-2)		ug/L	☐						
608	2,4,6-Trichloro-phenol (88-06-2)		ug/L	☐						

Explanation of QC Flags

Save Close

ORIGIN ID:RRLA (262) 202-5955
SHIPPING
TESTAMERICA
4125 N 124TH ST

BROOKFIELD, WI 53005
UNITED STATES US

SHIP DATE: 01SEP20
ACTWGT: 61.35 LB
CAD: 525155/CAFE3406

BILL RECIPIENT

TO SAMPLE RECEIPT
TESTAMERICA LABS
2417 BOND STREET

UNIVERSITY PARK IL 60484
(708) 534-5200

REF:
INV:
PO:
DEPT:

500-187192 Wayt

FedEx Express

RT 519 5 10:30 A
ST 27 1578 09.02

1 of 2
TRK# 0201 7125 4943 1578
MASTER

WED - 02 SEP 10:30A
PRIORITY OVERNIGHT

79 JOTA

60484
IL-US ORD

48qt.

ORIGIN ID:RRLA (262) 202-5955
SHIPPING
TESTAMERICA
4125 N 124TH ST

BROOKFIELD, WI 53005
UNITED STATES US

SHIP DATE: 01SEP20
ACTWGT: 22.35 LB
CAD: 525155/CAFE3406

BILL RECIPIENT

TO SAMPLE RECEIPT
TESTAMERICA LABS
2417 BOND STREET

UNIVERSITY PARK IL 60484
(708) 534-5200

REF:
INV:
PO:
DEPT:

FedEx Express

RT 519 5 10:30 A
ST 27 1589 09.02

2 of 2
MPS# 0283 7125 4943 1589
Mstr# 7125 4943 1578 0201

WED - 02 SEP 10:30A
PRIORITY OVERNIGHT

79 JOTA

60484
IL-US ORD

16qt.

eurofins | Environment Testing America

ANALYTICAL REPORT

Eurofins TestAmerica, Chicago
2417 Bond Street
University Park, IL 60484
Tel: (708)534-5200

Laboratory Job ID: 500-187434-1
Client Project/Site: Pt. Beach Nuclear Power Plant - 18722

For:
Sigma Group Inc., The
1300 West Canal Street
Milwaukee, Wisconsin 53233

Attn: Kristi Linsmeier

Authorized for release by:
9/18/2020 3:06:35 PM

Sandie Fredrick, Project Manager II
(920)261-1660
sandra.fredrick@eurofinset.com

LINKS

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The test results in this report meet all 2003 NELAC, 2009 TNI, and 2016 TNI requirements for accredited parameters, exceptions are noted in this report. This report may not be reproduced except in full, and with written approval from the laboratory. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

Case Narrative

Client: Sigma Group Inc., The
Project/Site: Pt. Beach Nuclear Power Plant - 18722

Job ID: 500-187434-1

Job ID: 500-187434-1

Laboratory: Eurofins TestAmerica, Chicago

Narrative

Job Narrative
500-187434-1

Comments
No additional comments.

Receipt
The samples were received on 9/5/2020 10:25 AM; the samples arrived in good condition, and where required, properly preserved and on ice. The temperature of the cooler at receipt was 0.7° C.

Metals
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

General Chemistry
Method SM 4500 NH3 G: The continuing calibration verification (CCV) associated with batch 500-561984/562012 recovered above the upper control limit for NH3. The samples associated with this CCV were non-detects for the affected analytes; therefore, the data have been reported. The associated sample is impacted: #001/002 (FPC) 9/3 - 9/4 (500-187434-1).

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Sample Summary

Client: Sigma Group Inc., The
Project/Site: Pt. Beach Nuclear Power Plant - 18722

Job ID: 500-187434-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received	Asset ID
500-187434-1	#001/002 (FPC) 9/3 - 9/4	Surface Water	09/04/20 11:30	09/05/20 10:25	
500-187434-2	#105 (FPC) 9/3 - 9/4	Surface Water	09/04/20 12:00	09/05/20 10:25	

Client Sample Results

Client: Sigma Group Inc., The
Project/Site: Pt. Beach Nuclear Power Plant - 18722

Job ID: 500-187434-1

Client Sample ID: #001/002 (FPC) 9/3 - 9/4

Lab Sample ID: 500-187434-1
Matrix: Surface Water

Date Collected: 09/04/20 11:30
Date Received: 09/05/20 10:25

Method: 200.7 Rev 4.4 - Metals (ICP)

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
Copper	0.0043	J	0.010	0.0035	mg/L		09/11/20 00:48	1	JEF

Method: SM 2340B - Total Hardness (as CaCO3) by calculation

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
Hardness as calcium carbonate	129		0.91	0.46	mg/L		09/11/20 07:27	1	JEF

General Chemistry

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
Ammonia	<0.10		0.20	0.10	mg/L		09/17/20 16:34	1	ACG1

Method: Field Sampling - Field Sampling

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
Field pH	7.7				SU		09/04/20 11:30	1	JMH
Field Temperature	79				Degrees F		09/04/20 11:30	1	JMH

Client Sample ID: #105 (FPC) 9/3 - 9/4

Lab Sample ID: 500-187434-2
Matrix: Surface Water

Date Collected: 09/04/20 12:00
Date Received: 09/05/20 10:25

Method: 200.7 Rev 4.4 - Metals (ICP)

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
Copper	0.011		0.010	0.0035	mg/L		09/11/20 01:01	1	JEF

Method: SM 2340B - Total Hardness (as CaCO3) by calculation

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
Hardness as calcium carbonate	204		0.91	0.46	mg/L		09/11/20 07:27	1	JEF

General Chemistry

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
Ammonia	0.45		0.20	0.10	mg/L		09/17/20 16:37	1	ACG1

Method: Field Sampling - Field Sampling

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
Field pH	7.5				SU		09/04/20 12:00	1	JMH
Field Temperature	77				Degrees F		09/04/20 12:00	1	JMH
Flow	117000				gal/day		09/04/20 12:00	1	JMH

Accreditation/Certification and Definitions Summary

Client: Sigma Group Inc., The
Project/Site: Pt. Beach Nuclear Power Plant - 18722

Job ID: 500-187434-1

Laboratory: Eurofins TestAmerica, Chicago

Unless otherwise noted, all analytes for this laboratory were covered under each accreditation/certification below.

Authority	Program	Identification Number	Expiration Date
Wisconsin	State	999580010	08-31-21

The following analytes are included in this report, but accreditation/certification is not offered by the governing authority:

Analysis Method	Prep Method	Matrix	Analyte
Field Sampling		Surface Water	Field pH
Field Sampling		Surface Water	Field Temperature
Field Sampling		Surface Water	Flow

Qualifiers

Metals

Qualifier	Qualifier Description
J	Reported value was between the limit of detection and the limit of quantitation.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
1C	Result is from the primary column on a dual-column method.
2C	Result is from the confirmation column on a dual-column method.
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
MPN	Most Probable Number
MQL	Method Quantitation Limit
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
NEG	Negative / Absent
POS	Positive / Present
PQL	Practical Quantitation Limit
PRES	Presumptive
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)
TNTC	Too Numerous To Count

Method Summary

Client: Sigma Group Inc., The
Project/Site: Pt. Beach Nuclear Power Plant - 18722

Job ID: 500-187434-1

Method	Method Description	Protocol	Laboratory
200.7 Rev 4.4	Metals (ICP)	EPA	TAL CHI
SM 2340B	Total Hardness (as CaCO3) by calculation	SM	TAL CHI
SM 4500 NH3 G	Ammonia	SM	TAL CHI
Field Sampling	Field Sampling	EPA	TAL CHI
200.7	Preparation, Total Metals	EPA	TAL CHI
SM 4500 NH3 B	Distillation, Ammonia	SM	TAL CHI

Protocol References:

EPA = US Environmental Protection Agency
SM = "Standard Methods For The Examination Of Water And Wastewater"

Laboratory References:

TAL CHI = Eurofins TestAmerica, Chicago, 2417 Bond Street, University Park, IL 60484, TEL (708)534-5200

Chain of Custody Record 458617

eurofins | Environment Testing TestAmerica

Address: _____

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

TAL-8210

Client Contact		Project Manager: K. Lienemann	Site Contact:	Date:	COC No:
Company Name: Jigme		Tel/Email: 414-643-4141	Lab Contact:	Carrier:	____ of ____ COCs
Address:		Analysis Turnaround Time			Sampler:
City/State/Zip: Milw WI		☐ CALENDAR DAYS ☐ WORKING DAYS			For Lab Use Only:
Phone: 414-643-4141		TAT if different from Below Standard			Walk-in Client:
Fax:		☐ 2 weeks			Lab Sampling:
Project Name: Pt Beach Nuclear Power Plant		☐ 1 week			
Site: Two Rivers WI		☐ 2 days			Job / SDG No.:
PO# PR # 187122		☐ 1 day		500-187434 COC	500-187434

	Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y/N)	Perform MS/MSD (Y/N)	Ammonia Nitrogen	T. Rec. Cu	Hardness							Sample Specific Notes:
1	#001/002 (FPC) 9/3-9/4	9/4/20	11:30A	FPC	SW	2			X	X	X						pH = 7.7	Temp = 79°F
2	#105 (FPC) 9/3-9/4	9/4/20	12:00P	FPC	SW	2			X	X	X					Flow = 117,000 gpd		pH = 7.5 Temp = 77°F

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other _____

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return to Client ☐ Disposal by Lab ☐ Archive for _____ Months

Special Instructions/QC Requirements & Comments:

Custody Seals Intact: ☐ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd: -0.3 Corr'd: 0.2 | Therm ID No.: _____

Relinquished by:	Company: Jigme	Date/Time: 9/4/20	Received by:	Company: TA	Date/Time: 9-4-20 13:00
Relinquished by:	Company: TA	Date/Time: 9-4-20 1700	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by: Paula Buckley	Company: TA	Date/Time: 9/5/20 1025

TestAme

THE LEADER IN ENVIRONMENT

ST 18 RT 716 5 12:00 A 1681 09.05

ORIGIN ID:RRLA (262) 202-5955
SHIPPING
TESTAMERICA
4125 N 124TH ST

BROOKFIELD, WI 53005
UNITED STATES US

SHIP DATE:
ACTWGT: 15
CAD: 52515

BILL RECIPIENT

TO SAMPLE RECEIPT
TESTAMERICA LABS
2417 BOND STREET

UNIVERSITY PARK IL 60484
(708) 534-5200 REF:
INV:
PO: DEPT:

FedEx Express

SATURDAY 12:00P
PRIORITY OVERNIGHT

TRK# 0201 7125 4943 1681

XO JOTA

60484
IL-US ORD

500-187434 Wayt

eurofins | Environment Testing America

ANALYTICAL REPORT

Eurofins TestAmerica, Chicago
2417 Bond Street
University Park, IL 60484
Tel: (708)534-5200

Laboratory Job ID: 500-187562-1
Client Project/Site: Pt. Beach Nuclear Power Plant - 18722

For:
Sigma Group Inc., The
1300 West Canal Street
Milwaukee, Wisconsin 53233

Attn: Kristi Linsmeier

Authorized for release by:
9/18/2020 4:14:02 PM

Sandie Fredrick, Project Manager II
(920)261-1660
sandra.fredrick@eurofinset.com

LINKS

Review your project results through TotalAccess

Have a Question? Ask The Expert

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The test results in this report meet all 2003 NELAC, 2009 TNI, and 2016 TNI requirements for accredited parameters, exceptions are noted in this report. This report may not be reproduced except in full, and with written approval from the laboratory. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

Case Narrative

Client: Sigma Group Inc., The
Project/Site: Pt. Beach Nuclear Power Plant - 18722

Job ID: 500-187562-1

Job ID: 500-187562-1

Laboratory: Eurofins TestAmerica, Chicago

Narrative

Job Narrative
500-187562-1

Comments
No additional comments.

Receipt
The samples were received on 9/10/2020 10:05 AM; the samples arrived in good condition, and where required, properly preserved and on ice. The temperature of the cooler at receipt was 1.1° C.

Metals
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

General Chemistry
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Sample Summary

Client: Sigma Group Inc., The
Project/Site: Pt. Beach Nuclear Power Plant - 18722

Job ID: 500-187562-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received	Asset ID
500-187562-1	#105 (FPC) 9/8-9/9 Day #3	Surface Water	09/09/20 13:00	09/10/20 10:05	
500-187562-2	#001/002 (FPC) 9/8-9/9 Day #3	Surface Water	09/09/20 13:30	09/10/20 10:05	

Client Sample Results

Client: Sigma Group Inc., The
Project/Site: Pt. Beach Nuclear Power Plant - 18722

Job ID: 500-187562-1

Client Sample ID: #105 (FPC) 9/8-9/9 Day #3

Lab Sample ID: 500-187562-1
Matrix: Surface Water

Date Collected: 09/09/20 13:00
Date Received: 09/10/20 10:05

Method: 200.7 Rev 4.4 - Metals (ICP)

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
Copper	0.0072	J	0.010	0.0035	mg/L		09/14/20 19:37	1	EEN

Method: SM 2340B - Total Hardness (as CaCO3) by calculation

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
Hardness as calcium carbonate	198		0.91	0.46	mg/L		09/14/20 23:54	1	EEN

General Chemistry

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
Ammonia	0.93		0.20	0.10	mg/L		09/18/20 12:49	1	ACG1

Method: Field Sampling - Field Sampling

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
Field pH	7.4				SU		09/09/20 13:00	1	JVB
Field Temperature	72				Degrees F		09/09/20 13:00	1	JVB
Flow	142000				gal/day		09/09/20 13:00	1	JVB

Client Sample ID: #001/002 (FPC) 9/8-9/9 Day #3

Lab Sample ID: 500-187562-2
Matrix: Surface Water

Date Collected: 09/09/20 13:30
Date Received: 09/10/20 10:05

Method: 200.7 Rev 4.4 - Metals (ICP)

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
Copper	<0.0035		0.010	0.0035	mg/L		09/14/20 20:02	1	EEN

Method: SM 2340B - Total Hardness (as CaCO3) by calculation

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
Hardness as calcium carbonate	144		0.91	0.46	mg/L		09/14/20 23:54	1	EEN

General Chemistry

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
Ammonia	0.12	J	0.20	0.10	mg/L		09/18/20 12:51	1	ACG1

Method: Field Sampling - Field Sampling

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
Field pH	7.3				SU		09/09/20 13:30	1	JVB
Field Temperature	70				Degrees F		09/09/20 13:30	1	JVB

Accreditation/Certification and Definitions Summary

Client: Sigma Group Inc., The
Project/Site: Pt. Beach Nuclear Power Plant - 18722

Job ID: 500-187562-1

Laboratory: Eurofins TestAmerica, Chicago

Unless otherwise noted, all analytes for this laboratory were covered under each accreditation/certification below.

Authority	Program	Identification Number	Expiration Date
Wisconsin	State	999580010	08-31-21

The following analytes are included in this report, but accreditation/certification is not offered by the governing authority:

Analysis Method	Prep Method	Matrix	Analyte
Field Sampling		Surface Water	Field pH
Field Sampling		Surface Water	Field Temperature
Field Sampling		Surface Water	Flow

Qualifiers

Metals

Qualifier	Qualifier Description
J	Reported value was between the limit of detection and the limit of quantitation.

General Chemistry

Qualifier	Qualifier Description
J	Reported value was between the limit of detection and the limit of quantitation.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
1C	Result is from the primary column on a dual-column method.
2C	Result is from the confirmation column on a dual-column method.
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
MPN	Most Probable Number
MQL	Method Quantitation Limit
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
NEG	Negative / Absent
POS	Positive / Present
PQL	Practical Quantitation Limit
PRES	Presumptive
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)

Accreditation/Certification and Definitions Summary

Client: Sigma Group Inc., The
Project/Site: Pt. Beach Nuclear Power Plant - 18722

Job ID: 500-187562-1

Glossary (Continued)

Abbreviation	These commonly used abbreviations may or may not be present in this report.
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)
TNTC	Too Numerous To Count

Method Summary

Client: Sigma Group Inc., The
Project/Site: Pt. Beach Nuclear Power Plant - 18722

Job ID: 500-187562-1

Method	Method Description	Protocol	Laboratory
200.7 Rev 4.4	Metals (ICP)	EPA	TAL CHI
SM 2340B	Total Hardness (as CaCO3) by calculation	SM	TAL CHI
SM 4500 NH3 G	Ammonia	SM	TAL CHI
Field Sampling	Field Sampling	EPA	TAL CHI
200.7	Preparation, Total Metals	EPA	TAL CHI
SM 4500 NH3 B	Distillation, Ammonia	SM	TAL CHI

Protocol References:

EPA = US Environmental Protection Agency
SM = "Standard Methods For The Examination Of Water And Wastewater"

Laboratory References:

TAL CHI = Eurofins TestAmerica, Chicago, 2417 Bond Street, University Park, IL 60484, TEL (708)534-5200

Chain of Custody Record 458624

eurofins | Environment Testing, TestAmerica

Address: _____

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

TAL-8210

Client Contact	Project Manager: K. Linsmeier	Site Contact:	Date:	COC No:
Company Name: J.Gma	Tel/Email: 414-643-4141	Lab Contact:	Carrier:	____ of ____ COCs
Address:	Analysis Turnaround Time			Sampler:
City/State/Zip: Milw, WI	☐ CALENDAR DAYS ☐ WORKING DAYS			For Lab Use Only:
Phone: 414-643-4141	TAT if different from Below Standard			Walk-in Client:
Fax:	☐ 2 weeks			Lab Sampling:
Project Name: Pt. Beach Nuclear Power Plant	☐ 1 week			
Site: Two Rivers WI	☐ 2 days			Job / SDG No.: 500-187562
PO# PR # 18722	☐ 1 day			

500-187562 COC

	Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y/N)	Perform MS/MSD (Y/N)	Ammonia Nitrogen	Total Rec. Cu	Hardness											Sample Specific Notes:
1	#105 (FPC) 9/8-9/9 Day #3	9/9/20	1:00P	FPC	SW	2			X	X	X										pH =	7.4 Temp = 72°F
2	# 001/002 (FPC) 9/8-9/9 Day #3	9/9/20	1:30P	FPC	SW	2			X	X	X										pH =	7.3 Temp = 70°F

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other _____

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☐ Disposal by Lab ☐ Archive for_____ Months

Special Instructions/QC Requirements & Comments:

Custody Seals Intact: ☐ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd: 11 Corr'd: _____ | Therm ID No.: _____

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
[signature]	J.Gma	9/9/20	[signature]	TA	9-9-20 1620
Relinquished by: [signature]	Company: TA 9-9-20	Date/Time: 1700	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by: [signature]	Company: TA-CHI	Date/Time: 9/10/20 1005

eurofins | Environment Testing America

ANALYTICAL REPORT

Eurofins TestAmerica, Chicago
2417 Bond Street
University Park, IL 60484
Tel: (708)534-5200

Laboratory Job ID: 500-187990-1
Client Project/Site: Pt. Beach Nuclear Power Plant - 18722

For:
Sigma Group Inc., The
1300 West Canal Street
Milwaukee, Wisconsin 53233

Attn: Kristi Linsmeier

Sandie Fredrick

Authorized for release by:
9/23/2020 1:26:28 PM

Sandie Fredrick, Project Manager II
(920)261-1660
sandra.fredrick@eurofinset.com

LINKS

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The test results in this report meet all 2003 NELAC, 2009 TNI, and 2016 TNI requirements for accredited parameters, exceptions are noted in this report. This report may not be reproduced except in full, and with written approval from the laboratory. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

Case Narrative

Client: Sigma Group Inc., The
Project/Site: Pt. Beach Nuclear Power Plant - 18722

Job ID: 500-187990-1

Job ID: 500-187990-1

Laboratory: Eurofins TestAmerica, Chicago

Narrative

Job Narrative
500-187990-1

Comments
No additional comments.

Receipt
The samples were received on 9/18/2020 9:45 AM; the samples arrived in good condition, and where required, properly preserved and on ice. The temperature of the cooler at receipt was 2.0° C.

Metals
Method SM 2340B: The low-level ICV at in Wisconsin batch 500-562816 was above the method acceptance limits of 70-130% recovery for Magnesium. The sample #001/002 (FPC) 9/16-9/17 Day #4 (500-187990-1) and #105 (FPC) 9/16-9/17 Day #4 (500-187990-2) was bracketed. The low-level standard concentration was insignificant compared with the reported sample results and the sample results were unaffected by the bias at that level. The mid-range bracketing the data were all within the 90-110% recovery limits.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

General Chemistry
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Sample Summary

Client: Sigma Group Inc., The
Project/Site: Pt. Beach Nuclear Power Plant - 18722

Job ID: 500-187990-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received	Asset ID
500-187990-1	#001/002 (FPC) 9/16-9/17 Day #4	Surface Water	09/17/20 12:00	09/18/20 09:45	
500-187990-2	#105 (FPC) 9/16-9/17 Day #4	Surface Water	09/17/20 12:30	09/18/20 09:45	

Client Sample Results

Client: Sigma Group Inc., The
Project/Site: Pt. Beach Nuclear Power Plant - 18722

Job ID: 500-187990-1

Client Sample ID: #001/002 (FPC) 9/16-9/17 Day #4

Lab Sample ID: 500-187990-1
Matrix: Surface Water

Date Collected: 09/17/20 12:00
Date Received: 09/18/20 09:45

Method: 200.7 Rev 4.4 - Metals (ICP)

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
Copper	0.0036	J	0.010	0.0035	mg/L		09/22/20 14:27	1	EEN

Method: SM 2340B - Total Hardness (as CaCO3) by calculation

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
Hardness as calcium carbonate	130		0.91	0.46	mg/L		09/22/20 21:09	1	EEN

General Chemistry

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
Ammonia	<0.10		0.20	0.10	mg/L		09/22/20 13:27	1	ACG1

Method: Field Sampling - Field Sampling

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
Field pH	7.3				SU		09/17/20 12:00	1	JMH
Field Temperature	75				Degrees F		09/17/20 12:00	1	JMH

Client Sample ID: #105 (FPC) 9/16-9/17 Day #4

Lab Sample ID: 500-187990-2
Matrix: Surface Water

Date Collected: 09/17/20 12:30
Date Received: 09/18/20 09:45

Method: 200.7 Rev 4.4 - Metals (ICP)

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
Copper	0.0078	J	0.010	0.0035	mg/L		09/22/20 14:31	1	EEN

Method: SM 2340B - Total Hardness (as CaCO3) by calculation

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
Hardness as calcium carbonate	242		0.91	0.46	mg/L		09/22/20 21:09	1	EEN

General Chemistry

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
Ammonia	0.52		0.40	0.20	mg/L		09/22/20 13:30	2	ACG1

Method: Field Sampling - Field Sampling

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
Field pH	6.7				SU		09/17/20 12:30	1	JMH
Field Temperature	81				Degrees F		09/17/20 12:30	1	JMH
Flow	96100				gal/day		09/17/20 12:30	1	JMH

Accreditation/Certification and Definitions Summary

Client: Sigma Group Inc., The
Project/Site: Pt. Beach Nuclear Power Plant - 18722

Job ID: 500-187990-1

Laboratory: Eurofins TestAmerica, Chicago

Unless otherwise noted, all analytes for this laboratory were covered under each accreditation/certification below.

Authority	Program	Identification Number	Expiration Date
Wisconsin	State	999580010	08-31-21

The following analytes are included in this report, but accreditation/certification is not offered by the governing authority:

Analysis Method	Prep Method	Matrix	Analyte
Field Sampling		Surface Water	Field pH
Field Sampling		Surface Water	Field Temperature
Field Sampling		Surface Water	Flow

Qualifiers

Metals

Qualifier	Qualifier Description
J	Reported value was between the limit of detection and the limit of quantitation.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
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DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
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ML	Minimum Level (Dioxin)
MPN	Most Probable Number
MQL	Method Quantitation Limit
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POS	Positive / Present
PQL	Practical Quantitation Limit
PRES	Presumptive
QC	Quality Control
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RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)
TNTC	Too Numerous To Count

Method Summary

Client: Sigma Group Inc., The
Project/Site: Pt. Beach Nuclear Power Plant - 18722

Job ID: 500-187990-1

Method	Method Description	Protocol	Laboratory
200.7 Rev 4.4	Metals (ICP)	EPA	TAL CHI
SM 2340B	Total Hardness (as CaCO3) by calculation	SM	TAL CHI
SM 4500 NH3 G	Ammonia	SM	TAL CHI
Field Sampling	Field Sampling	EPA	TAL CHI
200.7	Preparation, Total Metals	EPA	TAL CHI
SM 4500 NH3 B	Distillation, Ammonia	SM	TAL CHI

Protocol References:

EPA = US Environmental Protection Agency
SM = "Standard Methods For The Examination Of Water And Wastewater"

Laboratory References:

TAL CHI = Eurofins TestAmerica, Chicago, 2417 Bond Street, University Park, IL 60484, TEL (708)534-5200

Chain of Custody Record

458114

eurofins | Environment Testing TestAmerica

Address:

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

TAL-8210

Client Contact		Project Manager: K Linsmeier	Site Contact:	Date:	COC No:
Company Name:	S.yme	Tel/Email: 414 - 643 - 4141	Lab Contact:	Carrier:	____ of ____ COCs
Address:		Analysis Turnaround Time			Sampler:
City/State/Zip:	M, W, WI	☐ CALENDAR DAYS ☐ WORKING DAYS			For Lab Use Only:
Phone:	414 - 643 - 4141	TAT if different from Below Standard			Walk-in Client:
Fax:		☐ 2 weeks			Lab Sampling:
Project Name:	Pt. Beach Nuclear Power Plant	☐ 1 week			
Site:	Two Rivers WI	☐ 2 days			Job / SDG No.:
PO#	PR # 18722	☐ 1 day			500-187990

500-187990 COC

	Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y/N)	Perform MS / MSD (Y/N)	Ammonia Nitrogen	Total Rec. Cu	Hardness		Sample Specific Notes:
1	#001/002 (FPC) 9/16 - 9/17 Day 4	9/17/20	12:00P	C	SW	2			X	X	X		pH: 7.3 T= 75°F
2	#105 (FPC) 9/16 - 9/17	9/17/20	12:30P	C	SW	2			X	X	X		FLOW = 96,100 gpd pH: 6.7 T= 81°F

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other _____

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☐ Disposal by Lab ☐ Archive for _____ Months

Special Instructions/QC Requirements & Comments:

Custody Seals Intact: ☐ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd: 6.0 Corr'd: 2.0 | Therm ID No.: _____

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
[signature]	S.yme	9/17/20	[signature]	TA	9-17-20 1600
[signature]	TA	9-17-20 1700			
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
			Received by Laboratory by: [signature]	TA-CHI	9/18/20 0945

eurofins | Environment Testing America

ANALYTICAL REPORT

Eurofins TestAmerica, Chicago
2417 Bond Street
University Park, IL 60484
Tel: (708)534-5200

Laboratory Job ID: 500-187990-2
Client Project/Site: Pt. Beach Nuclear Power Plant - 18722

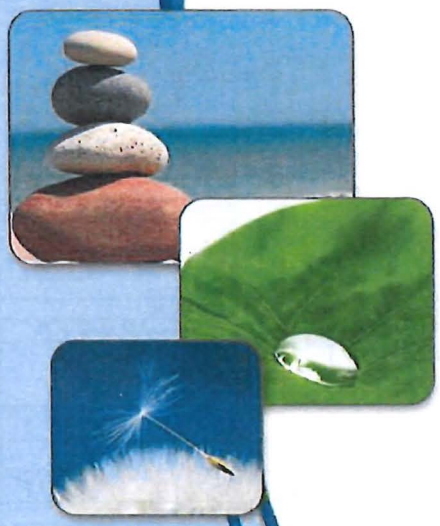
For:
Sigma Group Inc., The
1300 West Canal Street
Milwaukee, Wisconsin 53233

Attn: Kristi Linsmeier

Sandie Fredrick

Authorized for release by:
10/13/2020 3:24:55 PM

Sandie Fredrick, Project Manager II
(920)261-1660
sandra.fredrick@eurofinset.com



LINKS

Review your project results through TotalAccess

Have a Question? Ask The Expert

Visit us at: www.eurofinsus.com/Env

The test results in this report meet all 2003 NELAC, 2009 TNI, and 2016 TNI requirements for accredited parameters, exceptions are noted in this report. This report may not be reproduced except in full, and with written approval from the laboratory. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

Case Narrative

Client: Sigma Group Inc., The
Project/Site: Pt. Beach Nuclear Power Plant - 18722

Job ID: 500-187990-2

Job ID: 500-187990-2

Laboratory: Eurofins TestAmerica, Chicago

Narrative

Job Narrative
500-187990-2

Comments
No additional comments.

Receipt
The samples were received on 9/18/2020 9:45 AM; the samples arrived in good condition, and where required, properly preserved and on ice. The temperature of the cooler at receipt was 2.0° C.

General Chemistry
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Sample Summary

Client: Sigma Group Inc., The
Project/Site: Pt. Beach Nuclear Power Plant - 18722

Job ID: 500-187990-2

Lab Sample ID	Client Sample ID	Matrix	Collected	Received	Asset ID
500-187990-1	#001/002 (FPC) 9/16-9/17 Day #4	Surface Water	09/17/20 12:00	09/18/20 09:45	
500-187990-2	#105 (FPC) 9/16-9/17 Day #4	Surface Water	09/17/20 12:30	09/18/20 09:45	

Client Sample Results

Client: Sigma Group Inc., The
Project/Site: Pt. Beach Nuclear Power Plant - 18722

Job ID: 500-187990-2

Client Sample ID: #001/002 (FPC) 9/16-9/17 Day #4

Lab Sample ID: 500-187990-1

Date Collected: 09/17/20 12:00
Date Received: 09/18/20 09:45

Matrix: Surface Water

General Chemistry

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
Chemical Oxygen Demand	11.2		10.0	6.0	mg/L		10/13/20 11:26	1	JGM

Client Sample ID: #105 (FPC) 9/16-9/17 Day #4

Lab Sample ID: 500-187990-2

Date Collected: 09/17/20 12:30
Date Received: 09/18/20 09:45

Matrix: Surface Water

General Chemistry

Analyte	Result	Qualifier	LOQ	LOD	Unit	D	Analyzed	Dil Fac	Analyst
Chemical Oxygen Demand	12.7		10.0	6.0	mg/L		10/13/20 11:27	1	JGM

Accreditation/Certification and Definitions Summary

Client: Sigma Group Inc., The
Project/Site: Pt. Beach Nuclear Power Plant - 18722

Job ID: 500-187990-2

Laboratory: Eurofins TestAmerica, Chicago

The accreditations/certifications listed below are applicable to this report.

Authority	Program	Identification Number	Expiration Date
Wisconsin	State	999580010	08-31-21

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
1C	Result is from the primary column on a dual-column method.
2C	Result is from the confirmation column on a dual-column method.
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
MPN	Most Probable Number
MQL	Method Quantitation Limit
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
NEG	Negative / Absent
POS	Positive / Present
PQL	Practical Quantitation Limit
PRES	Presumptive
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)
TNTC	Too Numerous To Count

Method Summary

Client: Sigma Group Inc., The
Project/Site: Pt. Beach Nuclear Power Plant - 18722

Job ID: 500-187990-2

Method	Method Description	Protocol	Laboratory
SM 5220C	COD	SM	TAL CHI
SM 5220	COD	SM	TAL CHI

Protocol References:

SM = "Standard Methods For The Examination Of Water And Wastewater"

Laboratory References:

TAL CHI = Eurofins TestAmerica, Chicago, 2417 Bond Street, University Park, IL 60484, TEL (708)534-5200

Chain of Custody Record

458114

eurofins | Environment Testing TestAmerica

Address: _____

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

TAL-8210

Client Contact	Project Manager: K Linsmeier	Site Contact:	Date:	COC No:
Company Name: Sigma	Tel/Email: 414-643-4141	Lab Contact:	Carrier:	____ of ____ COCs
Address:	Analysis Turnaround Time			Sampler:
City/State/Zip: Milw WI	☐ CALENDAR DAYS ☐ WORKING DAYS			For Lab Use Only:
Phone: 414-643-4141	TAT if different from Below Standard			Walk-in Client:
Fax:	☐ 2 weeks			Lab Sampling:
Project Name: Pt. Beach Nuclear Power Plant	☐ 1 week			
Site: Two Rivers WI	☐ 2 days			Job / SDG No.: 500-187990
PO# PR # 18722	☐ 1 day			

500-187990 COC

	Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y/N)	Perform MS / MSD (Y/N)	Ammonia Nitrogen	Total Rec. Cu	Hardness	Sample Specific Notes:
1	#001/002 (FPC) 9/16 - 9/17 Day 4	9/17/20	12:00P	C	SW	2			X	X	X	pH: 7.3 T= 75°F
2	#105 (FPC) 9/16 - 9/17	9/17/20	12:30P	C	SW	2			X	X	X	FLOW = 96,100 gpd pH: 6.7 T= 81°F

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other _____

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☐ Disposal by Lab ☐ Archive for _____ Months

Special Instructions/QC Requirements & Comments:

Custody Seals Intact: ☐ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd: 6.0 Corr'd: 2.0 | Therm ID No.: _____

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
[signature]	Sigma	9/17/20	[signature]	TA	9-17-20 1600
Relinquished by: [signature]	Company: TA 9-17-20	Date/Time: 1700	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by: Laboratory by: [signature]	Company: TA-CHI	Date/Time: 9/18/20 0945

10/13/2020

Document Request 4

Affected SLRA Enclosure 3, Attachment 2, Sections: Chapter 10

SLRA Page Number: 10-15

Description of Change: Reference citation added to Chapter 10 and reference provided for docketing.

Reference pertains to: Sections 3.10.2, 4.9.2.4

Page 10-15

ORNL (Oak Ridge National Laboratory). 2012. An Assessment of Energy Potential at Non-Powered Dams in the United States. Oak Ridge, TN: ORNL. April 2012. Retrieved from <http://www1.eere.energy.gov/water/pdfs/npd_report.pdf> (accessed July 2, 2019, and February 28, 2020).

OSHA (Occupational Safety and Health Administration). 2019. Voluntary Protection Programs Compressed Reapproval Process (CRP) Evaluation Report. NextEra Energy Point Beach, LLC, Two Rivers, Wisconsin. Onsite Evaluation Dates September 23-26, 2019.

PADCNR (Pennsylvania Department of Conservation and Natural Resources). 2020. Invasive Plants in Pennsylvania: Hairy Willow-Herb. Retrieved from <http://www.docs.dcnr.pa.gov/cs/groups/public/documents/document/dcnr_010266.pdf> (accessed February 19, 2020).

Compressed Reapproval Process (CRP) Evaluation Report

NextEra Energy Point Beach, LLC
Two Rivers, WI

Onsite Evaluation Dates
September 23-26, 2019

VPP Evaluation Team
Kelly Bubolz, Team Leader, Safety Specialist
Mary Bauer, Backup Team Leader, Industrial Hygienist
Corey Beacom, Health Physicist/Industrial Hygienist
Jacob Schueller, Special Government Employee, Safety Specialist
Tina Demotts, Special Government Employee, Safety Specialist

EXECUTIVE SUMMARY

I. Purpose and Scope of Review

An onsite review was conducted from September 23-26, 2019, at the NextEra Energy Point Beach, LLC in Two Rivers, WI. The purpose of the evaluation was to determine the site's continued eligibility for site-based participation in the Occupational Safety and Health Administration's (OSHA) Voluntary Protection Programs (VPP). This onsite review was conducted using the Compressed Reapproval Process (CRP). The VPP Evaluation Team consisted of:

Kelly Bubolz, Team Leader, Safety Specialist, OSHA, Appleton, WI,
Mary Bauer, Backup Team Leader, Industrial Hygienist, OSHA, Eau Claire, WI,
Corey Beacom, PhD, Health Physicist/Industrial Hygienist, OSHA, Salt Lake City, UT,
Jacob Schueller, Safety Specialist, Special Government Employee (SGE), Oshkosh Defense, Oshkosh, WI,
Tina Demotts, Safety Specialist, SGE, Oshkosh Defense, Oshkosh, WI.

II. Methods of Data Collection

The information for this report was obtained from the site's VPP application, documentation reviewed onsite, interviews with employees, annual evaluations, and walk-throughs of the facility.

III. Employees at the Worksite

There are 450 employees working at the facility. In addition, there are 200 contractor employees onsite performing maintenance, capital projects, guard services, janitorial services, etc. Employees at the site are represented by the International Brotherhood of Electrical Workers, Local 2150, and the Northeast Wisconsin Building and Construction Trades Council. Formal interviews were conducted with 37 site employees and 18 contract employees. Informal interviews were conducted with 51 site employees and 33 contract employees.

IV. The Worksite

The site is properly classified under North American Industrial Classification System (NAICS) number 221113, *Nuclear Power Generation*. The site is located on 1260 acres adjacent to Lake Michigan. The major structures on the site are two reactor containments and the following structures: auxiliary building, pump house, turbine building, emergency generator building, and service building. The work performed at NextEra Energy Point Beach nuclear plant (PBNP) supports the operation, maintenance, modifications, and testing of plant equipment as necessary for the production and delivery of electricity by means of a nuclear power generating station. Unique to a nuclear power plant are systems that process radioactive liquid and solid radioactive waste, systems that are used to monitor radiological and atmospheric conditions in the plant, and systems designed to monitor and control the safe operation of the reactor core.

Housekeeping at the facility was considered by the VPP Evaluation Team to be excellent.

V. Worksite Hazards

The hazards at the site include radiation exposure, radiological contamination, high noise, heat stress, confined spaces, inhalation hazards, rotating equipment, fall hazards, and compressed gases. Radiation protection (RP) safety addresses employee exposure to radiation and radioactive material within the facility and nuclear safety addresses radiation release or exposure to the atmosphere or public.

PBNP has a comprehensive confined space program that complies with OSHA regulation 1910.146. They attempt to reclassify, if possible, to non-permit spaces. However, if reclassification is inappropriate, entry is conducted using a permit required confined space protocol following all precautions and requirements.

Hydrogen gas is used to cool the two turbine generators. The VPP Evaluation Team surveyed the hydrogen storage and piping system used to provide charging and make-up hydrogen gas to the two electric turbine generators. The OSHA Hydrogen Standard 1910.103 and National Fire Protection Association (NFPA) 55-2010, Compressed Gasses and Cryogenic Fluids Code were both consulted for minimum standards and prudent practice. It was estimated that the hydrogen system volume was 56,076 cubic feet, which includes the four main tanks and two reserve tanks, that are bundled and mounted outside on the east side of the turbine building. The hydrogen gas in storage weighs 140 pounds and consequently does not meet the OSHA threshold for the process safety management requirements.

The site does not use chemicals in sufficient quantity to place the site under the Process Safety Management (PSM) standard.

VI. Injury and Illness Rates

The three-year Total Case Incidence Rate (TCIR) and Days Away/Restricted/Transferred (DART) case incidence rate for the period 2017-2019 are 0.05 and 0.05, respectively. The site TCIR is 75% below, and the DART rate is 50% below the 2018 Bureau of Labor Statistics (BLS) industry average for NAICS number 221113.

The information on the OSHA 300 logs supports the information provided in the application, and the company's first report of injury forms support the data in the logs. The safety manager is responsible for the entries to the OSHA 300 log and verified the accuracy of the records. The safety manager understands the recordkeeping requirements. Based upon interviews conducted with management and employees, the logs accurately reflect the injury and illness experience at this plant.

The site qualifies for the alternative rate calculation that has been applied below.

Year	Hours	Total # of Cases	TCIR Rate	Number of Cases Involving Days Away from Work, Restricted Activity or Job Transfer	DART Rate
2016	1,387,718	0	0.0	0	0.0
~~2017~~	~~1,387,081~~	~~1~~	~~0.1~~	~~1~~	~~0.1~~
2018	1,329,828	0	0.0	0	0.0
2019	1,179,018	1	0.2	1	0.2
Total	3,896,564	1		1	
Three-Year Rate 2017-2019 NAICS code 221113			0.05		0.05
Most recent published BLS rate for NAICS code 221113			0.2		0.1

VII. OSHA Activity

There has been no OSHA inspection activity and there have been no fatalities at this site within the past 10 years. The site maintains an excellent relationship with its local OSHA Area and Regional Offices.

VIII. Elements of the VPP Review/Program Changes

The VPP Evaluation Team has examined each of the required elements of the site's safety and health management programs. All VPP requirements have been met and all OSHA standards are appropriately covered.

Management Leadership and Employee Involvement

The commitment to safety and health is directed from the NextEra Energy Nuclear Fleet corporate level and extends through all levels of management and employees at PBNP. The site safety culture is guided by its four safety guiding principles: all injuries are preventable; leaders are personally responsible for preventing injuries; safety shall be planned into all work; and all employees will look out for themselves and for each other. Based on employee interviews and observation, these principles are instilled in all employees through initial training and are continually reinforced on a daily basis. Interviews with the executive leadership team and with union leadership and represented employees confirmed that the labor/management relationship is strong with respect to safety and health. Employees stated that whenever a concern is raised, it is promptly addressed and resolved.

Management goals and objectives include performance metrics, such as keeping injuries and radiation dose to a minimum, as well as leading indicators, such as behavior-based safety observations and human performance processes aimed at proactively identifying and mitigating risk. An emphasis is placed on industrial safety, radiological safety, and nuclear safety as critical aspects of overall business performance. Planning for safety extends to daily operations and reflects the site's mantra, "Zero Today," a philosophy that all injuries are preventable, and zero injuries must be the vision. Tools including behavior-based safety (BBS), job hazard analysis, pre-job briefings, two-minute reviews, job site huddles, self-checking, three-way communication, procedure use and adherence, and others are employed daily to ensure safety is planned into all work.

All employees are expected to follow safe work practices and accept accountability for their actions. PBNP encourages employee participation through its various programs and policies. This is evidenced by the number of safety concerns that are raised by the individuals working in the field and tracked to closure through the corrective action program (CAP). Employees are confident that when they identify a safety issue, it will be adequately screened, prioritized and corrected in a timely manner. Additional opportunities to participate are provided through the safety committee, the BBS steering committee, medical response team member, or as a fire brigade member.

PBNP safety and health resources include a safety and health manager (which is a direct report to the operations general manager), senior industrial safety and health analyst, fire protection coordinator, safety committee chairperson, registered nurse, and human performance improvement coordinator. In addition, dedicated emergency planning and radiation physics teams support nuclear and radiological safety at the plant.

The contractor safety program is exceptional, starting with prequalification screening, extensive onsite qualification training, and extending through hazard assessment, safety planning, pre-job

briefs, inspections/oversight, and post-job reviews. In general, contractors (including supervisory personnel) must be trained and qualified to the same level as site employees, and are held accountable to the same standards.

Employees participate on the industrial safety committee (ISC). The ISC is responsible for promoting occupational safety and health at work and off the job for the benefit of all employees, contractors, and visitors. They accomplish this by reviewing, evaluating, and recommending the adoption of appropriate safety policies, safety practices, and plant modifications.

At PBNP, all meetings and briefings start with safety, and the daily 15-minute meeting (D-15) includes a "safety focus," "injury statistics" and a "thumbs up/thumbs down" rating by all personnel in the areas of "accident free" and "control dose."

Worksite Hazard Analysis

As a nuclear electrical generating facility, the inherent processes for the station to operate require many government and industry inspections. The Nuclear Regulatory Commission (NRC), Institute of Nuclear Power Operators, and World Association of Nuclear Operators, as well as self-assessments and insurance inspectors conduct regularly scheduled inspections.

All work performed at PBNP is analyzed for potential hazards regarding health and safety. The focus is the same whether the activity is an infrequently performed complex evolution, or a routine task, such as daily preventative maintenance. Many of the work hazards are identified during the work planning process and documented in the work package. Industrial safety issues are identified through the work order screening process.

The site has an industrial hygiene program with several long-standing programs such as radiation, hearing conservation, asbestos, and lead. The industrial hygiene program also includes programs such as bloodborne pathogens, heat stress, and ergonomics. Baseline industrial hygiene monitoring has been done for several contaminates and physical hazards. Historical and objective data is used when applicable since several tasks are done only during outages and not necessarily every outage.

Monitoring is scheduled if there is an employee complaint or concern, or a new or changed process, such as, the recent silica monitoring for a small concrete saw-cutting job by a contractor. New chemicals must be approved prior to allowing the material on the site.

The site has been operational since the 1970s and used asbestos containing insulation on the pipes and turbines. An on-site contractor is trained and qualified to remove insulation that is suspected or tested to be asbestos. Previous work orders with site descriptions and post removal labeling of the insulation or covering, track the "Asbestos Free" and "Asbestos Containing" insulation for future work. Project planning includes testing and removal of asbestos containing materials. If there is a question, the material is removed assuming it contains asbestos. Although a significant amount of asbestos containing material remains in the facility, the staff feels confident that there is no friable material. Work orders are submitted if any friable material is found.

Paint is tested for lead prior to work, and removed with a chemical stripper that gums up when scraped eliminating lead from becoming airborne. The Facilities Department manages the lead program and has the training and ability to do testing.

Noise surveys have been done and all plant employees are under the Hearing Conservation Program. Audiograms are done on-site with a contracted Audiologist. No standard threshold shifts have been recorded for over eight years. Plant personnel do not spend large amounts of time in loud areas. Plant outages mimic an industrial construction site with intermittent noise for hand tools and saws.

Heat Stress is reviewed each summer. This year, the worst situation was 106° F and 30% humidity for a 15-minute task. Employees were supplied cooling vests.

Ergonomic reviews are done at work stations with over 100 "sit to stand" workstations added. Workers implemented several improvements such as cradles for parts removal and replaced submersible pumps with lighter weight, easier to handle versions.

Employees are informed of how to obtain exposure and medical records at new hire orientation and at annual training. The on-site Health Services maintains the confidentiality of medical records. Health Services provides Hepatitis B vaccinations for first aid personnel, flu shots for all that request them under the wellness program, and medical evaluations for various programs such as respirators, emergency response, crane operator, NRC requirements, and rescue teams. New equipment and materials are purchased with particular requirements per the physical change procedure and the procurement control procedures to suit the needs of the job.

Most procedures at PBNP are to assure personnel safety and nuclear safety. The procedures include "precautions and limitations" to alert the user of hazards associated with the work to be done. All of the procedures go through a review process.

Due to the complexity of the work performed at PBNP, job hazard analysis is completed as part of every job in the form of precautions and limitations and pre-job briefs. Pre-job briefs are required for all work performed at the station. The detail of these briefs is determined by the complexity of the given task. All briefs are required to include job hazards, special precautions, and appropriate personal protective equipment.

PBNP procedures contain a precautions and limitations section. This section is used to alert the employee to potential hazards, to avoid abnormal or emergency situations, to provide protective measures related to plant equipment, personnel, and the public, and to specify limitations on affected parameters and appropriate corrective measures. Procedures contain notes, cautions and warnings in the body of the procedure that provide information related to personnel, public, equipment or plant safety.

A good portion of the daily routine work at PBNP occurs in the radiological controlled area (RCA). Entry into the RCA is strictly controlled. All personnel who enter must sign a radiation work permit (RWP). The RWP provides access control, guidelines for radiological protection, and informs the worker about expected conditions in a work area. The RWP provides an exposure recording system that allows the as low as reasonably achievable (ALARA) program to track and trend daily worker exposure received while working in the RCA.

Radiological surveys in the RCA are conducted using established frequencies (weekly, monthly, bi-monthly, quarterly). Surveys include radiation survey, contamination surveys, and airborne radiological surveys. Survey results are posted in the work area and are kept with radiation protection at the entrance of the RCA.

All work in the RCA is performed on a job-specific RWP. Each RWP has an established dose and dose rate limit for entry. If a worker exceeds the dose or dose rate limit on their electronic personal dosimeter (EPD), the worker is prevented from re-entering the RCA until an investigation is performed.

All workers trained to work in radioactive areas are issued a thermo luminescent dosimeter (TLD) to monitor their occupational radiation dose. TLD are analyzed by a vendor once per quarter. Dose between quarterly TLD analyses is tracked using the worker's EPD.

Portal monitors at the exit of the RCA and at the exit of the plant, monitor workers for contamination. If a worker sets off an alarm at a portal, radiation protection (RP) investigates and initiates internal dosimetry procedures (whole body count, urine analysis, fecal analysis) as appropriate to calculate dose from internally deposited radionuclides. The site sets administrative annual dose limits of 2 roentgen equivalent man (rem) for the total effective dose equivalent (TEDE) compared to the NRC limit of 5 rem; 20 rem total organ dose equivalent (TODE) compared to the NRC limit of 50 rem to any single organ; 6 rem to lens of the eye compared to the NRC limit of 15 rem; and 20 rem shallow dose equivalents compared to the NRC limit of 50 rem.

Administrative dose limits have not been exceeded since 1995.

If significant changes in the work environment occur, work activities will be suspended until the cause is known and addressed. In addition to suspension of the work, a CAP would be generated to track and trend the occurrence. Once identified, a deficiency is documented through the generation of a CAP, action request process, or through the work order process. The CAP is prioritized and assigned for action. The corrective actions group tracks the status of the assigned work and provides updates regarding completion.

One of the ways PBNP integrates new processes is through training. The training department facilitates new process integration by developing training programs that familiarize employees with the new process and the behaviors and skills needed to ensure a smooth transition to the new process.

The health physics department (HPD) performs daily surveys of radiation levels in the plant. These readings are compared to historical readings to verify that the radiological conditions in a specific area have not changed. These inspections are conducted by trained HPD technicians and are crucial to worker safety concerning exposure control. General traffic routes, temporary shielding, stay times, and RWP requirements are all determined from the information gleaned from these surveys.

Fire protection tours are performed monthly with the entire facility being inspected quarterly.

The leadership observation program is intended to enhance human performance at the station by providing a means for work tasks to be observed by members of the management team. Work tasks are compared to station standards and feedback is provided for all tasks observed. Feedback includes whether the standard has been exceeded or met, or improvement is required. Observations look for key elements of industrial safety and job performance.

The operating experience program reviews incidents that have occurred at other nuclear power facilities within the fleet that could affect plant equipment or personnel.

Hazard Prevention and Control

The inherent design of the pressurized water, closed-cycle reactor significantly reduces the quantities of fission products, which are released to the atmosphere. The reactor containment is designed to adequately retain these fission products under the most severe accident conditions. Several engineered safety features have been incorporated into the plant design to reduce the consequences of a loss-of-coolant accident. Complete supervision of both the reactor and turbine generator is accomplished from the control room.

The engineered safety features provided for this plant have redundancy of component and power sources such that under the conditions of a hypothetical loss-of-coolant accident, the system can, even when operating with partial effectiveness, maintain the integrity of the containment and keep the exposure of the public below the applicable guidelines.

Lagging on pipes, guards on machinery, location of labs and transformer bays are examples of engineering controls that have been implemented at PBNP. Asbestos lagging is replaced with non-asbestos materials on an ongoing basis.

Each team member within the facility is involved in and responsible for worksite analysis. These include completing job-site review cards, job safety analysis, and behavior-based safety observations. The effectiveness of this was evident throughout the on-site evaluation demonstrated through employee interviews and observations. Employees were able to show recent job site review cards completed for tasks that day and how they used the hierarchy of controls to control the hazards identified. The facility also has a strong health and wellness program for all team members as well as retirees and spouses. This program includes access to onsite medical professionals, trainings, and fitness center. New since the last evaluation is the implementation of a technical rescue team. This team is made of volunteers within the facility who are trained in confined space rescue, incident management, and high angle rescue.

An overtime policy provides instruction for setting forth a policy to restrict work hours to optimize nuclear, industrial, and radiological safety and to minimize the possibility of an accident due to fatigue. This directive applies to all PBNP personnel, and all contractors involved in work activities at the station.

Heat stress guidelines provide guidance for obtaining temperature readings, stay times and how to recognize the symptoms of heat related illness.

A pre-job brief is required for all work at PBNP. The level of detail and effort to conduct the brief is commensurate with the type of work being performed. The brief can involve a simple

interaction between employee and supervisor, the use of the "Event Free Human Performance Tools" card and/or the use of the "Pre-Job Brief Checklist." For infrequently performed tests or evolutions, management participation is required.

The PBNP utilizes tag-out processing procedures to protect workers from hazardous energy and control of ignition sources (hot work permit) to minimize the potential for fire.

PBNP has a personal protective equipment (PPE) program, which governs the use of PPE inside and outside the plant. PPE includes the use of fall protection, hearing protection, eye protection, hard hats, protective footwear, hand protection, and personal flotation devices.

Job specific procedures may also prescribe the PPE requirements for that particular task. These requirements are beyond the normal PPE requirements and are normally listed in the precautions and limitations portion of the procedure. They may include chemical PPE, radiation and contamination PPE, and electrical PPE.

The PBNP safety and discipline policy provides general safety guidelines and enforcement of all safety rules. Along with this safety policy is the PBNP accident prevention manual that provides the rules and safe practices needed to protect its employees from injury.

The preventive/predictive maintenance directive provides instruction for defining the responsibilities and requirements in the administration and implementation of the preventive maintenance optimization program for electrical, mechanical, and instrument and control maintenance tasks.

Local hospitals, clinics, emergency medical staff, and fire departments are utilized for emergency services. The facility has a registered nurse at the site full-time and a physician that is at the facility once a week to review the medical surveillance programs, such as, but not limited to pre-employment physicals, respirator medical evaluations, audiograms, NRC license physicals, asbestos physicals, HAZWOPER physicals, quality control inspector physicals and lead worker physicals.

Medical equipment is available at the plant, such as emergency medical technician kits, automated external defibrillators, and first aid kits for use by trained first aid and cardio pulmonary resuscitation employees.

Federal law requires each nuclear power plant to have an emergency plan. The primary goal of the emergency plan is protection of the health and safety of the public, PBNP's employees, and station equipment. The regulations require the emergency plan and implementing procedures to address a specific set of objectives/criteria. These objectives/criteria include classification of emergencies, response, mitigation, public information, notification/coordination with federal, state and local authorities, conducting of drills/training, and identification and correction of deficiencies. PBNP has an emergency plan and has implements emergency response procedures that address a wide variety of accident scenarios. The four categories from least to most severe include unusual event, alert, site area emergency, and general emergency. The plant conducts drills to demonstrate their ability to protect the health and safety of the public, employees and station equipment. Site accountability and evacuation drills are performed annually with evaluations performed by the plant's emergency preparedness group. General emergency

response drills are performed annually with an NRC/Federal Emergency Management Agency evaluated exercise held every two years.

Hydrogen gas is used to cool the two turbine generators. The VPP Evaluation Team surveyed the hydrogen storage and piping systems used to provide charging and make-up hydrogen gas to the two electric turbine generators. The OSHA Hydrogen standard 1910.103 and NFPA 55-2010, Compressed Gasses and Cryogenic Fluids Code were both consulted for minimum standards and prudent practice. It was estimated that the hydrogen system volume, by volume and weight, that the amount of hydrogen does not meet the OSHA threshold level requirements for process safety management.

A large portion of the daily routine work at PBNP occurs in the RCA. Entry is strictly controlled and mandatory dosimetry is required for all workers and visitors who enter the RCA. All workers and visitors receive training and then are required to sign a RWP. The RWP provides access control, guidelines for radiological protection, and informs the worker about expected conditions in work areas. The RWP provides an exposure recording system that allows the "as low as reasonably achievable" (ALARA) program to track and trend daily worker exposure while working in the RCA.

Radiological surveys in the RCA are conducted using established frequencies (weekly, monthly, bi-monthly, and quarterly). Surveys include radiation surveys, contamination surveys, and airborne surveys in addition to monitoring radiological instruments for environmental surveys. Surveys are posted in the work areas and kept with radiation protection at the entrance to the RCA.

All work in the RCA is performed on a job-specific RWP. Each RWP has an established dose and dose rate limit for a work entry. If a dose or dose rate limit, measured by their electronic personal dosimeter (EPD), is exceeded during work the worker is not permitted to re-enter a radiological controlled area until an investigation is completed.

Radiological surveys are completed prior to conducting work in the RCA. The surveys include air sample collection, dose rate, and contamination analysis of the proposed work area. If significant changes in the work area, activities are suspended until the cause is discovered and addressed. The surveys are conducted by trained technicians from the HPD and are crucial to worker ionizing radiation exposures.

All workers trained to work in RCAs are issued a thermo-luminescent dosimeter (TLD) and an EPD to monitor their occupational exposure dose to ionizing radiation. TLDs are monitored by a vendor quarterly, and EPDs are monitored and tracked daily when workers enter and leave the RCA. The dose between quarterly TLD analysis is tracked using the worker's EPD to ensure exposure dose is not exceeded. PBNP utilizes ALARA for all work done in the RCA to reduce exposures to all personnel to ionizing radiation. Administrative dose limits have not been exceeded since 1995.

The facility also portal monitors at the exit of the RCA and at the exit of the plant to monitor workers for contamination. If a worker sets off an alarm at a portal, monitor radiation protection (RP) investigate and perform decontamination immediately. RP also initiates internal dosimetry procedures when a worker triggers a contamination alarm to calculate dose from internally

deposited radionuclides. The site as set an administrative limit of two roentgen equivalent man (REM) total effective dose equivalent (TEDE) compared to the 10 CFR 20 limit of 5 REM, and 20 REM total organ dose equivalent (TODE) compared to 50 REM to any single organ. They have also set ocular dose limits to 6 REM compared to the 10 CFR 20 limit of 15 REM, and a 20 REM shallow dose equivalent compared to the limit of 50 REM.

Due to the age of this plant, the company exerts a concerted effort to limit the amount of "crud" contained in the reactor coolant system to reduce or eliminate high radiation areas inside the reactor containment. They have also implemented a layered shielding system that is easier to set-up compared to lead systems to shield high radiation spots to reduce worker exposure to radiation during outages. Permanent and temporary shielding is used throughout the plant to reduce dose rates to workers in addition to those set up during outages inside containment. Radiological surveys are done prior to performing work in the radiation control area. Radiological surveys include air sample collection, dose rate, and contamination analysis of the work environment. If significant changes in the work environment occur, work activities will be suspended until the cause is known and addressed. These surveys are conducted by trained HRD technicians and are crucial to worker safety concerning radiation exposure control. General traffic routes, temporary shielding, stay times, and RWP requirements are all determined from the information gleaned from these surveys.

Administrative dose limits are used that limit radiation exposures well below the federal annual limits set by NRC.

Filtration of the reactor coolant system (RCS) is used to remove activation products from RCS water and reduce dose rates throughout the plant.

ALARA review of work tasks is used in order to determine if all reasonable efforts have been made to reduce doses for work tasks.

Permanent and temporary shielding is used throughout the plant to reduce dose rates where appropriate.

EPDs are used to track dose rates and doses for RPWs in order to evaluate the effectiveness of dose controls.

Employee dose is monitored using both TLD and electronic dosimeters (ED). TLD are collected quarterly and analyzed by an off-site laboratory. TLD are used for the dose of record. EDs are used to monitor worker's radiation dose on a day-to-day basis using an electronic system. Dose and dose rate alarms are set prior to entry into the radiation control area according to the expected dose and dose rates for the work to be performed. The radiation protection supervisor immediately investigates a dosimeter alarm. The VPP Evaluation Team did a comprehensive review of the mechanical integrity of the power piping system. Included in this review was PBNP's effort to prevent steam and feed water releases and their associated hazards. A walk-around of the turbine building power piping (steam and feed) was conducted.

The flow accelerated corrosion (FAC) program was reviewed by the VPP Evaluation Team to gauge NextEra Energy Point Beach Plant's programmatic efforts to mitigate the hazards of steam releases from power piping whose wall thickness the flow accelerated corrosion process has thinned. Through the provided documentation, observation and interviews, PBNP's FAC Program meets the intent of American Society of Mechanical Engineers (ASME) B31.1-2007, Chapter VII, Operation and Maintenance.

Elements of ASME B31.1-2007, Chapter VII, Operation and Maintenance were met by PBNP program.

The operating company is required to issue written operating and maintenance procedures to assure safe operation of covered power piping. PBNP has demonstrated conformance to this requirement by issuing and implementing FAC Inspection Program and FAC Program Basis Document.

The operating company is required to assess the condition of covered power piping. PBNP has demonstrated conformance to this requirement by employing the "check works" computer program developed by the Electric Power Research Institute to: track pipe circuit inventory information, track data from pipe thickness measurements, calculate critical pipe thickness (hoop or bending) stress, calculate wear rate per year, and calculate the next inspection date.

ASME B31.1 Appendix V offers Operations and Maintenance recommendations for power piping to prevent steam releases.

Operating procedures demonstrate that the power piping is safely operated. For example, Operating Procedure N-MS-06 gives detailed instruction how to warm up a cold steam main so that a steam release does not result from a deleterious "water hammer" hydraulic event. These procedures meet the intent of Section 3.1 of ASME B31.1 Appendix V.

Steam trap maintenance is performed preventively, which also mitigates the hazards of water hammer causing steam releases by removing condensate from the steam piping. This maintenance task meets the intent of Section 4.1 of ASME B31.1 Appendix V.

Safety and Health Training

PBNP has a strong safety and health training program. They have a staff of 31 trainers who are responsible for ensuring that all OSHA and NRC requirements are met. There are six categories of safety training, including plant operations, industrial, radiation, nuclear, fire plan, and contractor. Training is provided via classroom, computer-based, and hands-on activities. New since the last evaluation is the Distance Learning Center and Control Room Simulator. The effectiveness of the safety and health training is verified by means of testing, demonstration of skills, and in some instances practice drills. Human performance training is an annual requirement for all employees including contractors. Human performance training addresses the incorporation of safe practices into every job at the plant.

PBNP drug testing/screening program includes pre-employment, random screening, post-accident, and for cause (employee(s) exhibiting strange or suspicious behavior).

No incentive programs are used at PBNP.

PBNP is an "equal opportunity employer." The employer does not discriminate and will take measures to ensure against discrimination in employment, recruitment, and advertisement for employment, compensation, termination, upgrading, promotions, and other conditions of employment against any employee or job applicant on the bases of race, creed, color, national origin, or sex.

PBNP is committed in all areas to providing a work environment that is free from harassment. Harassment based upon an individual's sex, race, ethnicity, national origin, age, religion or any other legally protected characteristics will not be tolerated. All employees, including supervisors and other management personnel, are expected and required to abide by this policy. No person will be adversely affected in employment with the employer because of bringing complaints of unlawful harassment.

The site has not had any whistleblower activity within the past 10 years.

IX. Areas of Excellence

All elements of the site's safety and health management programs met the high quality expected of VPP participants.

Contractors must complete a test regarding the site's safety and health program/rules/policies with a passing grade after orientation and before entering and working in the plant.

An area of excellence is the site's use of multi-media training, such as computer based, hands-on, the Distance Learning Center and Control Room Simulator, and classroom.

An area of excellence is the conducting of observations by employees for both routine and non-routine tasks (4200 completed for 2018) to keep safety in the forefront of each job performed at the facility.

"Safety Alerts" are posted to communicate to employees any near misses/incidents from other divisions so the whole plant is informed of safety and health incidents.

X. Recommendation for Participation

The VPP Evaluation Team recommends NextEra Energy Point Beach, LLC in Two Rivers, WI, be approved to continue to participate in the VPP at the Star level.

Compressed Reapproval Process (CRP) Site Worksheet

NextEra Energy Point Beach, LLC
Two Rivers, WI

Onsite Evaluation Dates
September 23-26, 2019

Section I: Management Leadership & Employee Involvement	Yes or No	How Assessed: Interview	Observation	Doc Review
A. Written Safety & Health Management System				
A1. *Is the written safety and health management system at least minimally effective to address the scope and complexity of worksite hazards? If not, please explain.* • Written policies and procedures make up a comprehensive safety and health management system that addresses all relevant aspects of industrial safety, radiological safety, and nuclear safety. Document control is rigorous and procedure use and adherence is instilled in the culture of all PBNP employees.	Yes	X		X

Section I: Management Leadership & Employee Involvement	Yes or No	How Assessed: Interview	Observation	Doc Review
B. Management Commitment & Leadership				
B1. *Does management overall demonstrate at least minimally effective, visible leadership with respect to the safety and health management system (as per FRN, VOL. 74, NO. 6, 01/09/09 page 936, IV. A.5. a-h)? Provide examples.* • The plant leadership team sets the expectations, leads by example, and ensures all managers and employees are accountable for safety and health. Leadership responsibility for injury prevention is a documented and demonstrated in the site's guiding principle. Examples include reviewing program-leading indicators, conducting safety planning and pre-job briefs, participating in event investigation and review, and demonstrating use of human performance tools.	Yes	X	X	

Section I: Management Leadership & Employee Involvement	Yes or No	How Assessed: Interview	Observation	Doc Review
C. Planning				
C1. *For site-based construction sites, is safety included in the planning phase of each project?*	N/A			
D. Authority and Line Accountability				
D1. *Does top management accept ultimate responsibility for safety and health? (Top management acknowledges ultimate responsibility even if some safety and health functions are delegated to others.) If not, please explain.* • Top management responsibility is documented in the NextEra Nuclear Fleet Commitment to Safety and is one of its four key Safety Guiding Principles.	Yes	X		X
D2. *Do the individuals' assigned responsibility for safety and health have the authority to ensure that hazards are corrected or necessary changes to the safety and health management system are made? If not, please explain.*	Yes	X		X
D3. *Are adequate resources (equipment, budget, or experts) dedicated to ensuring workplace safety and health? Provide examples.* • PBNP has several experts/professionals onsite including a full-time registered nurse and a medical assistant. A physician comes to the facility for a half a day a week and is on call otherwise. Safety professionals and environmental/health specialists are on staff. • There are two are Certified Health Physicists on staff at PBNP. • There are 31 Radiation Protection Technologists, nine of which are National Registered Radiological Protection Certified Technologists. • Nested contractors are onsite to do asbestos and lead abatement. • Corporate also has professional staff that can assist if called upon. • Medical personnel and engineers are on staff. Experts in asbestos and lead remediation and security are nested contractors. • Safety equipment and supplies are abundant with many varieties of each kind available for employees' use.	Yes	X		X

Section I: Management Leadership & Employee Involvement	Yes or No	How Assessed: Interview	Observation	Doc Review
E. Contract Employees				
E1. *Does the site's contractor program cover the prompt correction and control of hazards in the event that the contractor/sub-contractor fails to correct or control such hazards? Provide examples.* • The PBNP contractor hazard audit identified two contracting employees not wearing proper PPE, safety shoes. The contracting employees were escorted off-site in order to acquire needed PPE. PBNP's Disciplinary Program is a graduated system, beginning with a warning for a first violation to immediate removal and banning from the plant for egregious violations. Contractors discovered violating PBNP safety regulations, depending on the severity of the action, such as an immediately dangerous to life and health issue, may be immediately escorted from the plant and their entrance identification card is blocked - preventing entry through security gates. Additionally, PBNP uses the Management Action Response Checklist program to administer their employee discipline program.	Yes	X		X
E2. *Based on your answers to the above item, is the contract oversight minimally effective for the nature of the site? (Inadequate oversight is indicated by significant hazards created by the contractor, employees exposed to hazards, or a lack of host audits.) If not, please explain.*	Yes	X		X

Section I: Management Leadership & Employee Involvement	Yes or No	How Assessed: Interview	Observation	Doc Review
F. Employee Involvement				
F1. *Do employees support the site's participation in the VPP?* • Interviewed employees consistently described a great deal of pride in the PBNP safety performance and in its VPP recognition.	Yes	X	X	X
F2. *Do employees feel free to participate in the safety and health management system without fear of discrimination or reprisal? If so, please explain.* • CAPs are filed routinely by employees without fear of reprisal. • Managers expect and require employee participation in the safety and health management system.	Yes	X		X

Section I: Management Leadership & Employee Involvement	Yes or No	How Assessed: Interview	Observation	Doc Review
G. Safety and Health Management System Evaluation				
G1. *Does the annual evaluation cover the aspects of the safety and health management system, including the elements described in the* ***Federal Register****? If not, please explain.*	Yes	X		X

Section I: Management Leadership & Employee Involvement

Best Practices:

PBNP has implemented a human performance program that is deeply engrained in its culture and is a significant contributor to the plant's outstanding safety performance. All plant employees undertake a minimum of four hours of training each year to understand human performance principles and tools. These error-reduction tools and techniques are continually practiced and reinforced in all aspects of work every day. Human performance is based on recognition that people are fallible, and that events can be avoided through employing error-prevention techniques and designing error-tolerant systems. Key principles include adhering to procedures and processes, demonstrating a questioning attitude by identifying issues and writing corrective action reports, and a consistent use of 17 human performance techniques. A plant wide mantra is to work in "Prevention" mode, and managers and employees recognize the value of time spent conducting preventive tasks.

Section II: Worksite Analysis	Yes or No	How Assessed: Interview	Observation	Doc Review
A. Baseline Hazard Analysis				
A1. *Has the site been at least minimally effective at identifying and documenting the common safety and health hazards associated with the site (such as those found in OSHA regulations, building standards, etc., and for which existing controls are well known)? If not, please explain.*	Yes	X		X
A2. *Does the site have a documented sampling strategy used to identify health hazards and assess employees' exposure (including duration, route, and frequency of exposure), and the number of exposed employees? If not, please explain.*	Yes	X		X

Section II: Worksite Analysis	Yes or No	How Assessed: Interview	Observation	Doc Review
B. Hazard Analysis of Routine Activities				
B1. *Is there at least a minimally effective hazard analysis system in place for routine operations and activities?*	Yes	X		X
• All employees working in the RCA wear a TLD and an EPD. TLD is analyzed quarterly while EPD results are used to track dose between TLD analyses. EPDs are set with alarm points based on the RWP for the work that is being performed. Total dose and dose rate are set automatically on the EPD based on the RWP limits. If the dose or dose rate alarm on the worker's EPD exceeds the limit on the RWP, the worker is not allowed to re-enter the RCA until they meet with the radiation protection manager to discuss why the limit was exceeded. • Sampling results are compared to normal standards and limits that are more restrictive. This is particularly evident with radiation monitoring, where results are compared to more restrictive industry standards vs. OSHA acceptable exposure levels. • The site has annual administrative dose limits of: o 2 rem total effective dose equivalent (TEDE) compared to the NRC limit of 5 rem. o 20 rem total organ dose equivalent (TODE) compared to the NRC limit of 50 rem to any single organ. o 6 rem to lens of the eye compared to the NRC limit of 15 rem. o 20 rem shallow dose equivalent compared to the NRC limit of 50 rem. o The site has not exceeded any of the administrative dose limits for any worker since 1995.				

Section II: Worksite Analysis	Yes or No	How Assessed: Interview	Observation	Doc Review
C. Routine Inspections				
C1. *Does the site have a minimally effective system for performing safety and health inspections (i.e., a minimally effective system identifies hazards associated with normal operations)? If not, please explain.*	Yes	X		X
C2. *Are routine safety and health inspections conducted monthly, with the entire site covered at least quarterly (construction sites: entire site weekly)?* • Radiological surveys are conducted routinely. • A daily schedule of surveys is used to track which surveys need to be performed that day. The completed survey schedule is reviewed and signed by an RP supervisor. • All surveys are conducted at the required intervals. • Contamination surveys are conducted on a routine schedule. • Airborne radiological surveys (area samples, breathing zone samples, continuous air monitoring) are conducted on a routine schedule and to support work activities that may generate radiological aerosols. • TLD are provided to every worker in the RCA. Additionally, EPDs are assigned to each worker in the RCA that tracks cumulative job-specific dose and cumulative dose for the worker. • Portal radiation monitors at the exit of the RCA and the exit of the plant monitor if workers have been contaminated. If contaminated, the worker is decontaminated and an investigation is started.	Yes	X		X
C3. *For site-based construction sites, are employees required to conduct inspections as often as necessary, but not less than weekly, of their workplace/area and of equipment?*	N/A			

Section II: Worksite Analysis	Yes or No	How Assessed: Interview	Observation	Doc Review
D. Hazard Reporting				
D1. *Is there a minimally effective means for employees to report hazards and have them addressed? If not, please explain.*	Yes	X		X

Section II: Worksite Analysis	Yes or No	How Assessed: Interview	Observation	Doc Review
E. Hazard Tracking				
E1. *Does a minimally effective hazard tracking system exist that result in hazards being controlled? If not, please explain.*	Yes	X		X

Section II: Worksite Analysis	Yes or No	How Assessed: Interview	Observation	Doc Review
F. Accident/Incident Investigations				
F1. *Is there a minimally effective system for conducting accident/incident investigations, including near-misses? If not, please explain.*	Yes	X		X

Section II: Worksite Analysis	Yes or No	How Assessed: Interview	Observation	Doc Review
G. Trend Analysis				
G1. *Does the site have a minimally effective means for identifying and assessing trends?* • The site tracks total dose for each RWP. An RWP is required for work done in the RCA. The site compares the actual total radiation dose for each RWP to the projected dose for each RWP. • Individual departments conduct quarterly Department Roll Up Meetings, in which safety issues can be identified and trended to determine if there is a common cause with regard to industrial safety. Trending is also done for all facilities at the corporate level. Each site has access to accident/incident information of the corporate owned facilities.	Yes	X		X

Section II: Worksite Hazard Analysis

Best Practices

A best practice is that all of the Bridge Crane Operators meet ASME B30.2 1976 Medical/Physical Qualifications.

A best practice is the use of macro porous resin prior to refueling outages in order to decrease radiation sources resulting from the reactor coolant system.

A best practice is the low dose waiting areas throughout the RCA as indicated by signs.

Comments including Recommendations *(optional)*

Documents Referenced, Programs Reviewed *(optional)*

		How Assessed		
Section III: Hazard Prevention and Control	**Yes or No**	Interview	Observation	Doc Review
A. Hazard Prevention and Control				
A1. *Does the site select at least minimally effective controls to prevent exposing employees to hazards?*	Yes	X		X
A2. *Does the site have minimally effective written procedures for emergencies?*	Yes	X	X	X
A3. *Is the site covered by the Process Safety Management standard (29 CFR 1910.119)? If yes, please answer questions A4-A7 below. Additionally, please complete either the onsite evaluation supplement A or B, and onsite evaluation supplement C. If not, skip to section B.*	No			
A4. *Which chemicals that trigger the Process Safety Management (PSM) standard are present?*				
A5. *Which process(es) were followed from beginning to end and used to verify answers to the questions asked in the PSM application supplement, the PSM Questionnaire, and/or the Dynamic Inspection Priority Lists?*				
A6. *Verify that contractor employees who perform maintenance, repair, turnaround, major renovation or specialty work on or adjacent to a covered process have received adequate training and demonstrate appropriate knowledge of hazards associated with PSM, such as non-routine tasks, process hazards, hot work, emergency evacuation procedures, etc.? Please explain.*				
A7. *Is the PSM program adequate in that it addresses the elements of the PSM standard and the PSM directive? Please explain.*	N/A			

Section III: Hazard Prevention and Control	Yes or No	How Assessed: Interview	Observation	Doc Review
B. Recordkeeping				
B1. *Are OSHA required recordkeeping forms being maintained properly in terms of accuracy, form completion, etc.? If not, please explain.*	Yes	X		X
B2. *Is the recordkeeper knowledgeable of 29 CFR 1904, OSHA's recordkeeping standard?* • The safety and health manager and the industrial safety and health analyst are trained in proper OSHA 300 form recording.	Yes	X		X
C1. *Do the injury and illness rates accurately reflect work performed by contractors/sub-contractors at the site evaluated?* • The site's incident report records were reviewed to determine the accuracy of the OSHA 300 records. It was determined the records were accurate.	Yes	X		X

Section III: Hazard Prevention and Control

Best Practices

The station successfully trained and implemented an in house Technical Rescue Team. Started in 2016 as a Continuous Improvement Program (CIP) Initiative, the team is manned with a host of volunteers from all the various departments within the facility, who have completed the Technical Rescue Training provided by a certified Vendor, Sesco. This accomplishment allowed the opportunity for PBNP to have their own confined space and high angle rope rescue team to support the station 24/7 without having to rely on the local fire department.

The sites transient combustible control program monitors and controls the amount of combustibles that are allowed inside the site's main structures. These areas, called fire zones, are evaluated for the amount of combustibles allowable and then these areas are monitored to maintain that approved safe fire loads are not exceeded. This is a best practice.

The identification of asbestos insulation is visible throughout the site. Once an area is identified as containing asbestos, it is clearly marked with red letters stating "Contains Asbestos." If the insulation has been tested and does not contain asbestos, it will be clearly marked "Asbestos-Free" in blue letters. The site's philosophy is, "Unless proven otherwise, insulation SHALL be presumed to contain asbestos." This is a best practice.

Comments including Recommendations (optional)

Documents Referenced, Programs Reviewed (optional)

Section IV: Safety and Health Training	Yes or No	How Assessed: Interview	Observation	Doc Review
A. Safety and Health Training				
A1. *Does the training provided to managers, supervisors, and non-supervisory employees (including contract employees) adequately address safety and health hazards?*	Yes	X		X
A2. *Does the site provide minimally effective training to educate supervisors and employees (including contract employees) regarding the known hazards of the site and their controls? If not, please explain.*	Yes	X		X

Section IV: Safety and Health Training

Best Practices
An area of excellence/best practice is the site's use of multi-media training, such as computer based, hands-on, and classroom.

Comments including Recommendations *(optional)*

Documents Referenced, Programs Reviewed *(optional)*

VPP Participant and Onsite Evaluation Team Data Sheet

VPP Participant Information:		
Company Name: NextEra Energy Point Beach, LLC		
Site Address: 6610 Nuclear Road, Two Rivers, WI 54241		
Mailing Address: Same as above		
Site Manager Name: Eric McCartney, Site VP		
Site Manager Phone: 920-755-6190	Site Manager E-mail Address: eric.mccartney@fpl.com	
Small Employer (<250 employees onsite AND <500 employees corporate-wide: Yes____ No _X_		
NAICS Code: 221113	No. of site employees: 450	No. of site contract employees: 200

Union Information	
Union Name & Local No.:	International Brotherhood of Electrical Workers Local 2150
Site Representative:	Forrest Ceel, Business Manager
Mailing Address:	N56 W13777 Silver Springs Drive, Menominee, WI. 53051
Telephone Number:	262-252-2552

Union Information	
Union Name & Local No.:	Northeast Wisconsin Building and Construction Trades Council
Site Representative:	Ted Gumieny, Business Agent
Mailing Address:	2828 North Ballard Road, Appleton, WI 54911
Telephone Number:	920-733-3136

Onsite Evaluation Team Information:		
Evaluation Start Date: September 23, 2019	Evaluation End Date: September 26, 2019	
Type of Visit: Initial Approval: _____ Reevaluation: ____X____	Participation: Site-based: __X__ Mobile Workforce: _____ Corporate: _____	
MAO Requested: Yes_X_ No_____ If Yes, Date: September 12, 2019	MAO Rec'd Before Onsite: Yes_X_ No_____	Date MAO Rec'd: September 22, 2019
90/30 Day Items: Yes__X___ No_____	Date 90/30 Day Items Completed: October 02, 2019	
Team Members	Discipline of Members	
Team Leader (TL): Kelly Bubolz Back-Up Team Leader: Mary Bauer Team Member 2: Corey Beacom, Team Member 3: Jacob Schuller, Team Member 4: Tina Demotts,	Team Leader: Compliance Assistance Specialist Back-Up Team Leader: Industrial Hygienist PhD, Health Physicist/Industrial Hygienist, SGE: Safety Specialist SGE: Safety Specialist	

PARTICIPANT AREAS OF EXCELLENCE/BEST PRACTICES CHECKLIST

- ☐ Ergo Program
- ☐ PSM
- ☐ Medical Program
- ☐ Industrial Hygiene
- ☒ Pre-Job Analysis
- ☐ Confined Space Program
- ☐ Hazard Analysis
- ☒ Self-Inspections
- ☒ Employee Involvement
- ☐ Other:
- ☐ LO/TO Program
- ☒ Contractor Program
- ☐ Accountability
- ☒ Tracking of Hazards

STRATEGIC PLAN

High Hazard Industries

- ☐ Landscaping – 078
- ☐ Concrete/Gypsum/Plaster – 327
- ☐ Oil/Gas – 138
- ☐ Blast Furnace/Steel Production – 331
- ☐ Wholesale Storage – 422
- ☐ Fruits/Vegetables 203
- ☐ Ship/Boat Building/Repair – 373

Hazards

- ☒ Ergo
- ☐ Amputations – Construction
- ☐ Lead
- ☐ Amputations – General Industry
- ☐ Silica

Document Request 5

Affected SLRA Enclosure 3, Attachment 2, Sections: Chapter 10

SLRA Page Number: 10-15

Description of Change: Reference citation added to Chapter 10 and reference provided for docketing.

Reference pertains to: Sections 3.10.2, 4.9.2.4

Page 10-15

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U.S. Department of Labor

Occupational Safety and Health Administration
Chicago Regional Office
John C. Kluczynski Federal Building
230 S Dearborn Street, Suite 3244
Chicago, Illinois 60604-1694

March 4, 2020

Mr. Eric McCartney
Vice President
NextEra Energy Point Beach, LLC
6610 Nuclear Road
Two Rivers, WI 54241
Eric.mccartney@nexteraenergy.com

Dear Mr. McCartney:

I am pleased to approve NextEra Energy Point Beach, LLC, Two Rivers, WI, for continued participation in the Occupational Safety and Health Administration's (OSHA's) Voluntary Protection Program (VPP) as a Star participant.

Enclosed is a copy of the VPP On-site Evaluation Report upon which I based my decision plus important VPP information. I will be sending a copy of the evaluation report to your collective bargaining representative.

VPP participants serve as models for other employers, workers, and unions by operating excellent safety and health management programs. Achieving a level of worker protection that goes beyond compliance with government regulations is commendable.

Congratulations on your dedication and the involvement of your workers in the prevention of injuries and illnesses. I encourage you to share your successes with others and continually improve your safety and health efforts.

Sincerely,

Nancy M. Hauke
for Francis Yebesi
Acting Regional Administrator

Enclosures

Document Request 6

Affected SLRA Enclosure 3, Attachment 2, Sections: Chapter 10

SLRA Page Number: 10-17

Description of Change: Reference citation added to Chapter 10 and reference provided for docketing.

Reference pertains to: Sections 2.2.3.6, 3.6, 9.5.23

Page 10-17

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2020 Water Withdrawal Report
Report Status: Complete
Report Received: 01/22/2021
Report Type: Water Use System

Printed on: 01/22/2021

1. Property Information

Property Name: NEXTERA ENERGY POINT BEACH LLC | **Property #** 10208

Owner # 18772 | **Operator #** 19426

NEXTERA ENERGY POINT BEACH LLC
6610 NUCLEAR ROAD
TWO RIVERS WI 54241

TREVOR PETERMANN
NEXTERA
6610 NUCLEAR ROAD
TWO RIVERS WI 54241

Phone: (920) 755-6910 **Ext:**
Email: Andrew.Watry@nexteraenergy.com

Phone: (920) 755-6795 **Ext:**
Email: Trevor.Petermann@nexteraenergy.com

2. Source Information

a. Source Name Assigned by Owner: Warehouse 6 Well | **Source #** 1526

b. PLSS: NW ¼ of NW ¼ of Section 24, T 21 N, R 24 E

c. Hicap Well #: 1176 | **d. Constructed Year:** 1993 | **e. Unique Well # :** FY404

f. Pump Capacity (GPM): 60 | **g. Well Depth (ft):** 480 | **h. Casing Diameter (in):** 6

3. 2020 Water Withdrawal Reporting

a. Measurement Code: TFM-Totalizing flow meter

b. Water Use Code: PS31-Public/non-transient

c. Comments :

Month	Gallons Pumped or Withdrawn	
January	1,848	*Gallons*
February	883	*Gallons*
March	2,617	*Gallons*
April	2,100	*Gallons*
May	2,210	*Gallons*
June	1,770	*Gallons*
July	2,980	*Gallons*
August	2,770	*Gallons*
September	3,040	*Gallons*
October	4,600	*Gallons*
November	4,130	*Gallons*
December	3,100	*Gallons*

2020 Water Withdrawal Report
Report Status: Complete
Report Received: 01/22/2021
Report Type: Water Use System

Printed on: 01/22/2021

1. Property Information

Property Name: NEXTERA ENERGY POINT BEACH LLC | **Property #** 10208

Owner # 18772	**Operator #** 19426
NEXTERA ENERGY POINT BEACH LLC 6610 NUCLEAR ROAD TWO RIVERS WI 54241	TREVOR PETERMANN NEXTERA 6610 NUCLEAR ROAD TWO RIVERS WI 54241
Phone: (920) 755-6910 **Ext:**	**Phone:** (920) 755-6795 **Ext:**
Email: Andrew.Watry@nexteraenergy.com	**Email:** Trevor.Petermann@nexteraenergy.com

2. Source Information

a. Source Name Assigned by Owner: Site Boundary Control Center Well **Source #** 6333

b. PLSS: SW ¼ of SW ¼ of Section 24, T 21 N, R 24 E

c. Hicap Well #: 52826	**d. Constructed Year:** 1983	**e. Unique Well # :** BE655
f. Pump Capacity (GPM): 20	**g. Well Depth (ft):** 300	**h. Casing Diameter (in):** 6

3. 2020 Water Withdrawal Reporting

a. Measurement Code: TFM-Totalizing flow meter

b. Water Use Code: PS41-Public/transient

c. Comments :

Month	Gallons Pumped or Withdrawn	
January	4,322	*Gallons*
February	2,442	*Gallons*
March	2,584	*Gallons*
April	1,948	*Gallons*
May	2,454	*Gallons*
June	1,838	*Gallons*
July	1,756	*Gallons*
August	2,160	*Gallons*
September	1,958	*Gallons*
October	2,630	*Gallons*
November	4,778	*Gallons*
December	4,926	*Gallons*

2020 Water Withdrawal Report
Report Status: Complete
Report Received: 01/22/2021
Report Type: Water Use System

Printed on: 01/22/2021

1. Property Information

Property Name: NEXTERA ENERGY POINT BEACH LLC | **Property #** 10208

Owner # 18772 | **Operator #** 19426

NEXTERA ENERGY POINT BEACH LLC
6610 NUCLEAR ROAD
TWO RIVERS WI 54241

TREVOR PETERMANN
NEXTERA
6610 NUCLEAR ROAD
TWO RIVERS WI 54241

Phone: (920) 755-6910 **Ext:**
Email: Andrew.Watry@nexteraenergy.com

Phone: (920) 755-6795 **Ext:**
Email: Trevor.Petermann@nexteraenergy.com

2. Source Information

a. Source Name Assigned by Owner: Energy Information Center | **Source #** 7821

b. PLSS: SW ¼ of NE ¼ of Section 24, T 21 N, R 24 E

c. Hicap Well #: 68865 | **d. Constructed Year:** 1998 | **e. Unique Well # :** MY344

f. Pump Capacity (GPM): 65 | **g. Well Depth (ft):** 262 | **h. Casing Diameter (in):** 6

3. 2020 Water Withdrawal Reporting

a. Measurement Code: TFM-Totalizing flow meter

b. Water Use Code: PS41-Public/transient

c. Comments :

Month	Gallons Pumped or Withdrawn	
January	980	*Gallons*
February	700	*Gallons*
March	1,004	*Gallons*
April	1,694	*Gallons*
May	1,368	*Gallons*
June	722	*Gallons*
July	901	*Gallons*
August	787	*Gallons*
September	950	*Gallons*
October	778	*Gallons*
November	1,442	*Gallons*
December	808	*Gallons*

2020 Water Withdrawal Report
Report Status: Complete
Report Received: 01/22/2021
Report Type: Water Use System

Printed on: 01/22/2021

1. Property Information

Property Name: NEXTERA ENERGY POINT BEACH LLC | **Property #** 10208

Owner # 18772

NEXTERA ENERGY POINT BEACH LLC
6610 NUCLEAR ROAD
TWO RIVERS WI 54241

Phone: (920) 755-6910 **Ext:**
Email: Andrew.Watry@nexteraenergy.com

Operator # 19426

TREVOR PETERMANN
NEXTERA
6610 NUCLEAR ROAD
TWO RIVERS WI 54241

Phone: (920) 755-6795 **Ext:**
Email: Trevor.Petermann@nexteraenergy.com

2. Source Information

a. Source Name Assigned by Owner: Warehouse 7 **Source #** 18712

b. PLSS: NW ¼ of NW ¼ of Section 24, T 21 N, R 24 E

c. Hicap Well #: 71777	**d. Constructed Year:** 2011	**e. Unique Well # :** YG332
f. Pump Capacity (GPM): 650	**g. Well Depth (ft):** 640	**h. Casing Diameter (in):** 10

3. 2020 Water Withdrawal Reporting

a. Measurement Code: TFM-Totalizing flow meter

b. Water Use Code: PS31-Public/non-transient

c. Comments :

Month	Gallons Pumped or Withdrawn	
January	2,100	*Gallons*
February	3,400	*Gallons*
March	300	*Gallons*
April	1,500	*Gallons*
May	26,900	*Gallons*
June	16,500	*Gallons*
July	32,600	*Gallons*
August	700	*Gallons*
September	900	*Gallons*
October	300	*Gallons*
November	700	*Gallons*
December	1,800	*Gallons*

2020 Water Withdrawal Report
Report Status: Complete
Report Received: 01/22/2021
Report Type: Water Use System

Printed on: 01/22/2021

1. Property Information

Property Name: NEXTERA ENERGY POINT BEACH LLC | **Property #** 10208

Owner # 18772 | **Operator #** 19426

NEXTERA ENERGY POINT BEACH LLC
6610 NUCLEAR ROAD
TWO RIVERS WI 54241

TREVOR PETERMANN
NEXTERA
6610 NUCLEAR ROAD
TWO RIVERS WI 54241

Phone: (920) 755-6910 **Ext:**
Email: Andrew.Watry@nexteraenergy.com

Phone: (920) 755-6795 **Ext:**
Email: Trevor.Petermann@nexteraenergy.com

2. Source Information

a. Source Name Assigned by Owner: Main Well | **Source #** 6332

b. PLSS: NW ¼ of SE ¼ of Section 24, T 21 N, R 24 E

c. Hicap Well #: 52824 | **d. Constructed Year:** 1967 | **e. Unique Well # :** FB703

f. Pump Capacity (GPM): 65 | **g. Well Depth (ft):** 257 | **h. Casing Diameter (in):** 16

3. 2020 Water Withdrawal Reporting

a. Measurement Code: TFM-Totalizing flow meter

b. Water Use Code: PS31-Public/non-transient

c. Comments :

Month	Gallons Pumped or Withdrawn	
January	292,545	*Gallons*
February	215,178	*Gallons*
March	404,204	*Gallons*
April	323,368	*Gallons*
May	282,854	*Gallons*
June	217,846	*Gallons*
July	191,628	*Gallons*
August	238,650	*Gallons*
September	214,100	*Gallons*
October	336,166	*Gallons*
November	266,066	*Gallons*
December	279,949	*Gallons*

2020 Water Withdrawal Report
Report Status: Complete
Report Received: 01/22/2021
Report Type: Water Use System

Printed on: 01/22/2021

1. Property Information

Property Name: NEXTERA ENERGY POINT BEACH LLC | **Property #** 10208

Owner # 18772

NEXTERA ENERGY POINT BEACH LLC
6610 NUCLEAR ROAD
TWO RIVERS WI 54241

Phone: (920) 755-6910 **Ext:**
Email: Andrew.Watry@nexteraenergy.com

Operator # 19426

TREVOR PETERMANN
NEXTERA
6610 NUCLEAR ROAD
TWO RIVERS WI 54241

Phone: (920) 755-6795 **Ext:**
Email: Trevor.Petermann@nexteraenergy.com

2. Source Information

a. Source Name Assigned by Owner: Cooling water intake - 004 **Source #** 15492

b. PLSS: NW ¼ of NE ¼ of Section 24, T 21 N, R 24 E

c. Hicap Well #:	d. Constructed Year:	e. Unique Well # :
f. Pump Capacity (GPM): 869200	g. Well Depth (ft):	h. Casing Diameter (in):

3. 2020 Water Withdrawal Reporting

a. Measurement Code: OTH-Other approved method

b. Water Use Code: EG22-Nuclear Power-once

c. Comments :

Month	Gallons Pumped or Withdrawn	
January	21,495,400,000	*Gallons*
February	20,213,000,000	*Gallons*
March	16,432,900,000	*Gallons*
April	30,348,100,000	*Gallons*
May	34,236,400,000	*Gallons*
June	33,132,000,000	*Gallons*
July	34,236,400,000	*Gallons*
August	34,236,400,000	*Gallons*
September	33,132,000,000	*Gallons*
October	21,766,200,000	*Gallons*
November	32,704,100,000	*Gallons*
December	27,133,200,000	*Gallons*

Document Request 7

Affected SLRA Enclosure 3, Attachment 2, Sections: Chapter 10

SLRA Page Number: 10-27

Description of Change: Reference citation added to Chapter 10 and reference provided for docketing.

Reference pertains to: Section 9.1

Page 10-27

WDOA (Wisconsin Department of Administration). 2020. Comprehensive Planning. Retrieved from <https://doa.wi.gov/Pages/LocalGovtsGrants/Comprehensive-Planning.aspx> (accessed April 5, 2020).

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DEPARTMENT OF ADMINISTRATION

STATE OF WISCONSIN
DEPARTMENT OF ADMINISTRATION

Tony Evers, Governor
Joel Brennan, Secretary
Dawn Vick, Division Administrator

March 26, 2021

Richard F. Orthen, Principal Licensing Engineer
NextEra Energy, Inc.
Florida Power & Light Company
700 Universe Boulevard
Juno Beach, Florida 33408

RE: Wisconsin Coastal Management Program: Point Beach Consultation

Mr. Orthen:

Thank you for contacting the Wisconsin Coastal Management Program (WCMP) about Point Beach Nuclear Plant' s license renewal with the Nuclear Regulatory Commission and the consultations you are undertaking with Wisconsin state agencies. Through its federal consistency process, WCMP reviews federally-affiliated projects that may affect coastal resources. As I mentioned in our correspondence, I have had conversations with staff at the Wisconsin Department of Natural Resources (DNR) and the Wisconsin State Historic Preservation Office (SHPO).

Provided that NextEra Energy and NRC continue to consult with SHPO to meet any of their conditions and that any discharges are covered by the WPDES permit (as communicated with DNR), WCMP has no comments on the project and will not conduct a formal federal consistency review. This does not exempt the project from any other required state or local permits..

Please let me know if you have any questions or concerns. You can reach me at kathleen.angel@wisconsin.gov or 608-267-7988.

Sincerely,

Kate Angel
Wisconsin Coastal Management Program

Tracy Brunner, ERM

Document Request 8

Affected SLRA Enclosure 3, Attachment 2, Sections: Chapter 10

SLRA Page Number: 10-6

Description of Change: Reference citation added to Chapter 10 and reference provided for docketing.

Reference pertains to: Section 3.2

Page 10-6

Fuller, P., L. Nico, E. Maynard, J. Larson, A. Fusaro, and A.K. Bogdanoff. 2020c. *Petromyzon marinus* Linnaeus, 1758: U.S. Geological Survey, Nonindigenous Aquatic Species Database. Retrieved from <https://nas.er.usgs.gov/queries/FactSheet.aspx?SpeciesID=836> (accessed February 11, 2020).

GAI (GAI Consultants). 2020. Wetland Delineation Report. NextEra Energy, Point Beach Energy Center Wetland Delineation, Manitowoc County, Wisconsin. September 18, 2020.

Gannon, J.E., F.J. Bircker, and K.S. Bricker. 1982. Zooplankton Community Composition in Nearshore Waters of Southern Lake Michigan. Retrieved from <https://nepis.epa.gov/Exe/ZyPDF.cgi/200070MR.PDF?Dockey=200070MR.PDF> (accessed April 3, 2020).

gai consultants

gaiconsultants.com | transforming ideas into reality.

Wetland Delineation Report

NextEra Energy
Point Beach Energy Center Wetland Delineation
Manitowoc County, Wisconsin

GAI Project Number: R200714.00, Task 001
September 18, 2020

Prepared by: GAI Consultants, Inc.
Oshkosh Office
515 South Washburn Street, Suite 104
Oshkosh, Wisconsin 54904

Prepared for: NextEra Energy
6610 Nuclear Road
Two Rivers, WI 54241

Wetland Delineation Report

NextEra Energy
Point Beach Energy Center Wetland Delineation

Manitowoc County, Wisconsin

GAI Project Number: R200714.00, Task 001

September 18, 2020

Prepared for:
NextEra Energy
6610 Nuclear Road
Two Rivers, WI 54241

Prepared by:
GAI Consultants, Inc.
Oshkosh Office
515 S. Washburn Street, Suite 104
Oshkosh, Wisconsin 54904

Authors:

Kellen Black

Kellen Black
Project Environmental Specialist

Kevin R. Eibenholzl

Kevin Eibenholzl
Senior Project Environmental Specialist

Table of Contents

1.0 Introduction 1

2.0 Methods 1

3.0 Results and Discussion 1
- 3.1 Analysis of the WETS Tables 2
- 3.2 WWI Mapping 2
- 3.3 NRCS Soils Information 2
- 3.4 Study Area Background 2

4.0 Environmental Features Included in this Delineation 2
- 4.1 Wetlands 2

5.0 Conclusion 4

6.0 References 5

Table 1 WETS Table Summary
Table 2 Wetlands Identified Within the Project Study Area

Appendix A – Wetland Delineation Map
Appendix B – WETS Table
Appendix C – NRCS Custom Soils Resource Reports
Appendix D – Photo Log of the Delineated Wetlands
Appendix E – Wetland Delineation Data Sheets

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1.0 Introduction

On August 18th and 19th, 2020, Mr. Andrew Sabai and Mr. Kellen Black of GAI Consultants (GAI) performed wetland delineation services on behalf of NextEra Energy, Inc. for the NextEra Point Beach Wetland Delineation Project (Project) located in Manitowoc County, Wisconsin. The Project included a wetland delineation of two separate areas on NextEra's Point Beach Energy Facility property.

The Middle ("Priority") Site is located in Section 24, Township 21 North, Range 24 East and the North Site is located in Section 14, Township 21 North, Range 24 East. Both sites are located in the Town of Two Rivers, Manitowoc County, Wisconsin. This report summarizes the results of the wetland delineation activities completed for the Project.

Mr. Black earned a Bachelor's Degree in Geography and Resource Management from the University of Wisconsin at Eau Claire. Mr. Black has 10 years of professional experience in the private and public sectors, including wetland delineation, botanical and wildlife surveys, habitat assessment, State Natural Area (SNA) management, and invasive species management projects throughout Wisconsin. In addition, Kellen has also completed the advanced wetland delineation training workshop provided by UW-La Crosse.

Mr. Sabai earned a Master's Degree in Biology from the University of Wisconsin Oshkosh. He specializes in aquatic plant surveys, invasive species mapping, endangered resources monitoring, water quality monitoring, and wetland determinations. At GAI he is a field lead on a project involving environmental field reviews, including invasive species identification and mapping. He has conducted surveys and monitoring for aquatic plant invasive species (AIS).

2.0 Methods

Prior to performing the field work, GAI reviewed the antecedent information and maps to help determine the likely locations for wetlands on the project. These included Wisconsin Department of Natural Resources (WDNR) Wisconsin Wetland Indicator (WWI) maps, United States Department of Agriculture-Natrual Resources Conservation Service (USDA-NRCS) soils maps, Google Earth aerial photos, USDA-NRCS Agricultural Applied Climate Information System WETS Tables and project maps.

Field methods were used as prescribed in the 1987 United State Army Corps of Engineers (USACE) *Wetlands Delineation Manual* and the 2012 *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region*. Soil pits were dug within the wetlands and corresponding upland sites to confirm the soils classifications and determine the wetland boundaries. Hydrology was determined using surface and subsurface indicators. Vegetation at both upland and wetland test sites were identified to species and recorded on the wetland data sheets along with their relative dominance and wetland indicators. Upland plots were used where the wetland/upland boundaries were not easily discernible. Soils were confirmed using a Munsell Color Chart to determine the presence or absence of redoximorphic features indicative of hydric soils. Wetland boundaries were flagged using standard delineation flagging. The wetland boundaries were determined by using the test plots and best professional judgement. Wetland boundaries were recorded using a Trimble R-1 GPS unit with sub-meter accuracy.

3.0 Results and Discussion

A desktop review of mapping within the Project vicinity was examined and evaluated in order to gain a preliminary understanding of the Project study area, including documented features in the Project vicinity. The Middle Site Project study area consists of a previously forested area adjacent to an existing electrical switchyard that was cleared and graded in the 1990s, leaving a sloped, undulating

ground surface with perennial herbaceous vegetation. The North Site Project study area is located on an actively farmed agricultural field adjacent to a WWI mapped Palustrine Forested (PFO) wetland.

3.1 Analysis of the WETS Tables

Information collected through the NRCS Field Office Technical Guide's (FOTG) Agricultural Applied Climate Inforation System (AgACIS) was used to determine average precipitation patterns for the project areas and determine if recent weather patterns fell within or outside of normal ranges. from the Two Rivers weather station, Manitowoc County, Wisconsin indicates that precipitation was well-above average in March, May and July. February and April experienced slightly below average precipitation. Of the 7 months leading up to the survey, January and June were the only months with precipitation within the normal range. Table 1 provides a synopsis of the reported precipitation from the Two Rivers Weather Station (units are in inches of precipitation). The full report generated using the USDA-NRCS Agricultural Applied Climate Information system website is included as Appendix B.

3.2 WWI Mapping

One wetland at the North Site was delineated during the field survey that is contiguous with a mapped WWI wetland; this wetland is associated with a T3K (forested, broad-leaved deciduous, wet soil, palustrine) WWI wetland complex. A map of the GAI delineated wetland with respect to the WWI mapped wetland is provided as Appendix A. The Middle Site did not have any associated WWI wetlands.

3.3 NRCS Soils Information

According to the USDA-NRCS custom soils resource report generated for this project (Appendix C), two soil mapping units are located in the portions of the project areas that may be impacted by construction, including one hydric soil mapping unit and one soil mapping unit that has no hydric component. The hydric soil mapping unit is Manawa Silt Loam (MbA), 0 to 3 percent slopes, and the soil that contains no hydric component is Kewaunee Loam (KnB), 2 to 6 percent slopes. Additional soil description information for these soils are provided in Appendix C.

3.4 Study Area Background

The Middle Site study area is a historically forested area adjacent to the existing switchyard that was cleared in 1990s and that was additionally impacted by grading activities. The hummocky topography that resulted from grading activities and the potential movement of hydric soils from their original location to other parts of the localized area may have promoted the development of these wetlands within depressions on the landscape. The entire study area is heavily impacted by various invasive herbaceous species, the most abundant of which, included *Phragmites australis* (Common reed) and *Cirsium arvense* (Canada thistle); in addition, *Phalaris arundinacea* (Reed canary grass), a non-regulated invasive plant often found in degraded areas, was found throughout the study area.

The North Site study area is an actively farmed agricultural field north of an existing spent nuclear fuel rod storage area that is currently planted with corn. The majority of the study area exhibited healthy crop growth, with the eastern edge, adjacent to the mapped WWI PFO wetland, exhibiting stunted crop growth, evidence of standing water, and algal matting on the exposed soil surface. Minimal weedy herbaceous vegetation was noted in among the stunted corn stalks. The soils and vegetation in the farmed wetland are perennially impacted by agricultural activities.

4.0 Environmental Features Included in this Delineation

4.1 Wetlands

In order to document site conditions, one transect was completed for each of the identified wetlands at both sites, which included one upland and one wetland data point to determine the wetland boundary.

Soil test pits were taken at each data point and hydrology and wetland soil indicators were recorded on the corresponding wetland data forms. Summarized information for the delineated wetland can be found in Table 2. Color photographs of each feature within the study area are provided in Appendix D. Wetland and upland Data Forms are included in Appendix D.

Middle Site

Wetland indicators were observed during the field survey. Four wetlands, all classified as PEM (Palustrine Emergent), per the Cowardin wetland classification system, were identified and delineated within the study area. All four wetlands are located in proximity to Lake Michigan. Lake Michigan is located in proximity to, but not within the Project Area.

Upland Areas

Upland sampling points were collected for each of the four identified wetlands. Herbaceous vegetation in the upland areas is dominated by *Ambrosia artemisifolia* (Common ragweed), *Daucus carota* (Wild carrot), *Lotus corniculatus* (Bird's-foot trefoil), and *Poa pratensis* (Kentucky bluegrass). Dominant hydrophytic vegetation, hydrology indicators, and hydric soil indicators were all absent at the upland sampling points, with the exception of Wetland 3, where the Depleted Matrix (F3) hydric soil indicator was met, which is likely due to the known historic grading impacts and potential movement of hydric soils within the localized area. See the upland data sheets provided in Appendix D for the complete data collected at these locations

Wetland 1

Herbaceous vegetation in this wetland is dominated by *Juncus tenuis* (Path rush). Multiple hydrology indicators were met at this location, including Inundation Visible on Aerial Imagery (B7), Sparsely Vegetated Concave Surface (B8), Drainage Patterns (B10), Stunted or Stressed Plants (D1), Geomorphic Position (D2), and FAC-Neutral Test (D5). The Redox Dark Surface (F6) and Redox Depressions (F8) hydric soil indicators were met at this location. See the wetland data sheet provided in Appendix D for the complete data for Wetland 1.

Wetland 2

Herbaceous vegetation in this wetland is dominated by Reed canary grass and Common reed. Multiple hydrology indicators were met at this location, including Drainage Patterns (B10), Geomorphic Position (D2), and FAC-Neutral Test (D5). The Redox Dark Surface (F6) and Redox Depressions (F8) hydric soil indicators were met at this location. See the wetland data sheet provided in Appendix D for the complete data for Wetland 2.

Wetland 3

Herbaceous vegetation in this wetland is dominated by *Bidens frondosa* (Devil's beggartick). Multiple hydrology indicators were met at this location, including Stunted or Stressed Plants (D1), Geomorphic Position (D2), and FAC-Neutral Test (D5). The Redox Dark Surface (F6) and Redox Depressions (F8) hydric soil indicators were met at this location. See the wetland data sheet provided in Appendix D for the complete data for Wetland 3.

Wetland 4

This wetland is located in a drainage adjacent to an access road. Herbaceous vegetation in this wetland is dominated by Reed canary grass. Two hydrology indicators were met at this location, including Geomorphic Position (D2), and FAC-Neutral Test (D5). The Redox Dark Surface (F6) hydric soil indicator was met at this location. See the wetland data sheet provided in Appendix D for the complete data for Wetland 4.

North Site

Upland Area

One upland sampling point was collected adjacent to the identified wetland. Herbaceous vegetation was limited to healthy, planted *Zea mays* (Corn) and Common ragweed. Dominant hydrophytic vegetation, hydrology indicators, and hydric soil indicators were all absent at the upland sampling point. See the upland data sheet provided in Appendix D for the complete data collected at these locations

Wetland 1

This is an actively farmed wetland, currently planted with corn, that is contiguous with a mapped WWI PFO wetland. Severely stunted corn was observed in this area. The PFO portion of this wetland was not sampled, as it is not being considered for impact by Project activities. Herbaceous vegetation in this wetland consists of stunted Corn, along with Bidens vulgata (*Tall beggarstick*) interspersed. Multiple hydrology indicators were met at this location, including Algal Mat or Crust (B4), Sparsely Vegetated Concave Surface (B8), Surface Soil Cracks (B6), Drainage Patterns (B10), Saturation Visible on Aerial Imagery (C9), Stunted or Stressed Plants (D1), and Geomorphic Position (D2). The Redox Dark Surface (F6) hydric soil indicator was met at this location. See the wetland data sheet provided in Appendix D for the complete data for Wetland 1. See the wetland data sheet provided in Appendix D for the complete data for Wetland 4.

5.0 Conclusion

GAI conducted a wetland delineation at NextEra's Point Beach Energy Center property, located in Two Rivers, Manitowoc County, Wisconsin on August 18th and 19th, 2020. Two separate sites were investigated during this delineation. The Middle Site study area, a previously-forested area adjacent to an existing electrical switchyard that has been impacted by historic grading, is heavily impacted by invasive herbaceous vegetation species and contains four PEM wetlands. The North Site study area, an actively farmed agricultural field currently planted in corn, contains one farmed wetland that is contiguous with a mapped WWI forested wetland complex and exhibited stunted corn and hydrophytic vegetation species at the time of the delineation. All five of the wetlands identified during the delineation met the hydrology, vegetation, and soils wetland indicators, as is reflected in the attached wetland data sheets.

Activities, which impact or potentially impact jurisdictional wetlands, are currently regulated at several levels of government. Federal (U.S. Army Corps of Engineers), State (Wisconsin Department of Natural Resources), and local government agencies may all be involved in reviewing a single project. It is important to obtain Army Corp of Engineers and Wisconsin Department of Natural Resources concurrence on the wetland boundaries prior to proceeding with activities in wetland. The final authority for wetland boundaries and permit requirements rests with the government agencies which have jurisdiction over your project.

The findings of this wetland delineation report are only valid for the site conditions which existed at the time of this investigation. Findings are subject to revision based upon natural or induced changes in weather, vegetation management, land use, topography, surface water flow, subsurface drainage, storm water management, within or near the project site which may affect the soils, hydrology, or vegetative community on the project site.

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TABLES

Table 1

WETS Table Summary (units are in inches)

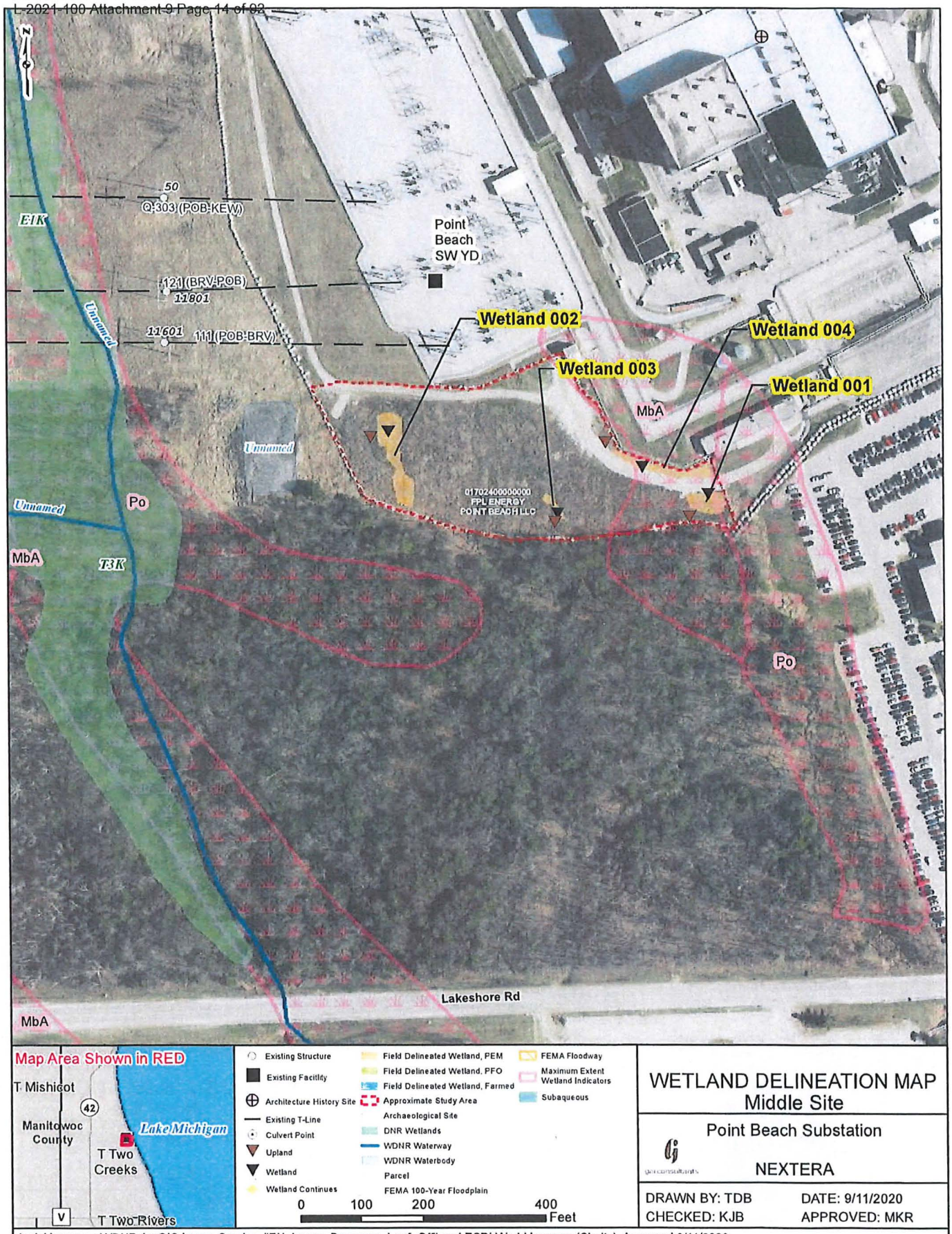
Month	Average	<30% Chance	>30% Chance	2020 (Actual)
January	1.61	1.06	1.93	1.79
February	1.53	1.06	1.82	0.92
March	2.05	1.2	2.5	3.76
April	3.4	2.56	3.96	2.16
May	3.85	2.82	4.52	5.59
June	4.21	2.91	5.01	3.88
July	3.49	2.33	4.18	6.55

Table 2

Wetlands Identified Within the Project Study Area.

Wetland I.D.	Latitude	Longitude	Wetland Classification	Proximal Waterbody	Areas of Special Natural Resource (ASNRI)/ Priority Navigable Waterway (PNW)	Open Ended
Middle (Priority) Site						
Wetland 1	44.278975178	-87.536827080	PEM	Lake Michigan - Outside of Project Study Area	No	No
Wetland 2	44.279266984	-87.538734892	PEM	Lake Michigan - Outside of Project Study Area	No	No
Wetland 3	44.278938610	-87.537627373	PEM	Lake Michigan - Outside of Project Study Area	No	No
Wetland 4	44.279097395	-87.537122187	PEM	Lake Michigan - Outside of Project Study Area	No	No
North Site						
Wetland 1	44.286251762	-87.544022917	PEM/PFO	Lake Michigan - Outside of Project Study Area	No	Yes

APPENDIX A
Wetland Delineation Maps



WETLAND DELINEATION MAP
Middle Site

Point Beach Substation

NEXTERA

DRAWN BY: TDB DATE: 9/11/2020
CHECKED: KJB APPROVED: MKR

Aerial Imagery: WDNR ArcGIS Image Service, "EN_Image_Basemap_Leaf_Off" and ESRI World Imagery (Clarity). Accessed 9/11/2020.
ATC Data 2018; WDNR Hydro, 11/2018; WDNR WWI, 12/2019; WDNR Managed Land Parcels, 08/2020, FEMMA NFHL, 2019; WISDOT, 2018;
NRCS, 11/2019; WHS ASI, 02/2020;

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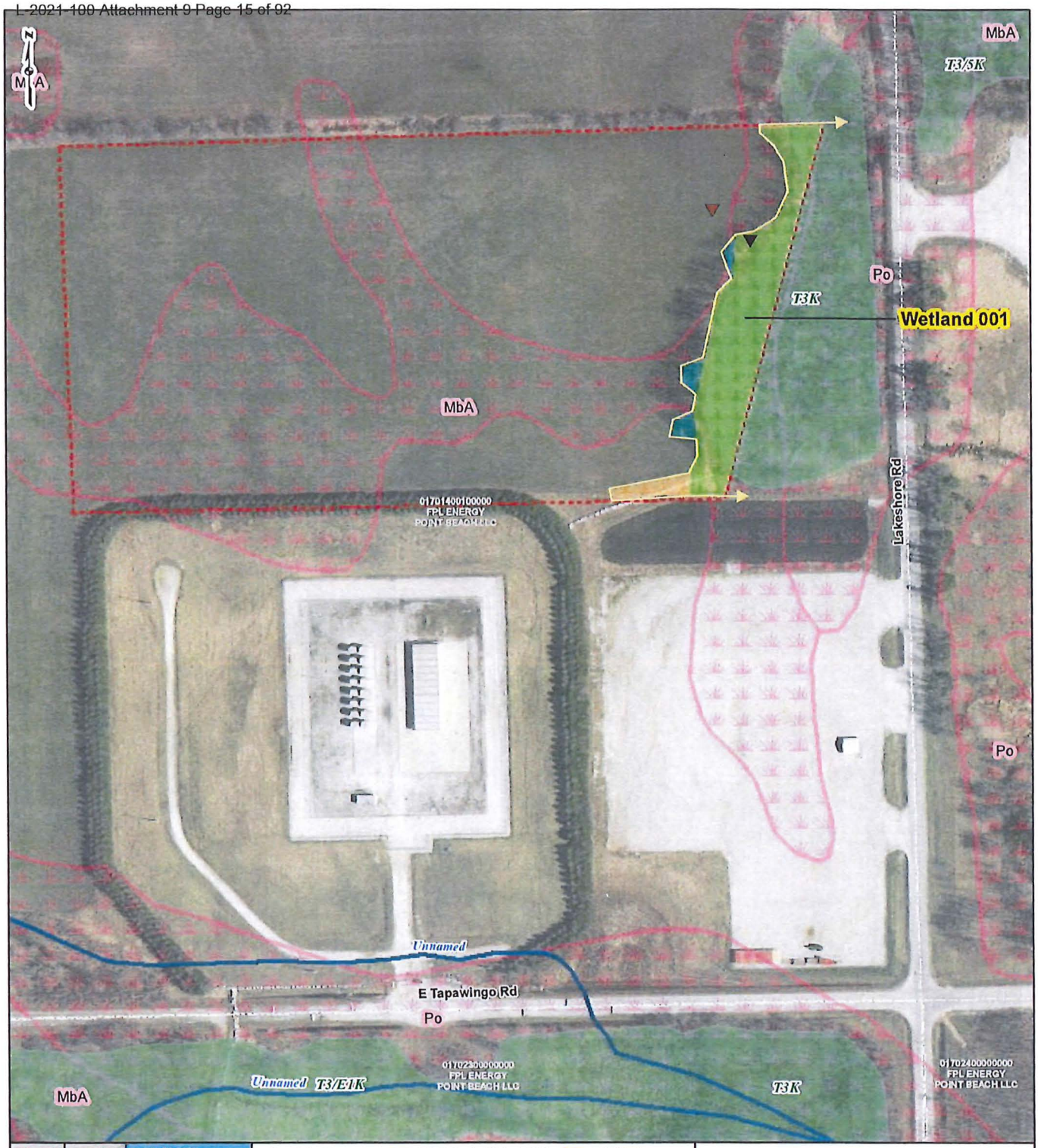

Existing Structure
Existing Facility
Architecture History Site
Existing T-Line
Culvert Point
Upland
Wetland
Wetland Continues
Field Delineated Wetland, PEM
Field Delineated Wetland, PFO
Field Delineated Wetland, Farmed
Approximate Study Area
Archaeological Site
DNR Wetlands
WDNR Waterway
WDNR Waterbody
Parcel
FEMA 100-Year Floodplain
FEMA Floodway
Maximum Extent Wetland Indicators
Subaqueous

0 100 200 400 Feet

WETLAND DELINEATION MAP
North Site

Point Beach Substation

NEXTERA

DRAWN BY: TDB DATE: 9/11/2020
CHECKED: KJB APPROVED: MKR

Aerial Imagery: WDNR ArcGIS Image Service, "EN_Image_Basemap_Leaf_Off" and ESRI World Imagery (Clarity). Accessed 9/11/2020.
ATC Data 2018; WDNR Hydro, 11/2018; WDNR WWI, 12/2019; WDNR Managed Land Parcels, 08/2020, FEMMA NFHL, 2019; WISDOT, 2018;
NRCS, 11/2019; WHS ASI, 02/2020;

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APPENDIX B
WETS Table

WETS Table

WETS Station: TWO RIVERS, WI

Requested years: 2000 - 2020

Month	Avg Max Temp	Avg Min Temp	Avg Mean Temp	Avg Precip	30% chance precip less than	30% chance precip more than	Avg number days precip 0.10 or more	Avg Snowfall
Jan	27.1	13.3	20.2	1.61	1.06	1.93	5	13.2
Feb	28.8	13.7	21.3	1.53	1.06	1.82	5	13.2
Mar	37.8	23.8	30.8	2.05	1.20	2.50	5	6.0
Apr	48.0	34.6	41.3	3.40	2.56	3.96	7	2.1
May	58.3	43.9	51.1	3.85	2.82	4.52	8	0.0
Jun	68.8	53.6	61.2	4.21	2.91	5.01	7	0.0
Jul	75.6	60.1	67.8	3.49	2.33	4.18	6	0.0
Aug	75.9	60.5	68.2	3.18	2.15	3.80	6	0.0
Sep	-	-	-	2.46	1.58	2.96	6	-
Oct	55.8	41.8	48.8	2.93	2.14	3.44	7	-
Nov	43.2	30.5	36.9	2.16	1.31	2.61	5	2.0
Dec	31.9	19.0	25.5	2.12	1.41	2.54	6	12.6
Annual:					30.52	34.75		
Average	-	-	-	-	-	-	-	-
Total	-	-	-	32.98			71	-

GROWING SEASON DATES

Years with missing data:	24 deg = 2	28 deg = 2	32 deg = 2
Years with no occurrence:	24 deg = 0	28 deg = 0	32 deg = 0
Data years used:	24 deg = 19	28 deg = 19	32 deg = 19
Probability	24 F or higher	28 F or higher	32 F or higher
50 percent *	Insufficient data	Insufficient data	Insufficient data
70 percent *	Insufficient data	Insufficient data	Insufficient data

* Percent chance of the growing season occurring between the Beginning and Ending dates.

STATS TABLE - total precipitation (inches)

Yr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annl
1950										M0.11	0.89	M0.95	1.95
1951	1.45	M0.89							M0.98	4.87	2.35	2.17	12.71
1952	2.57	0.94	3.33	2.13	2.29	2.15	8.88	2.88	0.33	0.07	2.36	1.08	29.01
1953	0.73	3.15	1.25	M3.43	1.56	4.02	1.59	3.33	1.23	0.45	0.63	1.53	22.90
1954	0.66	1.03	0.99	5.64	3.32	4.65	2.76	1.41	5.02	4.89	0.99	1.35	32.71
1955	0.55	1.23	1.20	3.08	2.32	2.93	3.88	0.68	1.19	2.94	M0.70	M0.07	20.77
1956	0.41	0.47	2.91	1.81	3.59	1.58	4.94	M3.48	M1.68	0.49	2.65	1.22	25.23
1957	0.42	0.39	1.10	2.27	4.33	2.04	3.33	2.67	1.09	1.57	3.77	1.99	24.97
1958	0.54	0.23	0.78	2.44	1.01	2.41	2.84	4.05	3.65	2.65	2.15	0.14	22.89
1959	1.06	2.71	3.36	2.86	4.12	1.96	5.27	4.49	4.32	5.15	2.17	3.70	41.17

1960	1.52	M0.08	M0.99	3.09	5.51	M1.89	5.09	3.98	3.92	2.67	1.83	0.09	30.66
1961	0.33	1.02	3.50	2.03	1.10	5.90	3.62	2.79	4.97	3.46	3.49	1.27	33.48
1962	1.70	2.25	1.05	2.49	1.49	3.59	2.04	3.57	2.66	2.43	2.05	0.62	25.94
1963	0.89	0.72	2.65	1.55	3.02	1.77	3.79	2.06	2.18	0.37	1.63	1.07	21.70
1964	1.01	0.24	2.08	3.64	4.05	0.35	4.64	2.55	3.99	0.39	1.49	1.36	25.79
1965	1.78	1.11	3.36	4.01	2.20	2.75	1.70	4.26	6.91	2.10	1.94	2.41	34.53
1966	1.40	2.97	2.65	1.54	2.04	1.23	3.78	2.70	0.76	0.59	1.92	2.35	23.93
1967	1.90	1.92	1.20	3.77	2.10	4.90	1.47	1.14	1.60	4.11	1.82	1.51	27.44
1968	1.19	0.60	0.56	4.10	3.05	6.38	0.98	1.33	2.42	0.73	1.21	3.78	26.33
1969	2.61	0.01	1.44	3.11	1.96	5.49	3.57	0.23	2.01	3.66	0.80	1.17	26.06
1970	0.67	0.20	1.17	1.47	4.83	1.00	2.02	1.30	6.17	2.58	3.21	1.83	26.45
1971	1.40	2.95	1.96	1.28	1.53	1.92	2.23	2.19	1.95	2.07	3.15	4.52	27.15
1972	0.42	0.72	2.20	3.05	2.42	2.25	4.46	5.50	4.10	2.83	0.87	2.79	31.61
1973	1.95	1.67	1.89	4.10	6.68	2.31	1.11	3.66	3.05	3.57	1.30	3.38	34.67
1974	2.71	1.52	2.05	2.78	3.22	4.13	1.67	2.63	1.41	1.42	1.85	2.06	27.45
1975	1.89	2.08	3.77	1.84	2.92	3.25	1.19	10.74	1.36	0.24	2.44	1.24	32.96
1976	2.23	1.62	5.97	3.55	3.24	1.32	2.34	0.93	0.85	2.03	0.33	0.40	24.81
1977	0.69	0.92	5.79	2.44	0.81	3.05	2.23	3.36	3.19	1.74	2.66	2.36	29.24
1978	1.74	0.37	0.36	3.29	4.77	3.58	3.57	1.71	6.74	3.65	2.42	2.26	34.46
1979	3.21	1.46	5.36	3.10	2.20	1.90	1.22	2.85	0.15	2.36	1.89	1.33	27.03
1980	1.26	0.70	0.92	3.59	2.25	4.47	2.62	8.29	3.27	1.94	1.08	M1.47	31.86
1981	0.10	2.46	0.47	3.46	0.76	2.94	1.25	4.82	5.47	1.86	1.34	1.26	26.19
1982	3.13	0.14	2.08	2.13	4.14	1.85	2.89	3.42	1.58	2.13		3.10	26.59
1983	0.98	1.87	2.66	2.96	4.75	2.23	3.27	3.43	4.38	1.93	2.66	2.00	33.12
1984	0.81	1.33	1.67	3.14	3.30	4.12	2.90	3.70	5.16	4.24	2.94	1.46	34.77
1985	1.44	2.37	2.76	2.77	1.18	1.50	3.68	3.50	3.49	3.84	7.01	2.18	35.72
1986	0.77	1.85	1.60	2.25	1.69	5.03	5.82	2.45	11.29	1.85	0.83	0.49	35.92
1987	1.19	0.28	1.97	2.32	2.61	1.82	2.43	3.96	4.81	1.70	2.81	2.95	28.85
1988	1.91	0.68	0.72	2.60	0.35	0.85	1.88	2.66	3.97	3.18	3.60	1.06	23.46
1989	0.41	0.73	3.26	0.83	4.42	0.88	2.73	1.33	1.04	3.18	1.19	0.65	20.65
1990	1.65	0.82	3.92	1.85	4.04	5.83	2.27	3.15	6.24	2.80	2.73	1.49	36.79
1991	0.48	0.45	2.82	2.93	3.04	1.59	6.02	2.43	1.82	5.60	2.42	2.07	31.67
1992	0.86	1.54	2.13	3.52	1.35	1.76	4.15	3.04	4.84	1.42	4.98	2.47	32.06
1993	2.29	1.21	1.47	4.92	3.01	7.33	3.83	2.50	M3.88	1.55	2.30	0.54	34.83

1994	2.41	2.88	1.30	5.12	1.06	2.43	3.75	4.22	2.87	0.92	1.94	0.71	29.61
1995	0.89	0.52	1.43	2.61	2.48	0.38	1.98	5.44	1.42	3.63	2.91	1.43	25.12
1996	2.73	0.97	1.14	3.11	1.23	8.61	2.20	1.46	1.45	2.19	0.82	1.42	27.33
1997	2.58	2.01	2.17	1.85	2.45	4.07	1.64	3.66	1.28	1.17	0.37	0.83	24.08
1998	3.12	1.07	4.95	2.65	1.99	4.73	1.52	5.67	1.83	2.58	2.20	0.38	32.69
1999	M0.90	0.35	0.48	2.88	5.41	5.31	4.44	2.25	2.41	1.07	0.71	1.31	27.52
2000	1.71	1.96	0.91	2.33	5.74	2.09	4.95	3.54	3.49	1.33	2.25	2.94	33.24
2001	0.33	1.82	0.58	3.64	5.00	3.14	1.25	6.50	3.73	2.05	1.43	1.22	30.69
2002	1.33	1.02	2.52	3.85	3.28	5.43	0.85	3.47	1.76	3.51	0.94	0.77	28.73
2003	0.61	0.59	2.16	2.35	4.04	2.50	4.09	1.02	2.03	1.26	4.13	1.41	26.19
2004	1.54	1.61	3.36	2.27	7.70	3.30	2.68	2.02	0.38	2.57	2.32	2.38	32.13
2005	2.41	1.43	M0.92	0.85	M2.11	1.54	3.01	3.38	M1.55	1.47	M4.40	0.58	23.65
2006	2.20	1.32	2.10	M2.60	6.29	1.93	M6.11	1.59	3.20	2.79	2.05	2.05	34.23
2007	1.63	1.98	4.60	2.26	2.54	1.57	3.52	4.54	1.18	3.21	0.44	2.00	29.47
2008	2.59	2.68	0.60	5.52	1.11	9.07	3.86	1.00	1.59	1.99	1.37	4.26	35.64
2009	0.61	M2.14	2.22	3.61	3.62	1.67	1.28	4.89	2.67	5.22	1.41	3.06	32.40
2010	0.67	1.11	0.36	3.94	2.96	7.00	5.54	1.74	2.98	1.63	0.79	2.32	31.04
2011	1.91	1.67	3.29	5.62	2.15	6.35	2.41	1.20	3.06	1.39	3.75	1.15	33.95
2012	1.52	0.68	2.67	3.17	5.25	M3.10	4.39	4.18	0.67	4.18	0.55	2.71	33.07
2013	2.32	3.53	2.16	4.25	2.22	5.08	2.32	1.45	2.50	4.12	5.30	1.35	36.60
2014	1.21	0.80	1.11	5.57	3.95	5.64	1.75	2.69	2.39	4.90	1.95	0.93	32.89
2015	0.43	0.56	0.68	2.71	3.79	3.66	1.43	3.78	4.23	1.99	3.55	5.07	31.88
2016	1.21	0.75	4.00	1.89	1.60	3.95	6.71	3.00	3.86	3.00	1.63	2.16	33.76
2017	2.95	1.45	2.82	4.72	3.61	7.88	3.53	3.17	0.91	3.30	1.28	1.44	37.06
2018	1.99	1.19	0.74	4.00	4.03	5.29	4.71	6.09	1.70	3.50	1.10	1.15	35.49
2019	2.84	2.94	1.57	4.03	4.20	4.36	2.37	4.31	5.32	5.15	2.47	3.47	43.03
2020	1.79	0.92	3.76	2.16	5.59	3.88	6.55	M1.47					26.12

Notes: Data missing in any month have an "M" flag. A "T" indicates a trace of precipitation.

Data missing for all days in a month or year is blank.

Creation date: 2016-07-22

APPENDIX C
NRCS Custom Soils Resource Reports

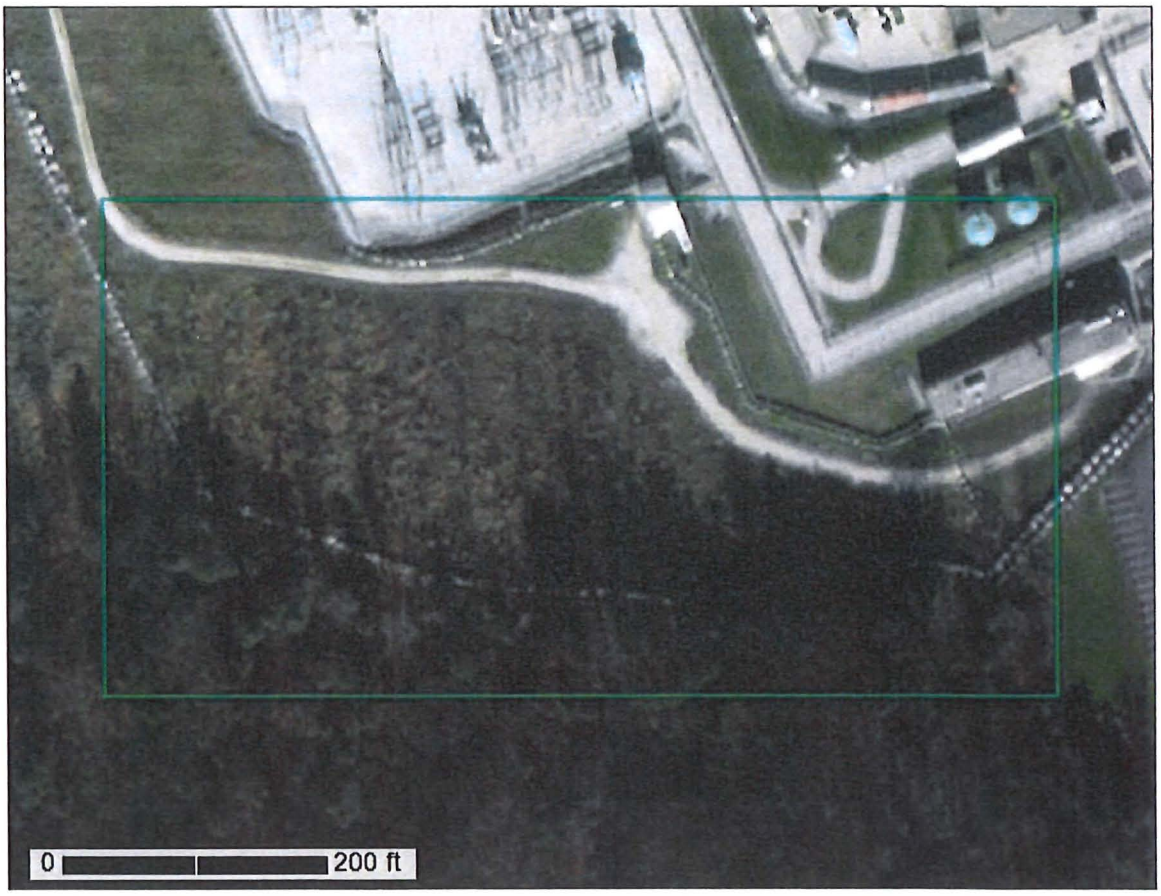
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Calumet and Manitowoc Counties, Wisconsin



August 24, 2020

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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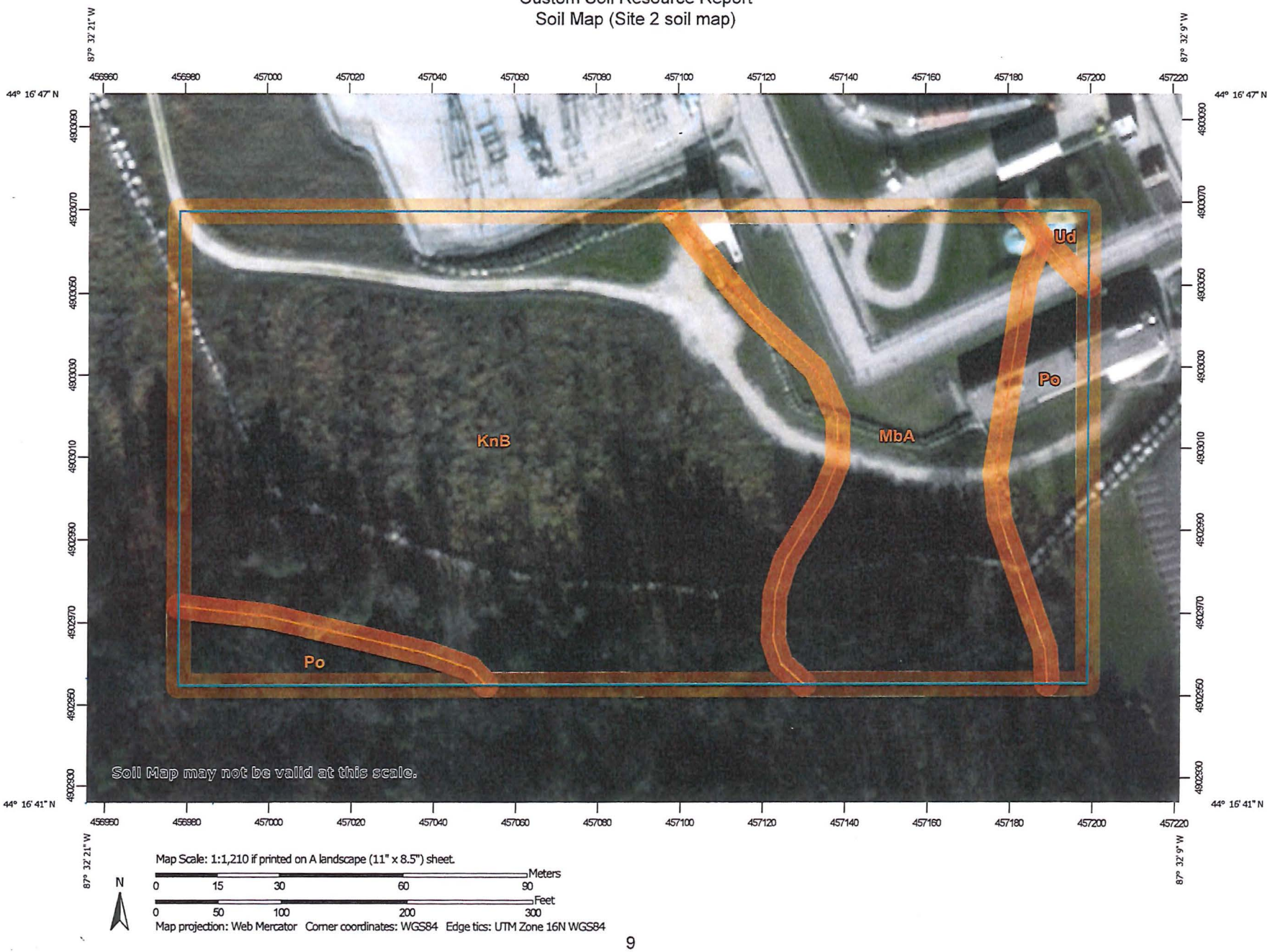
identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map (Site 2 soil map)



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Calumet and Manitowoc Counties, Wisconsin
Survey Area Data: Version 20, Jun 8, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Dec 31, 2009—Jul 22, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend (Site 2 soil map)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
KnB	Kewaunee loam, 2 to 6 percent slopes	4.0	62.8%
MbA	Manawa silt loam, 0 to 3 percent slopes	1.6	25.8%
Po	Poygan silty clay loam, 0 to 2 percent slopes, occasionally ponded, drained	0.7	10.7%
Ud	Udorthents	0.0	0.6%
Totals for Area of Interest		**6.3**	**100.0%**

Map Unit Descriptions (Site 2 soil map)

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Calumet and Manitowoc Counties, Wisconsin

KnB—Kewaunee loam, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 2tjw0
Elevation: 740 to 1,300 feet
Mean annual precipitation: 29 to 32 inches
Mean annual air temperature: 43 to 46 degrees F
Frost-free period: 110 to 140 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Kewaunee and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kewaunee

Setting

Landform: Till plains
Landform position (three-dimensional): Rise
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Clayey till and/or calcareous, dense clayey till

Typical profile

Ap - 0 to 8 inches: loam
Bt - 8 to 25 inches: clay
BC - 25 to 32 inches: clay
Cd - 32 to 79 inches: silty clay loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: 20 to 40 inches to densic material
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water capacity: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: D
Forage suitability group: Mod AWC, adequately drained (G095AY005WI)
Other vegetative classification: Mod AWC, adequately drained (G095AY005WI)
Hydric soil rating: No

Minor Components

Manawa

Percent of map unit: 10 percent
Landform: Drainageways
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

Symco

Percent of map unit: 5 percent
Landform: Drainageways
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

MbA—Manawa silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2t731
Elevation: 580 to 1,130 feet
Mean annual precipitation: 29 to 35 inches
Mean annual air temperature: 43 to 46 degrees F
Frost-free period: 141 to 190 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Manawa and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Manawa

Setting

Landform: Drainageways on ground moraines
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Thin loess over clayey till and/or calcareous, dense clayey till

Typical profile

Ap - 0 to 7 inches: silt loam
2Bt - 7 to 22 inches: silty clay
2Cd - 22 to 79 inches: silty clay

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 20 to 40 inches to densic material
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.60 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water capacity: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: D
Forage suitability group: Mod AWC, high water table (G095AY004WI)
Other vegetative classification: Mod AWC, high water table (G095AY004WI)
Hydric soil rating: No

Minor Components

Kewaunee

Percent of map unit: 8 percent
Landform: Ground moraines
Landform position (two-dimensional): Summit, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Poygan, occassionally ponded

Percent of map unit: 7 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Po—Poygan silty clay loam, 0 to 2 percent slopes, occasionally ponded, drained

Map Unit Setting

National map unit symbol: 2ygzh
Elevation: 610 to 1,210 feet
Mean annual precipitation: 27 to 33 inches
Mean annual air temperature: 43 to 46 degrees F
Frost-free period: 130 to 170 days

Farmland classification: Prime farmland if drained

Map Unit Composition

Poygan, occassionally ponded, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Poygan, Occassionally Ponded

Setting

Landform: Depressions
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Silty and clayey till

Typical profile

Ap - 0 to 10 inches: silty clay loam
Bg - 10 to 27 inches: silty clay
C - 27 to 79 inches: clay

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Occasional
Calcium carbonate, maximum content: 35 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water capacity: Low (about 5.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C/D
Hydric soil rating: Yes

Minor Components

Manawa, occassionally ponded

Percent of map unit: 10 percent
Landform: Drainageways
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Concave
Other vegetative classification: Mod AWC, high water table (G095AY004WI)
Hydric soil rating: No

Kewaunee

Percent of map unit: 3 percent
Landform: Moraines
Landform position (two-dimensional): Summit, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex

Across-slope shape: Linear
Hydric soil rating: No

Willette, muck, ponded
Percent of map unit: 2 percent
Landform: Depressions
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Linear
Other vegetative classification: Frequently flooded, organics (G095AY010WI)
Hydric soil rating: Yes

Ud—Udorthents

Map Unit Setting
National map unit symbol: g622
Elevation: 580 to 1,130 feet
Mean annual precipitation: 29 to 32 inches
Mean annual air temperature: 36 to 54 degrees F
Frost-free period: 130 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition
Udorthents and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents

Typical profile
C - 0 to 60 inches: variable

Properties and qualities
Slope: 0 to 60 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to high (0.00 to 5.95 in/hr)
Depth to water table: About 60 to 80 inches
Frequency of flooding: None
Frequency of ponding: None

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: A
Hydric soil rating: No

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United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Calumet and Manitowoc Counties, Wisconsin

August 24, 2020

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map (Site 3 soils map)

Map Scale: 1:1,060 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 15 30 60 90

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 16N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Calumet and Manitowoc Counties, Wisconsin
Survey Area Data: Version 20, Jun 8, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Dec 31, 2009—Jul 22, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend (Site 3 soils map)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
KnB	Kewaunee loam, 2 to 6 percent slopes	2.6	43.4%
MbA	Manawa silt loam, 0 to 3 percent slopes	2.0	33.3%
Po	Poygan silty clay loam, 0 to 2 percent slopes, occasionally ponded, drained	1.4	23.3%
Totals for Area of Interest		**5.9**	**100.0%**

Map Unit Descriptions (Site 3 soils map)

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or

landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Calumet and Manitowoc Counties, Wisconsin

KnB—Kewaunee loam, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 2tjw0
Elevation: 740 to 1,300 feet
Mean annual precipitation: 29 to 32 inches
Mean annual air temperature: 43 to 46 degrees F
Frost-free period: 110 to 140 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Kewaunee and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kewaunee

Setting

Landform: Till plains
Landform position (three-dimensional): Rise
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Clayey till and/or calcareous, dense clayey till

Typical profile

Ap - 0 to 8 inches: loam
Bt - 8 to 25 inches: clay
BC - 25 to 32 inches: clay
Cd - 32 to 79 inches: silty clay loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: 20 to 40 inches to densic material
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water capacity: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: D
Forage suitability group: Mod AWC, adequately drained (G095AY005WI)
Other vegetative classification: Mod AWC, adequately drained (G095AY005WI)
Hydric soil rating: No

Minor Components

Manawa

Percent of map unit: 10 percent
Landform: Drainageways
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

Symco

Percent of map unit: 5 percent
Landform: Drainageways
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

MbA—Manawa silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2t731
Elevation: 580 to 1,130 feet
Mean annual precipitation: 29 to 35 inches
Mean annual air temperature: 43 to 46 degrees F
Frost-free period: 141 to 190 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Manawa and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Manawa

Setting

Landform: Drainageways on ground moraines
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Thin loess over clayey till and/or calcareous, dense clayey till

Typical profile

Ap - 0 to 7 inches: silt loam
2Bt - 7 to 22 inches: silty clay
2Cd - 22 to 79 inches: silty clay

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 20 to 40 inches to densic material
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.60 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water capacity: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: D
Forage suitability group: Mod AWC, high water table (G095AY004WI)
Other vegetative classification: Mod AWC, high water table (G095AY004WI)
Hydric soil rating: No

Minor Components

Kewaunee

Percent of map unit: 8 percent
Landform: Ground moraines
Landform position (two-dimensional): Summit, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Poygan, occassionally ponded

Percent of map unit: 7 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Po—Poygan silty clay loam, 0 to 2 percent slopes, occasionally ponded, drained

Map Unit Setting

National map unit symbol: 2ygzh
Elevation: 610 to 1,210 feet
Mean annual precipitation: 27 to 33 inches
Mean annual air temperature: 43 to 46 degrees F
Frost-free period: 130 to 170 days

Farmland classification: Prime farmland if drained

Map Unit Composition

Poygan, occassionally ponded, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Poygan, Occassionally Ponded

Setting

Landform: Depressions
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Silty and clayey till

Typical profile

Ap - 0 to 10 inches: silty clay loam
Bg - 10 to 27 inches: silty clay
C - 27 to 79 inches: clay

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Occasional
Calcium carbonate, maximum content: 35 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water capacity: Low (about 5.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C/D
Hydric soil rating: Yes

Minor Components

Manawa, occassionally ponded

Percent of map unit: 10 percent
Landform: Drainageways
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Concave
Other vegetative classification: Mod AWC, high water table (G095AY004WI)
Hydric soil rating: No

Kewaunee

Percent of map unit: 3 percent
Landform: Moraines
Landform position (two-dimensional): Summit, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex

Across-slope shape: Linear
Hydric soil rating: No

Willette, muck, ponded
Percent of map unit: 2 percent
Landform: Depressions
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Linear
Other vegetative classification: Frequently flooded, organics (G095AY010WI)
Hydric soil rating: Yes

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APPENDIX D
Photo Logs of the Delineated Wetlands

Photograph 1. Wetland 1. Facing East.
44.278975178, -87.536827080

Photograph 2. Wetland 2. Facing South.
44.279266984, -87.538734892

Photograph 3. Wetland 3. Facing South.
44.278938610, -87.537627373

Photograph 4. Wetland 4. Facing West.
44.279097395, -87.537122187

Photograph 1. Wetland 1. Facing East.
44.287566822, -87.543597804

Photograph 2. Wetland 1. Facing North.
44.286251762, -87.544022917

APPENDIX E
Wetland Delineation Data Sheets

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: NextEra Point Beach - Middle ("Priority") Site City/County: Two Rivers, Manitowoc Co. Sampling Date: 8/18/2020

Applicant/Owner: NextEra State: WI Sampling Point: W01-W

Investigator(s): Andrew Sabal, Kellen Black Section, Township, Range: S24, T21N24E

Landform (hillside, terrace, etc.): Depression Local relief (concave, convex, none): Concave Slope %: 1

Subregion (LRR or MLRA): LRR K Lat: 44.278975178 Long: -87.536827080 Datum: NAD1983 (Conus)

Soil Map Unit Name: Manawa Silt Loam NWI classification: EM-1

Are climatic / hydrologic conditions on the site typical for this time of year? Yes x No ____ (If no, explain in Remarks.)

Are Vegetation no , Soil no , or Hydrology no significantly disturbed? Are "Normal Circumstances" present? Yes x No ____

Are Vegetation no , Soil no , or Hydrology no naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area within a Wetland?** **Yes** X **No** ____
Hydric Soil Present?	Yes X	No ____	If yes, optional Wetland Site ID: Wetland 1
Wetland Hydrology Present?	Yes X	No ____	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- x Inundation Visible on Aerial Imagery (B7)
- x Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- x Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- x Stunted or Stressed Plants (D1)
- x Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No x	Depth (inches): ____
Water Table Present?	Yes ____	No x	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No x	Depth (inches): ____

Wetland Hydrology Present? **Yes** X **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: W01-W

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	

Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	

Herb Stratum (Plot size: 5 Feet)			
1. *Phalaris arundinacea*	2	No	FACW
2. *Schoenoplectus tabernaemontani*	1	No	OBL
3. *Bidens frondosa*	10	No	FACW
4. *Daucus carota*	5	No	UPL
5. *Melilotus officinalis*	5	No	FACU
6. *Juncus tenuis*	50	Yes	FAC
7. *Carex vulpinoidea*	15	No	OBL
8. *Poa pratensis*	10	No	FACU
9.			
10.			
11.			
12.			
	98	=Total Cover	

Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	16	x 1 =	16
FACW species	12	x 2 =	24
FAC species	50	x 3 =	150
FACU species	15	x 4 =	60
UPL species	5	x 5 =	25
Column Totals:	98 (A)		275 (B)

Prevalence Index = B/A = 2.81

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
X 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes X No ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point W01-W

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-12	10YR 2/2	90	10YR 3/6	10	C	M	Loamy/Clayey	Prominent redox concentrations
12-22	5YR 4/4	60	10YR 3/6	15	C	M	Loamy/Clayey	Prominent redox concentrations

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(LRR R, MLRA 149B)**
- ___ Thin Dark Surface (S9) **(LRR R, MLRA 149B)**
- ___ High Chroma Sands (S11) **(LRR K, L)**
- ___ Loamy Mucky Mineral (F1) **(LRR K, L)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- X Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- X Redox Depressions (F8)
- ___ Marl (F10) **(LRR K, L)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(LRR K, L, MLRA 149B)**
- ___ Coast Prairie Redox (A16) **(LRR K, L, R)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR K, L, R)**
- ___ Polyvalue Below Surface (S8) **(LRR K, L)**
- ___ Thin Dark Surface (S9) **(LRR K, L)**
- ___ Iron-Manganese Masses (F12) **(LRR K, L, R)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 149B)**
- ___ Mesic Spodic (TA6) **(MLRA 144A, 145, 149B)**
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** ___

Remarks:

This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 7.0, 2015 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: NextEra Point Beach - Middle ("Priority") Site City/County: Two Rivers, Manitowoc Co. Sampling Date: 8/18/2020

Applicant/Owner: NextEra State: WI Sampling Point: W01-U

Investigator(s): Andrew Sabai, Kellen Black Section, Township, Range: S24, T21N24E

Landform (hillside, terrace, etc.): hillside Local relief (concave, convex, none): none Slope %: 1

Subregion (LRR or MLRA): LRR K Lat: 44.278883 Long: -87.537155 Datum: NAD1983(Conus)

Soil Map Unit Name: Manawa Silt Loam NWI classification: ____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes x No ____ (If no, explain in Remarks.)

Are Vegetation no , Soil no , or Hydrology no significantly disturbed? Are "Normal Circumstances" present? Yes x No ____

Are Vegetation no , Soil no , or Hydrology no naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No x	**Is the Sampled Area within a Wetland?** Yes ____ No x
Hydric Soil Present?	Yes ____	No x	If yes, optional Wetland Site ID: ____
Wetland Hydrology Present?	Yes ____	No x	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ? Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No x	Depth (inches): ____
Water Table Present?	Yes ____	No x	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No x	Depth (inches): ____

Wetland Hydrology Present? Yes ____ No x

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: W01-U

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	

Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	

Herb Stratum (Plot size: 5 Feet)			
1. *Daucus carota*	15	Yes	UPL
2. *Ambrosia artemisiifolia*	20	Yes	FACU
3. *Erigeron annuus*	10	No	FACU
4. *Trifolium repens*	2	No	FACU
5. *Bellis perennis*	4	No	UPL
6. *Lotus corniculatus*	5	No	FACU
7. *Trifolium hybridum*	2	No	FACU
8. *Cirsium arvense*	5	No	FACU
9. *Poa pratensis*	15	Yes	FACU
10.			
11.			
12.			
	78	=Total Cover	

Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	59	x 4 =	236
UPL species	19	x 5 =	95
Column Totals:	78 (A)		331 (B)

Prevalence Index = B/A = 4.24

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ___ No X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point W01-U

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 3/2	100					Loamy/Clayey	
2-7	10YR 5/3	48						
	10YR 5/2	47						
	10YR 3/1	5						
7-10	10YR 5/3	60						Gravel component
	10YR 5/2	40						

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(LRR R, MLRA 149B)**
- ___ Thin Dark Surface (S9) **(LRR R, MLRA 149B)**
- ___ High Chroma Sands (S11) **(LRR K, L)**
- ___ Loamy Mucky Mineral (F1) **(LRR K, L)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) **(LRR K, L)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(LRR K, L, MLRA 149B)**
- ___ Coast Prairie Redox (A16) **(LRR K, L, R)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR K, L, R)**
- ___ Polyvalue Below Surface (S8) **(LRR K, L)**
- ___ Thin Dark Surface (S9) **(LRR K, L)**
- ___ Iron-Manganese Masses (F12) **(LRR K, L, R)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 149B)**
- ___ Mesic Spodic (TA6) **(MLRA 144A, 145, 149B)**
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Compacted clay/gravel

Depth (inches): 10

Hydric Soil Present? Yes ___ No X

Remarks:

This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 7.0, 2015 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: NextEra Point Beach - Middle ("Priority") Site City/County: Two Rivers, Manitowoc Co. Sampling Date: 8/18/2020

Applicant/Owner: NextEra State: WI Sampling Point: W02-W

Investigator(s): Andrew Sabal, Kellen Black Section, Township, Range: S24, T21N24E

Landform (hillside, terrace, etc.): Depression Local relief (concave, convex, none): Concave Slope %: 1

Subregion (LRR or MLRA): LRR K Lat: 44.279266984 Long: -87.538734892 Datum: NAD1983(Conus)

Soil Map Unit Name: Kewaunee Loam NWI classification: EM-1

Are climatic / hydrologic conditions on the site typical for this time of year? Yes x No ____ (If no, explain in Remarks.)

Are Vegetation no , Soil no , or Hydrology no significantly disturbed? Are "Normal Circumstances" present? Yes x No ____

Are Vegetation no , Soil no , or Hydrology no naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area within a Wetland?** Yes X No ____
Hydric Soil Present?	Yes X	No ____	If yes, optional Wetland Site ID: Wetland 2
Wetland Hydrology Present?	Yes X	No ____	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- x Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- x Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No x	Depth (inches): ____
Water Table Present?	Yes ____	No x	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No x	Depth (inches): ____

Wetland Hydrology Present? Yes X No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: W02-W

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	=Total Cover		
Herb Stratum (Plot size: 5 Feet)			
1. *Lycopus uniflorus*	15	No	OBL
2. *Carex bebbii*	10	No	OBL
3. *Phragmites australis*	40	Yes	FACW
4. *Phalaris arundinacea*	40	Yes	FACW
5. *Carex vulpinoidea*	15	No	OBL
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	120 =Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	=Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	40	x 1 =	40
FACW species	80	x 2 =	160
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	120 (A)		200 (B)

Prevalence Index = B/A = 1.67

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- X 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes X No ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point W02-W

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 2/1	100					Loamy/Clayey	
3-13	10YR 2/1	90	10YR 4/6	10	C	M	Loamy/Clayey	Prominent redox concentrations
13-22	10YR 4/2	40	10YR 4/6	15	C	M	Loamy/Clayey	Prominent redox concentrations
	10YR 4/4	30						
	10YR 6/2	10						
	10YR 2/1	5						

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(LRR R, MLRA 149B)**
- ___ Thin Dark Surface (S9) **(LRR R, MLRA 149B)**
- ___ High Chroma Sands (S11) **(LRR K, L)**
- ___ Loamy Mucky Mineral (F1) **(LRR K, L)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- X Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- X Redox Depressions (F8)
- ___ Marl (F10) **(LRR K, L)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(LRR K, L, MLRA 149B)**
- ___ Coast Prairie Redox (A16) **(LRR K, L, R)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR K, L, R)**
- ___ Polyvalue Below Surface (S8) **(LRR K, L)**
- ___ Thin Dark Surface (S9) **(LRR K, L)**
- ___ Iron-Manganese Masses (F12) **(LRR K, L, R)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 149B)**
- ___ Mesic Spodic (TA6) **(MLRA 144A, 145, 149B)**
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** ___

Remarks:
This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 7.0, 2015 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: NextEra Point Beach - Middle ("Priority") Site City/County: Two Rivers, Manitowoc Co. Sampling Date: 8/18/2020

Applicant/Owner: NextEra State: WI Sampling Point: W02-U

Investigator(s): Andrew Sabai, Kellen Black Section, Township, Range: S24, T21N24E

Landform (hillside, terrace, etc.): Hill top Local relief (concave, convex, none): none Slope %: 0

Subregion (LRR or MLRA): LRR K Lat: 44.279282 Long: -87.538657 Datum: NAD1983(Conus)

Soil Map Unit Name: Kewaunee Loam NWI classification: ____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes x No ____ (If no, explain in Remarks.)

Are Vegetation no, Soil no, or Hydrology no significantly disturbed? Are "Normal Circumstances" present? Yes x No ____

Are Vegetation no, Soil no, or Hydrology no naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No x	**Is the Sampled Area within a Wetland?** Yes ____ No x
Hydric Soil Present?	Yes ____	No x	If yes, optional Wetland Site ID: ____
Wetland Hydrology Present?	Yes ____	No x	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No x	Depth (inches): ____
Water Table Present?	Yes ____	No x	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No x	Depth (inches): ____

Wetland Hydrology Present? Yes ____ No x

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: W02-U

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	

Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	

Herb Stratum (Plot size: 5 Feet)			
1. *Asclepias syriaca*	15	Yes	UPL
2. *Ambrosia artemisiifolia*	15	Yes	FACU
3. *Solidago altissima*	10	No	FACU
4. *Achillea millefolium*	5	No	FACU
5. *Poa pratensis*	20	Yes	FACU
6. *Cirsium arvense*	1	No	FACU
7. *Daucus carota*	5	No	UPL
8. *Hypericum perforatum*	5	No	UPL
9.			
10.			
11.			
12.			
	76	=Total Cover	

Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	51	x 4 =	204
UPL species	25	x 5 =	125
Column Totals:	76 (A)		329 (B)

Prevalence Index = B/A = 4.33

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ___ No x

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point W02-U

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-10	10YR 3/1	60					Loamy/Clayey	
	10YR 3/4	40						
10-22	10YR 4/2	70					Loamy/Clayey	
	5YR 4/4	25						
	10YR 3/1	5						

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(LRR R, MLRA 149B)**
- ___ Thin Dark Surface (S9) **(LRR R, MLRA 149B)**
- ___ High Chroma Sands (S11) **(LRR K, L)**
- ___ Loamy Mucky Mineral (F1) **(LRR K, L)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) **(LRR K, L)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(LRR K, L, MLRA 149B)**
- ___ Coast Prairie Redox (A16) **(LRR K, L, R)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR K, L, R)**
- ___ Polyvalue Below Surface (S8) **(LRR K, L)**
- ___ Thin Dark Surface (S9) **(LRR K, L)**
- ___ Iron-Manganese Masses (F12) **(LRR K, L, R)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 149B)**
- ___ Mesic Spodic (TA6) **(MLRA 144A, 145, 149B)**
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ___ **No** x

Remarks:
This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 7.0, 2015 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: NextEra Point Beach - Middle ("Priority") Site City/County: Two Rivers, Manitowoc Co. Sampling Date: 8/18/2020

Applicant/Owner: NextEra State: WI Sampling Point: W03-W

Investigator(s): Andrew Sabai, Kellen Black Section, Township, Range: S24, T21N24E

Landform (hillside, terrace, etc.): Depression Local relief (concave, convex, none): Concave Slope %: 1

Subregion (LRR or MLRA): LRR K Lat: 44.278938610 Long: -87.537627373 Datum: NAD1983(Conus)

Soil Map Unit Name: Kewaunee Loam NWI classification: EM-1

Are climatic / hydrologic conditions on the site typical for this time of year? Yes x No ____ (If no, explain in Remarks.)

Are Vegetation no , Soil no , or Hydrology no significantly disturbed? Are "Normal Circumstances" present? Yes x No ____

Are Vegetation no , Soil no , or Hydrology no naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area within a Wetland?** Yes X No ____
Hydric Soil Present?	Yes X	No ____	If yes, optional Wetland Site ID: Wetland 3
Wetland Hydrology Present?	Yes X	No ____	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- x Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- x Stunted or Stressed Plants (D1)
- x Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No x	Depth (inches): ____
Water Table Present?	Yes ____	No x	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No x	Depth (inches): ____

Wetland Hydrology Present? Yes X No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: W03-W

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	
Herb Stratum (Plot size: 5 Feet)			
1. *Bidens frondosa*	40	Yes	FACW
2. *Ambrosia artemisiifolia*	5	No	FACU
3. *Phalaris arundinacea*	10	No	FACW
4. *Carex vulpinoidea*	10	No	OBL
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	65	=Total Cover	
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	10	x 1 =	10
FACW species	50	x 2 =	100
FAC species	0	x 3 =	0
FACU species	5	x 4 =	20
UPL species	0	x 5 =	0
Column Totals:	65 (A)		130 (B)

Prevalence Index = B/A = 2.00

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

X 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes X No ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point W03-W

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 2/1	95	10YR 4/6	5	C	M	Loamy/Clayey	Prominent redox concentrations
6-22	5YR 4/4	60					Loamy/Clayey	
	10YR 4/2	20						
	10YR 4/4	15						
	10YR 6/2	5						

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(LRR R, MLRA 149B)**
- ___ Thin Dark Surface (S9) **(LRR R, MLRA 149B)**
- ___ High Chroma Sands (S11) **(LRR K, L)**
- ___ Loamy Mucky Mineral (F1) **(LRR K, L)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- X Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- X Redox Depressions (F8)
- ___ Marl (F10) **(LRR K, L)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(LRR K, L, MLRA 149B)**
- ___ Coast Prairie Redox (A16) **(LRR K, L, R)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR K, L, R)**
- ___ Polyvalue Below Surface (S8) **(LRR K, L)**
- ___ Thin Dark Surface (S9) **(LRR K, L)**
- ___ Iron-Manganese Masses (F12) **(LRR K, L, R)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 149B)**
- ___ Mesic Spodic (TA6) **(MLRA 144A, 145, 149B)**
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** ___

Remarks:

This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 7.0, 2015 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: NextEra Point Beach - Middle ("Priority") Site City/County: Two Rivers, Manitowoc Co. Sampling Date: 8/18/2020

Applicant/Owner: NextEra State: WI Sampling Point: W03-U

Investigator(s): Kellen Black and Andrew Sabai Section, Township, Range: S24, T21N24E

Landform (hillside, terrace, etc.): Hillside Local relief (concave, convex, none): none Slope %: 2

Subregion (LRR or MLRA): LRR K Lat: 44.278875 Long: -87.537638 Datum: NAD1983(Conus)

Soil Map Unit Name: Kewaunee Loam NWI classification: ____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes x No ____ (If no, explain in Remarks.)

Are Vegetation no, Soil no, or Hydrology no significantly disturbed? Are "Normal Circumstances" present? Yes x No ____

Are Vegetation no, Soil no, or Hydrology no naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No X	**Is the Sampled Area within a Wetland?** Yes ____ No x
Hydric Soil Present?	Yes X	No ____	If yes, optional Wetland Site ID: ____
Wetland Hydrology Present?	Yes ____	No X	

Remarks: (Explain alternative procedures here or in a separate report.)
The soils at this data point are likely impacted and influenced by historic grading.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No x	Depth (inches): ____
Water Table Present?	Yes ____	No x	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No x	Depth (inches): ____

Wetland Hydrology Present? Yes ____ No x

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: W03-U

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	

Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	

Herb Stratum (Plot size: 5 Feet)			
1. *Poa pratensis*	90	Yes	FACU
2. *Ambrosia acanthicarpa*	1	No	UPL
3. *Daucus carota*	1	No	UPL
4. *Phalaris arundinacea*	5	No	FACW
5. *Bellis perennis*	2	No	UPL
6. *Cirsium arvense*	5	No	FACU
7.			
8.			
9.			
10.			
11.			
12.			
	104	=Total Cover	

Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	5	x 2 =	10
FAC species	0	x 3 =	0
FACU species	95	x 4 =	380
UPL species	4	x 5 =	20
Column Totals:	104 (A)		410 (B)

Prevalence Index = B/A = 3.94

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ___ No x

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point W03-U

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 3/2	60					Loamy/Clayey	
4-6	10YR 2/1	100					Loamy/Clayey	
6-22	10YR 4/2	65	10YR 4/6	2	C	PL	Loamy/Clayey	Prominent redox concentrations

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- X Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(LRR R, MLRA 149B)**
- ___ Thin Dark Surface (S9) **(LRR R, MLRA 149B)**
- ___ High Chroma Sands (S11) **(LRR K, L)**
- ___ Loamy Mucky Mineral (F1) **(LRR K, L)**
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) **(LRR K, L)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(LRR K, L, MLRA 149B)**
- ___ Coast Prairie Redox (A16) **(LRR K, L, R)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR K, L, R)**
- ___ Polyvalue Below Surface (S8) **(LRR K, L)**
- ___ Thin Dark Surface (S9) **(LRR K, L)**
- ___ Iron-Manganese Masses (F12) **(LRR K, L, R)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 149B)**
- ___ Mesic Spodic (TA6) **(MLRA 144A, 145, 149B)**
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes X No ___

Remarks:
This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 7.0, 2015 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)
The soils at this site have been historically impacted by grading.

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: NextEra Point Beach - Middle ("Priority") Site City/County: Two Rivers, Manitowoc Co. Sampling Date: 8/18/2020

Applicant/Owner: NextEra State: WI Sampling Point: W04-W

Investigator(s): Andrew Sabai, Kellen Black Section, Township, Range: S24, T21N24E

Landform (hillside, terrace, etc.): Drainage Local relief (concave, convex, none): none Slope %: 3

Subregion (LRR or MLRA): LRR K Lat: 44.279097395 Long: -87.537122187 Datum: NAD1983(Conus)

Soil Map Unit Name: Manawa Silt Loam NWI classification: EM-1

Are climatic / hydrologic conditions on the site typical for this time of year? Yes x No ____ (If no, explain in Remarks.)

Are Vegetation no , Soil no , or Hydrology no significantly disturbed? Are "Normal Circumstances" present? Yes x No ____

Are Vegetation no , Soil no , or Hydrology no naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area within a Wetland?** Yes X No ____
Hydric Soil Present?	Yes X	No ____	If yes, optional Wetland Site ID: Wetland 4
Wetland Hydrology Present?	Yes X	No ____	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- x Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No x	Depth (inches): ____
Water Table Present?	Yes ____	No x	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No x	Depth (inches): ____

Wetland Hydrology Present? Yes X No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: W04-W

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	
Herb Stratum (Plot size: 5 Feet)			
1. *Phalaris arundinacea*	100	Yes	FACW
2. *Cirsium arvense*	1	No	FACU
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	101	=Total Cover	
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	100	x 2 =	200
FAC species	0	x 3 =	0
FACU species	1	x 4 =	4
UPL species	0	x 5 =	0
Column Totals:	101 (A)		204 (B)

Prevalence Index = B/A = 2.02

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- X 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes X No ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point W04-W

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-5	10YR 3/1	98	10YR 4/4	2	C	M	Loamy/Clayey	Distinct redox concentrations
5-13	10YR 3/1	85	10YR 4/4	15	C	M	Loamy/Clayey	Distinct redox concentrations
13-22	10YR 4/2	70	10YR 4/4	10	C	M	Loamy/Clayey	Distinct redox concentrations
	10YR 6/3	10						
	10YR 3/1	10						

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(LRR R, MLRA 149B)**
- ___ Thin Dark Surface (S9) **(LRR R, MLRA 149B)**
- ___ High Chroma Sands (S11) **(LRR K, L)**
- ___ Loamy Mucky Mineral (F1) **(LRR K, L)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- X Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) **(LRR K, L)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(LRR K, L, MLRA 149B)**
- ___ Coast Prairie Redox (A16) **(LRR K, L, R)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR K, L, R)**
- ___ Polyvalue Below Surface (S8) **(LRR K, L)**
- ___ Thin Dark Surface (S9) **(LRR K, L)**
- ___ Iron-Manganese Masses (F12) **(LRR K, L, R)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 149B)**
- ___ Mesic Spodic (TA6) **(MLRA 144A, 145, 149B)**
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes X No ___

Remarks:
This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 7.0, 2015 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: NextEra Point Beach - Middle ("Priority") Site City/County: Two Rivers, Manitowoc Co. Sampling Date: 8/18/2020

Applicant/Owner: NextEra State: WI Sampling Point: W04-U

Investigator(s): Andrew Sabai, Kellen Black Section, Township, Range: S24, T21N24E

Landform (hillside, terrace, etc.): hilside Local relief (concave, convex, none): none Slope %: 3

Subregion (LRR or MLRA): LRR K Lat: 44.279221 Long: -87.537284 Datum: NAD1983(Conus)

Soil Map Unit Name: Kewaunee Loam NWI classification: ____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes x No ____ (If no, explain in Remarks.)

Are Vegetation no , Soil no , or Hydrology no significantly disturbed? Are "Normal Circumstances" present? Yes x No ____

Are Vegetation no , Soil no , or Hydrology no naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No x	**Is the Sampled Area within a Wetland?** Yes ____ No x
Hydric Soil Present?	Yes ____	No ____	If yes, optional Wetland Site ID: ____
Wetland Hydrology Present?	Yes ____	No x	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ? Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No x	Depth (inches): ____
Water Table Present?	Yes ____	No x	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No x	Depth (inches): ____

Wetland Hydrology Present? Yes ____ No x

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: W04-U

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	

Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	

Herb Stratum (Plot size: 5 Feet)			
1. *Lotus corniculatus*	90	Yes	FACU
2. *Asclepias syriaca*	2	No	UPL
3. *Cirsium arvense*	10	No	FACU
4. *Phalaris arundinacea*	10	No	FACW
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	112	=Total Cover	

Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	10	x 2 =	20
FAC species	0	x 3 =	0
FACU species	100	x 4 =	400
UPL species	2	x 5 =	10
Column Totals:	112 (A)		430 (B)

Prevalence Index = B/A = 3.84

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ___ No x

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point W04-U

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-7	10YR 3/2	100					Loamy/Clayey	
7-9	10YR 4/3	50					Loamy/Clayey	
	10YR 3/2	40						
	5YR 4/4	10						

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(LRR R, MLRA 149B)**
- ___ Thin Dark Surface (S9) **(LRR R, MLRA 149B)**
- ___ High Chroma Sands (S11) **(LRR K, L)**
- ___ Loamy Mucky Mineral (F1) **(LRR K, L)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) **(LRR K, L)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(LRR K, L, MLRA 149B)**
- ___ Coast Prairie Redox (A16) **(LRR K, L, R)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR K, L, R)**
- ___ Polyvalue Below Surface (S8) **(LRR K, L)**
- ___ Thin Dark Surface (S9) **(LRR K, L)**
- ___ Iron-Manganese Masses (F12) **(LRR K, L, R)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 149B)**
- ___ Mesic Spodic (TA6) **(MLRA 144A, 145, 149B)**
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Compacted clay and gravel

Depth (inches): 9

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 7.0, 2015 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: NextEra Point Beach - North Site City/County: Two Rivers, Manitowoc Co. Sampling Date: 8/19/2020

Applicant/Owner: NextEra State: WI Sampling Point: W01-W

Investigator(s): Andrew Sabai, Kellen Black Section, Township, Range: S14, T21N24E

Landform (hillside, terrace, etc.): bottom of slope Local relief (concave, convex, none): concave Slope %: 0

Subregion (LRR or MLRA): LRR K Lat: 44.286251762 Long: -87.544022917 Datum: NAD1983(Conus)

Soil Map Unit Name: Kewaunee Silt Loam NWI classification: EM-2f

Are climatic / hydrologic conditions on the site typical for this time of year? Yes x No ___ (If no, explain in Remarks.)

Are Vegetation yes, Soil yes, or Hydrology no significantly disturbed? Are "Normal Circumstances" present? Yes x No ___

Are Vegetation no, Soil no, or Hydrology no naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes x	No ___	**Is the Sampled Area within a Wetland?** **Yes** x **No** ___
Hydric Soil Present?	Yes X	No ___	If yes, optional Wetland Site ID: W001
Wetland Hydrology Present?	Yes x	No ___	

Remarks: (Explain alternative procedures here or in a separate report.)
This data point is located in a farmed wetland. Severely stunted corn.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- x Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- x Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- x Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No x	Depth (inches): ___
Water Table Present?	Yes ___	No x	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes ___	No x	Depth (inches): ___

Wetland Hydrology Present? **Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: W01-W

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	

Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	

Herb Stratum (Plot size: 5 Feet)			
1. *Zea mays*	10	Yes	UPL
2. *Moss*	1	No	
3. *Ambrosia artemisiifolia*	1	No	FACU
4. *Plantago major*	2	No	FACU
5. *Bidens vulgata*	15	Yes	FAC
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	29	=Total Cover	

Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	15	x 3 =	45
FACU species	3	x 4 =	12
UPL species	10	x 5 =	50
Column Totals:	28 (A)		107 (B)

Prevalence Index = B/A = 3.82

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

x Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes x No ___

Remarks: (Include photo numbers here or on a separate sheet.)
Few plants groing corn and all plant stunted, mostlikely from high water table in spring.

SOIL

Sampling Point W01-W

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-15	10YR 3/2	95	10YR 4/6	5	C	M	Loamy/Clayey	Prominent redox concentrations
15-22	10YR 5/2	70	10YR 4/6	25	C	M	Loamy/Clayey	Prominent redox concentrations
	10YR 3/1	5						

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(LRR R, MLRA 149B)**
- ___ Thin Dark Surface (S9) **(LRR R, MLRA 149B)**
- ___ High Chroma Sands (S11) **(LRR K, L)**
- ___ Loamy Mucky Mineral (F1) **(LRR K, L)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- X Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) **(LRR K, L)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(LRR K, L, MLRA 149B)**
- ___ Coast Prairie Redox (A16) **(LRR K, L, R)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR K, L, R)**
- ___ Polyvalue Below Surface (S8) **(LRR K, L)**
- ___ Thin Dark Surface (S9) **(LRR K, L)**
- ___ Iron-Manganese Masses (F12) **(LRR K, L, R)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 149B)**
- ___ Mesic Spodic (TA6) **(MLRA 144A, 145, 149B)**
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** ___

Remarks:
This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 7.0, 2015 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)
This data point is located in a farmed wetland. Severely stunted corn.

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: NextEra Point Beach - North Site City/County: Two Rivers, Manitowoc Co. Sampling Date: 8/19/2020

Applicant/Owner: NextEra State: WI Sampling Point: W01-U

Investigator(s): Andrew Sabai, Kellen Black Section, Township, Range: S14, T21N24E

Landform (hillside, terrace, etc.): hillside Local relief (concave, convex, none): none Slope %: 2

Subregion (LRR or MLRA): LRR K Lat: 44.287263 Long: -87.543818 Datum: NAD1983(Conus)

Soil Map Unit Name: Kewaunee Silt Loam NWI classification: ____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes x No ____ (If no, explain in Remarks.)

Are Vegetation yes, Soil yes, or Hydrology yes significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation no, Soil no, or Hydrology no naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No x	**Is the Sampled Area within a Wetland?** Yes ____ No x
Hydric Soil Present?	Yes ____	No ____	If yes, optional Wetland Site ID: ____
Wetland Hydrology Present?	Yes ____	No x	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No x	Depth (inches): ____
Water Table Present?	Yes ____	No x	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No x	Depth (inches): ____

Wetland Hydrology Present? Yes ____ No x

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Farmed corn, very healthy, few weeds present.

VEGETATION – Use scientific names of plants.

Sampling Point: W01-U

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	

Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	

Herb Stratum (Plot size: 5 Feet)			
1. *Zea mays*	75	Yes	UPL
2. *Ambrosia artemisiifolia*	1	No	UPL
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	76	=Total Cover	

Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	76	x 5 =	380
Column Totals:	76 (A)		380 (B)

Prevalence Index = B/A = 5.00

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ___ No x

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point W01-U

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-12	10YR 3/3	99	10YR 4/4	1	C	M	Loamy/Clayey	Faint redox concentrations
12-15	5YR 4/4	80					Loamy/Clayey	
	10YR 4/2	20						
15-22	5YR 4/4	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(LRR R, MLRA 149B)**
- ___ Thin Dark Surface (S9) **(LRR R, MLRA 149B)**
- ___ High Chroma Sands (S11) **(LRR K, L)**
- ___ Loamy Mucky Mineral (F1) **(LRR K, L)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) **(LRR K, L)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(LRR K, L, MLRA 149B)**
- ___ Coast Prairie Redox (A16) **(LRR K, L, R)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR K, L, R)**
- ___ Polyvalue Below Surface (S8) **(LRR K, L)**
- ___ Thin Dark Surface (S9) **(LRR K, L)**
- ___ Iron-Manganese Masses (F12) **(LRR K, L, R)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 149B)**
- ___ Mesic Spodic (TA6) **(MLRA 144A, 145, 149B)**
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ___ **No** X

Remarks:
This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 7.0, 2015 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)
This data point is located in a farmed upland. Healthy corn.

Document Request 9

Affected SLRA Enclosure 3, Attachment 2, Sections: Chapter 10

SLRA Page Number: 10-25

Description of Change: Reference citation added to Chapter 10 and reference provided for docketing.

Reference pertains to: Section 3.6

Page 10-25

WDNR. 2011c. Water Use General Permit No. 3 – Temporary Construction Dewatering. December 8, 2011.

WDNR. 2011d. Well Construction Report Form 3300-77A, Wisconsin Unique Well Number YG332. Well Completion Date September 13, 2011.

WDNR. 2012a. Permit Fact Sheet, Wisconsin Department of Natural Resources, August 29, 2012.

Well Construction Report

WISCONSIN UNIQUE WELL NUMBER **YG332**

State of WI - Private Water Systems-DG/2
Department of Natural Resources, Box 7921
Madison, WI 53707

Form 3300-77A (R 9/05)

Property Owner: NextEra - Point Beach	Telephone Number: (
Mailing Address: P.O. Box 14000	
City: Juno Beach	State: FL; Zip Code: 33408-
County of Well Location: MANITOWOC	Co. Well permit No. W_____
Well Completion Date (mm-dd-yyyy): 09 - 13 - 2011	

1. Well Location

[X] Town ☐ City ☐ Village of Two Creeks | Fire # (If avail.)

Street Address or Road Name and Number: Nuclear Rd

Subdivision Name | Lot # | Block #

Gov't Lot # _____ or ne 1/4 of ne 1/4 of Section 23, T 21 N; R 24 [X] E ☐ W

Latitude Deg. 44 Min. 16.983

Longitude Deg. 87 Min. 32.437

Lat/Long Method: GPS006

Well Constructor (Business Name): Ground Source, Inc	License # 4462
Address: 3671 Monroe Rd	Facility ID Number (Public Wells)
City: De Pere; State: WI; Zip Code: 54115-	Well Plan Approval #
Hicap Permanent Well #	Date of Approval (mm/dd/yyyy) / /
Common Well #	Specific Capacity gpm/ft

2. Well Type ☐ Replacement (see item 12 below) [X] New ☐ Reconstruction

of previous unique well # _____ constructed in _____

Reason for replaced or reconstructed well?

[X] Drilled ☐ Driven Point ☐ Jetted ☐ Other _____

3. Well serves 1 # of Test Well (For example: home, barn, restaurant, church, school, industry, etc.)

High Capacity: Well? [X] Yes ☐ No; Property? [X] Yes ☐ No

4. Is the well located upslope or sideslope and not downslope from any contamination sources, including those on neighboring properties? [X] Yes ☐ No (If no, explain on back side.)

Well located within 1,200 feet of a quarry? ☐ Yes [X] No If yes, distance in feet from quarry: _____

Well located in floodplain? ☐ Yes [X] No

Distance in feet from well to nearest: (include proposed)

- ____ 1. Landfill
- ____ 2. Building Overhang
- ____ 3. Septic ☐ Holding Tank ☐
- ____ 4. Sewage Absorption Unit
- ____ 5. Nonconforming Pit
- ____ 6. Buried Home Heating Oil Tank
- ____ 7. Buried Petroleum Tank
- ____ 8. Shoreline ☐ Swimming Pool ☐
- ____ 9. Downspout/Yard Hydrant
- ____ 10. Privy
- ____ 11. Foundation Drain to Clearwater
- ____ 12. Foundation Drain to Sewer
- ____ 13. Building Drain ☐ Cast Iron or Plastic ☐ Other
- ____ 14. Building Sewer ☐ Gravity ☐ Pressure ☐ Cast Iron or Plastic ☐ Other
- ____ 15. Collector Sewer: ☐ sanitary ___ units ___ in. diam. ☐ storm ☐ ≤ 6" ☐ > 6"
- ____ 16. Clearwater Sump
- ____ 17. Wastewater Sump
- ____ 18. Paved Animal Barn Pen
- ____ 19. Animal Yard or Shelter
- ____ 20. Silo
- ____ 21. Barn Gutter
- ____ 22. Manure Pipe ☐ Gravity ☐ Pressure ☐ Cast Iron or Plastic ☐ Other
- ____ 23. Other Manure Storage _____
- ____ 24. Ditch
- ____ 25. Other NR 812 Waste Source

5. Drillhole Dimensions and Construction Method

Dia. (in.)	From (ft.)	To (ft.)	Upper Enlarged Drillhole	Lower Open Bedrock
			[X]---1. Rotary - Mud Circulation----------	☐
9	surface	113	☐---2. Rotary - Air----------	[X]
			☐---3. Rotary - Air and Foam----------	☐
6	113	640	☐---4. Drill-Through Casing Hammer	
			☐---5. Reverse Rotary	
			☐---6. Cable-tool Bit _____ in. dia.--------	☐
			☐---7. Temp. Outer Casing _____ in. dia.	
			Removed? _____ depth ft. ☐ Yes ☐ No - If no, explain on back side.	

6. Casing, Liner, Screen

Dia. (in.)	Material, Weight, Specification Manufacturer & Method of Assembly	From (ft.)	To (ft.)
6	nwe pln end blk steel welded	surface	113
	18.97 .280 a53 IPSCO		
Dia. (in.)	Screen type, material & slot size	From	To

7. Grout or Other Sealing Material

Method _____

Kind of Sealing Material	From (ft.)	To (ft.)	# Sacks Cement
Drill mud and cuttings	surface	113	
(Gravel pack if applicable)			

8. Geology

Geology Codes	Type, Caving/Noncaving, Color, Hardness, etc.	From (ft.)	To (ft.)
- - C -	Clay	0	109
- - T -	Till	109	111
- F L -	Fractured, Limestone/Dolomite	111	113
- - L H	Limestone/Dolomite, Shaley	113	165
- - L -	Limestone/Dolomite	165	340
- F L -	Fractured, Limestone/Dolomite	340	380
- - L -	Limestone/Dolomite	380	640

9. Static Water Level

_____ ft. above ground surface

17.6 ft. below ground surface

10. Pump Test

Pumping level 21.8 ft. below surface

Pumping at 125 GPM for 1.5 Hrs.

11. Well Is:

36 in. [X] Above Grade ☐ Below

Developed? [X] Yes ☐ No

Disinfected? [X] Yes ☐ No

Capped? [X] Yes ☐ No

12. Did you permanently abandon and fill all unused, noncomplying or unsafe wells on this property?

[X] Yes ☐ No If no, explain on reverse.

13. Signature of Well Constructor or Supervisory Driller: tv — Date Signed: 10/14/2011

Print Name of Drill Rig Operator (Mandatory unless same as above): cv — Date: 10/14/2011

Make additional comments on reverse side about geology, additional screens, water quality, etc.

Comments on reverse side _____ (CHECK √, IF YES) Variance Issued ☐ Yes [X] No

Notification #

Document Request 10

Affected SLRA Sections: None

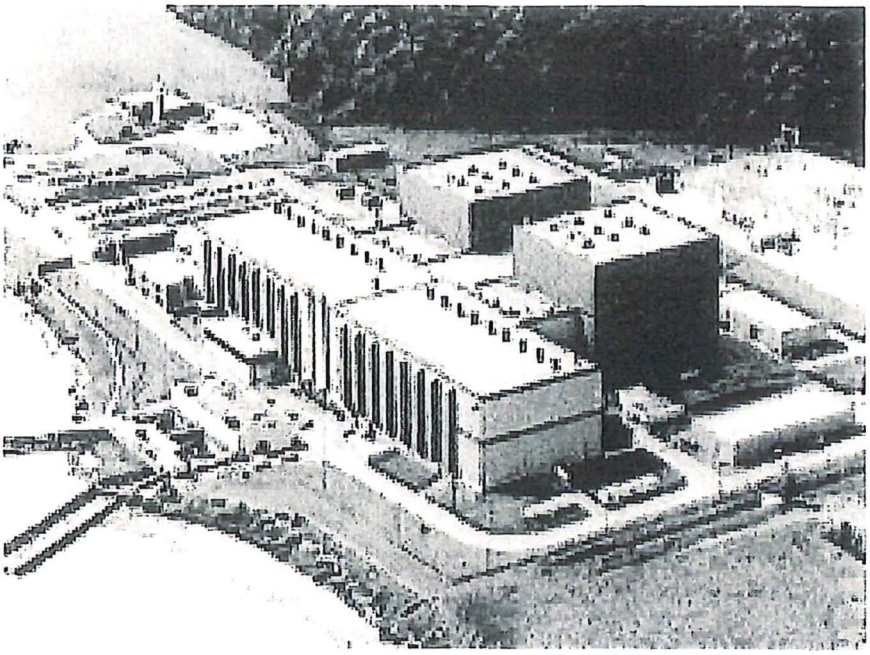
SLRA Page Number: N/A

Description of Change: Existing reference provided for docketing.

Existing Reference

EA Engineering (EA Engineering, Science, and Technology). 2007. Impingement Mortality and Entrainment Characterization Study Point Beach Nuclear Plant.

Impingement Mortality and Entrainment Characterization Study Point Beach Nuclear Plant



Prepared for

We Energies
Milwaukee, Wisconsin

Prepared by

EA Engineering, Science, and Technology
444 Lake Cook Road, Suite 18
Deerfield, IL 60015

August 2007

13976.05

Impingement Mortality and Entrainment Characterization Study Point Beach Nuclear Plant

Prepared for

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Milwaukee, Wisconsin

Prepared by

EA Engineering, Science, and Technology
444 Lake Cook Road, Suite 18
Deerfield, IL 60015

Rich Monzingo 8/5/07

Dr. Richard Monzingo
Project Manager
Date

Joe Vondruska 8/5/2007

Joe Vondruska
Project Director
Date

August 2007 *13976.05*

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1. INTRODUCTION

Forward: On January 25, 2007 the U.S. Court of Appeals for the Second Court issued its decision in the litigation over the Phase II 316(b) rules. The court's decision remanded several provisions of the rules. With so many provisions of the Phase II rule affected by the decision, the EPA issued an internal Memorandum on March 20, 2007 stating that the rule should be considered suspended. The EPA Administrator signed a final rule officially suspending the Phase II rule on July 2, 2007 (72 Fed. Reg. 37107, July 9, 2007). The scope of this study was established long before the Court's decision and EPA's action. Therefore, the way the information and findings are presented in this report reflect the requirements of the Phase II 316(b) rule as finalized on July 9, 2004.

The U.S. Environmental Protection Agency's (EPA) Phase II 316(b) rule is applicable to the cooling water intake structure (CWIS) at Point Beach Nuclear Plant (69 Fed. Reg. 41576, July 9, 2004). The rule requires application of Best Technology Available (BTA) to meet performance standards for reducing impingement mortality, and where applicable, entrainment at affected facilities. Applicable performance standards are determined based on waterbody type, generating capacity utilization rate, and/or ratio of water withdrawal to mean annual flow (rivers and streams).

The Point Beach Nuclear Plant (PBNP) is located in Wisconsin on the shore of Lake Michigan. Facilities that withdraw cooling water from the Great Lakes are subject to both the impingement and entrainment performance standards if the capacity utilization rate is greater than 15 percent, as is the case for PBNP.[1] Performance standards include an 80 to 95 percent reduction in impingement and 60 to 90 percent reduction in entrainment losses from a "baseline calculation", as required under the Phase II rule that was issued June 2004. The "baseline calculation" can be determined from existing data or data from new studies.

The rule specifies that a Comprehensive Demonstration Study (CDS) be conducted at facilities that have not met applicable performance standards, the results of which are to be submitted to the Bureau of Watershed Management, Wisconsin Department of Natural Resources (WDNR). The National Pollutant Discharge Elimination System (NPDES), referred to as the Wisconsin Pollutant Discharge Elimination System or WPDES in Wisconsin, requires that the CDS for PBNP be submitted by December 31, 2007. This report provides results of an impingement mortality and entrainment characterization study (IMECS), which was conducted at PBNP from December 2005 through November 2006.

The IMECS was conducted in accordance with the sampling plan outlined in We Energies' Proposal for Information Collection (PIC) submitted to the WDNR in December 2004 (ENSR 2004). The WDNR provided comments to the PIC and We Energies revised the sampling plan accordingly and resubmitted the finalized sampling plan to the WDNR (Hellman 2005).

[1] See 40 CFR 125.94(b).

The Phase II 316(b) rule requires that the IMECS characterize fish and shellfish susceptible to entrainment and impingement "in the vicinity" of the CWIS and must include:

- Taxonomic identification of fish and shellfish and their life stages;
- Description of abundance and temporal/spatial characteristics of these organisms;
- Characterization of annual, seasonal, and diel variations (e.g., related to climate/weather differences, spawning, feeding and water column migration);
- Documentation of current entrainment and impingement of all life stages of fish and shellfish at the facility; and
- Identification of Federal and/or State protected species entrained or impinged at the facility.

1.1 STUDY OBJECTIVES

We Energies contracted EA Engineering, Science, and Technology (EA) to perform the IMECS for PBNP, which included this one-year field study that was conducted from December 2005 through November 2006. The overall objective of the IMECS was to develop entrainment and impingement "calculation baseline" estimates assuming that the CWIS fits the definition of a baseline facility, which the EPA defined as a:

- CWIS that was designed as a once-through cooling system;
- The intake structure opening is located at, and the face of the standard 3/8-inch mesh traveling screens are oriented parallel to the shoreline near the surface of the source waterbody; and
- Current operational practices, procedures, and structural configuration at the facility are those that are maintained without structural or operational controls for the purpose of reducing impingement mortality and/or entrainment losses.

The CWIS for the PBNP does not fit the definition of a baseline intake because of its offshore location and implementation of measures to reduce impingement losses (ENSR 2004). The offshore intake is nearly 2,000 feet offshore and the structure was recently modified so that the intake "crib" is submerged ~11.5 feet below the water surface in an effort to reduce impingement of alewife that have congregated around the intake structure. In addition, a high-frequency acoustic deterrence system is seasonally deployed and has been optimized to deter alewife, the species most commonly impinged at PBNP. Specific objectives of the IMECS follow.

1.1.1 Entrainment

The following objectives were established for monitoring entrainment and ambient abundance of shellfish and ichthyoplankton in the vicinity of the CWIS:

1. Determine the density of shellfish and ichthyoplankton currently being entrained through the existing offshore intake structure;

2. Determine the density of shellfish and ichthyoplankton along three depth contours to provide a perspective on shellfish and ichthyoplankton densities at various locations near the CWIS;

3. Characterize and quantify the difference in entrainment rates that could occur at various locations in the vicinity of PBNP (e.g., diel variations related to climate and weather differences, spawning, feeding, and water column migration) through the use of the newly collected data and historical data from relevant studies; and

4. Evaluate the performance of the existing offshore intake comparative to entrainment expected at an onshore baseline intake relative to the entrainment performance standard (60 to 90 percent reduction).

1.1.2 Impingement

The objectives of the impingement monitoring study were to:

1. Determine the number of shellfish and fish that are currently impinged at the PBNP intake;

2. Evaluate the effectiveness of the existing offshore intake comparative to impingement expected at an onshore baseline intake relative to meeting the impingement performance standard (80 to 95 percent reduction); and

3. Evaluate historic impingement data collected at PBNP and/or other relevant studies and utilize these data to assist in developing the impingement baseline calculation.

1.2 SITE DESCRIPTION

PBNP is located on the western shore of Lake Michigan about 80 miles north of Milwaukee in Manitowoc County, Wisconsin (Figure 1-1). The plant has two steam generating reactor units rated to generate about 1,050 megawatts (MW). Once-through cooling water is withdrawn from Lake Michigan through an intake crib that is 1,750 feet offshore in about 22 feet of water (Figure 1-2). The intake crib has a 110-ft outside diameter and consists of two annular rings of steel piles driven into the lakebed, with the annulus filled with limestone blocks (Figure 1-3). Water is drawn through the limestone

blocks and concrete encased 30-in corrugated galvanized steel pipes (Figure 1-4 and Figure 1-5). Water flows from the intake to the pumphouse through two 14-ft diameter, corrugated galvanized structural steel pipes buried beneath the lakebed (Figure 1-6).

The total design capacity of the cooling water pumps is 1,008 MGD. Water passes through vertical bar racks (3/8-in by 4-in, with 2¼-in spacing on center) in the onshore forebay and eight traveling bar screens (3/8-in mesh, 11 feet wide) at the pumphouse (Figure 1-7 and Figure 1-8). The traveling screens use an 80 psi screen wash that discharges to the lake via a return trough.

Fish and debris removed from the traveling screens are returned to Lake Michigan via a 24-in pipe to the Unit 2 discharge flume. Warm water can be recirculated to the intake crib to minimize ice build-up during the winter. The intake crib extended above the lake surface prior to 2001 so that cooling water was drawn into the crib from the entire water column (Figure 1-9 and 1-10). This design was re-evaluated due to episodes of cormorant impingement. In addition, under certain wind conditions, the PBNP thermal discharge plume that floats on the lake surface would occasionally encounter the intake crib. This movement of warm water around the intake is believed to have resulted in significant impingement events due to the attraction of alewife to the thermal plume. In 2001, such an event forced plant outages. To address both cormorant and thermal recirculation concerns, the intake crib was cut down so that it is submerged about 11.5 ft below the lake surface. The altered intake crib contains three concrete conduits through its wall and continues to draw water through the blocks of the wall. The top of the crib is now covered by a "super-plastic" grating designed to exclude debris from the crib.

Approach velocities in the vicinity of the crib have been measured has high as 2.0 ft/sec, but most velocities are much lower (Bootsma 2001). Based on the measured velocities, it has been estimated that approximately one-half of the intake flow occurs through the cap with the other half through the walls of the intake crib.

In addition to changing the configuration of the crib, the intake was outfitted with an acoustic deterrent system intended to reduce impingement of alewife. The sound frequency (125 kHz) of the system has been shown to be effective at deterring alewife at a CWIS located on Lake Ontario (Ross et al. 1993).

The following sections provide a description of the study methods (Section 2), the IMECS results (Section 3), which provide the basis for development of the entrainment and impingement baseline calculation estimates for PBNP (Section 4).

2. METHODS

The impingement mortality and entrainment characterization study (IMECS) for We Energies' Point Beach Nuclear Plant (PBNP) was conducted from December 2005 through November 2006 consistent with the sampling plan provided in the proposal for information collection (PIC) submitted to the WDNR (ENSR 2004) and the revised sampling plan addressing the WDNR's comments/concerns regarding the PIC (Hellman 2005).

The following sections provide details for the entrainment (Section 2.1) and impingement (Section 2.2) field studies including sampling frequency and duration, sample collection and processing procedures, data management procedures, and quality assurance/quality control (QA/QC) measures.

2.1 ENTRAINMENT CHARACTERIZATION

2.1.1 Sample Collection

Entrainment sampling at PBNP was conducted in the intake forebay weekly from mid-April through September 2006 (Table 2-1). The sampling events were segregated into six-hour intervals (0000-0600, 0600-1200, 1200-1800, and 1800-0000 hours) over each 24-hour sampling event. Based upon the assumption that water (and therefore ichthyoplankton and macroinvertebrates) were well mixed due to turbulence in the forebay, entrainment collections were collected at one depth with an electric powered Marlow Trash Hog II pump (model Number 3DTH23EL) rated at about 240 gpm. During each of the four sampling periods, entrainment samples were collected from the southwest corner of the intake forebay at mid-depth.

The pump discharged into a half-meter plankton net with 335-micron mesh that was partially submerged in a 200-gallon nalgene tank to minimize turbulence and possible damage to collected organisms. A schematic of the pumps, hoses, and net assembly is shown in Figure 2-1. Not shown on the schematic is the use of a scaffold, which enabled the collection pump to be located adjacent to the top of the forebay wall. Figures 2-2 show photographs of the entrainment sampling equipment set up on the scaffold along side the intake forebay. The target sample volume was 100 m^3 (26,417 gals), which took approximately two hours. A Signet 8150 Flow Totalizer with an integral paddlewheel flow sensor was installed in the three-inch discharge hose to measure the volume of water sampled by the pump. When the target or higher water volume was reached, the pump was turned off and the net was carefully washed down to concentrate the sample in the collection container. The sample was removed and transferred to a labeled jar(s) containing 10 percent buffered formalin and rose bengal. After the system was returned to sample collection status and the flow meter returned to zero, the pump was ready for the next collection. During each sample, water temperature was measured using a Model 556 YSI meter by inserting the probe in the nalgene tank. Entrainment sampling during the week of 2 July could not be conducted due to the unavailability of PBNP support staff, however a makeup sample was made the following week. The entrainment

sampling program yielded a total of 96 samples (one depth x four diel sampling periods per event x 24 sampling events).

The offshore ambient sampling program for ichthyoplankton and shellfish in the vicinity of PBNP was conducted at three depth contours to represent near plant and intake conditions. Sampling was collected at the three locations from mid-April through September 2006 to establish seasonal species composition and abundance. Samples were collected by towing two one-meter diameter plankton nets equipped with 335 μm Nitex netting and recording flow meters (General Oceanics Model 2030R). The nets were towed at a speed and duration (~2.5 minutes) to sample approximately 100 m^3 of source water per sample.

The ambient samples were collected in non-thermally influenced areas located outside the PBNP excursion zone, which was marked with buoys from May through September. The samples were taken along transects positioned either north or south of the plant depending on the prevailing winds, which influence the position of the buoyant plume formed by the PBNP discharge. The three ambient sampling locations were the:

- 6 to 8-ft Depth Contour—this nearshore location was established in non-thermally influenced areas where mid-depth samples were collected (Figure 2-3). Data collected at this location were used to estimate the "calculation baseline" that reflected densities of organisms near a hypothetical shoreline intake structure with a surface withdrawal.

- 18-ft Depth Contour— is approximate to the depth contour of the current CWIS. This sampling location was established in non-thermally influenced areas (Figure 2-3). Samples were collected from three depths (surface, mid-depth, and near bottom) within the 18-ft. contour sampling zone. Data from this location were used to estimate the ichthyoplankton and shellfish densities near the CWIS.

- 30-ft Depth Contour—this offshore location was also established in a non-thermally influenced area (Figure 2-3). Samples from this contour were also collected from three depths (surface, mid-depth, and near bottom). Data from this location were used to estimate the shellfish and ichthyoplankton densities at a hypothetical location for a relocated offshore intake.

Ambient samples were collected after dawn (day-time) and after sunset (night-time) in order to establish diel patterns. Duplicate towed net samples were collected during the two sampling periods at each location and each depth yielding 28 samples/sampling event Ambient sampling was conducted every two weeks from mid-April through May 2006 and August through September 2006. Weekly sampling was conducted during June and July. The ambient sampling program yielded a total of 448 samples (28 samples per sampling event x 16 sampling events).

The volume of water filtered for each sample, water temperature, and dissolved oxygen (DO) was recorded at each ambient sampling location and depth. Weather observations

were also noted at the beginning of each sampling period, as well as significant changes (e.g., rapid rise/fall in air temperatures, change in wind direction and thunderstorms) that occurred during the sampling events.

Operating conditions during each study were supplied by We Energies. These included intake and discharge water temperature, number and duration of pumps operating, and cooling/circulating water (CW) volume pumped by hour for each sampling event, as well as daily, weekly, and monthly CW volume totals. CW volume data were used to extrapolate entrainment sample densities to total entrainment estimates based on per unit volume of CW pumped.

2.1.2 Sample Processing

Upon arrival in the laboratory, all samples were logged on a sample control sheet. Prior to processing, the samples were rinsed through a 335 μm mesh sieve to remove excess detritus and formalin. The rinsed samples were then sorted for shellfish and ichthyoplankton with the aid of an illuminated magnifier and placed in labeled vials. Five percent of the samples were resorted for quality assurance purposes.

The sorted shellfish, larval fish, and fish eggs were enumerated and identified with the aid of dissecting microscopes equipped with polarizing lenses. Characters used to describe early life stages of fishes are qualitative, rather subjective, and change as early development progresses (e.g., pigmentation patterns). Quantitative characters such as myomere counts often show considerable overlap among species and can vary geographically and temporally for a given species (Bosley and Connor 1984). Thus, identifications for this study were made to the lowest practical taxon, which for larval fish, sometimes was to the species level, but often to the genus level (e.g., *Lepomis* or *Coregonus* cannot typically be separated to species), and occasionally higher levels (e.g., family). On occasion, "type" identifications were made where the characters of a specimen agreed with the taxon to which it was assigned, but the taxonomist could not be 100 percent certain that it in fact it was that taxon. Thus, a "type" designation may not be the taxon indicated, but rather a taxon that shares many of the same larval characteristics with that taxon. Fish eggs typically cannot be identified to species or genus, but attempts were made to provide at least family level egg identifications.

Ichthyoplankton identifications were made using applicable references and taxonomic keys (e.g., Auer 1982, Wallus et al. 1990, Kay et al. 1994, Simon and Wallus 2004, and Wallus and Simon 2006). Life stages of fish were categorized as egg, yolk-sac larvae, post yolk-sac larvae, and juveniles. A voucher series was compiled and verified by noted ichthyoplankton expert and author Robert Wallus. USEPA did not define "shellfish" in the Phase II rule. The term is usually understood to include organisms used for human consumption such as shrimp, crayfish, and clams. Although it is expected that the term will be better defined in the future, for the purpose of this study, "shellfish" included crayfish and the amphipods *Diporeia, Gammarus,* and *Hyalella azteca*, and the zooplankter *Mysis*. Invertebrate taxonomic keys included Balcer et al. (1984), Page (1995), and Smith (2001).

2.1.3 Data Management

Field and laboratory data for each entrainment and ambient sample were recorded on forms compatible for computer entry and all data processing activities were recorded on a log sheet for each batch of data. Following serialization, diga-coding, and QA/QC checks, the data were manually entered into an Excel® spreadsheet. All (i.e., 100 percent) of the manually entered data were then compared against the hardcopy field and laboratory data forms. Errors were corrected and the data were subsequently managed in a SAS format (Version 8.2).

Appendix A provides the raw entrainment and ambient monitoring data listings by sampling event for the April through September 2006 entrainment characterization study period.

2.1.4 Cooling Water Volume and Temperature

Cooling water volumes as well as intake and discharge water temperatures provided by We Energies were summed on a per-sample event and per-week (i.e., Sunday through Saturday) basis. Mean, minimum, and maximum water temperatures were calculated for each sampling period.

2.1.5 Entrainment Estimates

Tabular results were prepared that provided the number of each taxon collected during each entrainment sampling event. These daily results (expressed as the number of organisms per 1,000 m^3) were expanded based on circulating water flow to yield weekly estimates, which when summed, yielded annual entrainment estimates by taxa and life stage.

The weekly entrainment estimates were calculated using the following formula:

$$\text{Weekly Estimate} = \frac{\text{Number Collected}}{\text{Sample Volume}} \times \text{Weekly Cooling Water Volume}$$

The entrainment extrapolations were based on data summarized in Appendix A and were subsequently converted to number of organisms per million gallons of cooling water use. These density data were then multiplied by weekly cooling water flows (Table 2-1) to yield estimates of the number of organisms entrained at PBNP over the course of the study (i.e., the study estimate).

Data from the three ambient sampling locations were converted to the number of shellfish and ichthyoplankton per 1,000 m^3 of water filtered and statistically tested for location differences. The nearshore densities were used to estimate the "calculation baseline", which assumed the intake was positioned on the shoreline and met the EPA definition of a baseline intake. Comparisons between the entrainment and ambient results were only

made when entrainment and ambient samples were collected concurrently. On two sample weeks in May, although entrainment samples were collected either the day or the night ambient samples could not be collected. During the week of July 2, although ambient samples were taken entrainment samples could not be collected.

2.2 IMPINGEMENT MONITORING

The impingement study at PBNP focused on fish and shellfish. Targeted shellfish included crayfish and native freshwater mussels were processed if encountered; however invasive taxa such as *Corbicula* (Asiatic clam) and *Dreissena* (zebra and quagga mussels) were excluded. The Great Lakes crayfish was the only "shellfish" species collected during the 2005-06 impingement study.

2.2.1 Sampling Duration and Frequency

Impingement sampling was conducted at the PBNP pumphouse from 7-8 December 2005 through 29-30 November 2006 (Table 2-2). Sampling was conducted weekly from December 2005 through 11 May 2006 and twice weekly from 15-16 May 2006 through November 2006. The twice weekly sampling events were separated by at least 48-hours within any given week. Impingement sampling on 7-13 May and 7-10 June were conducted over a shortened time period due to facility activities. Impingement sampling on 3-4 July was shortened and the 5-6 July sample could not be conducted due to the unavailability of PBNP support staff. The outlined sampling program yielded a total of 80 sampling events that averaged 22.2 hours in duration (range = 3.3 to 24.4 hrs.) during the 12-month study.

2.2.2 Sample Collection and Processing

Operations personnel were responsible for rotating and washing the traveling water screens prior to each sampling event to assure that only those fish impinged during the sampling period were collected. Also, because the screens are operated automatically based on differential pressure, coordination with operations was necessary so that the screens were cleaned as needed, especially when the fish/debris loading was insufficient to trigger automatic operation of the screens. At a minimum, so that specimens could be processed by both shifts, the screens were run and the trash basket emptied at 12 hours into the sample period and at the end of the sample period. The sampling crews stayed on-site throughout each 24-hr. sampling event to ensure that the collection basket was properly deployed and retrieved, and to verify that the collection basket did not overflow.

For each sampling period, debris (including fish and shellfish) was washed from the upstream side of the screens into a common debris return trough. Impinged fish and shellfish were collected with a collection basket equipped with 3/8-in. square mesh basket that was placed where the screen wash discharges to a 24-inch pipe leading to the Unit 2 discharge flume (Figure 2-3).

Impinged organisms were classified as alive or dead upon examination and identified to the lowest possible taxonomic level, typically to species. Specimens determined to be dead at least 24 hours prior to impingement (e.g., those exhibiting advanced decomposition, missing scales and eyes, clouded eyes, pale/bleached gills, and excessive fungus relative to other fish in the sample) were tallied but were not further processed. Up to 50 randomly selected individuals per species that were classified as alive or fresh dead were individually weighed (in grams) and measured (total length in mm). When more than 50 individuals occurred in a sample, the remaining individuals were counted and batch weighed. Alewife impingement rates routinely required the use of the plus count/ batch weight procedure. Other species that were infrequently processed as batches (i.e., >50 individuals per sample) were gizzard shad, spottail shiner, rainbow smelt, white sucker, ninespine stickleback, yellow perch and mottled sculpin.

On those occasions when numbers and/or debris loads were excessive, a maximum of 20 representative gallons of specimens and debris were removed, sorted, and the specimens processed as discussed above. The volume (in gallons) of the unprocessed portion was measured, recorded, and examined for species or sizes of species not encountered within the processed 20 gallons. If such a species or specimen was encountered, it was processed as described above and noted as "do not extrapolate" on the data sheet. In order to account for specimens within the unprocessed portion of a sample, a multiplication factor was calculated by dividing the total gallons of a sample by the gallons processed. This factor was applied to all specimens processed within the 20-gallon subsample. For example, if it was determined that there is a total count of 324 alewife in the first 20 gallons of a sample that required subsampling and there are 80 gallons of fish and debris remaining, then the multiplication factor would be 80 divided by 20 to yield 4. Therefore, the extrapolated number of alewife was 324 multiplied by 4 to yield 1296 alewife impinged during this sample period. For this example, batch weights would also be multiplied by 4 to obtain total weight (biomass). This sub-sampling procedure was required eight times during the one-year study when the estimated numbers ranged from 26,441 to 215,303 (Table 2-3).

All fish and shellfish impinged during each sampling event were typically processed on site; however, specimens that could not be positively identified were returned to EA's Deerfield, Illinois laboratory for identification and processing. Deteriorated or damaged fish were identified to the lowest possible taxonomic level. A voucher collection of preserved specimens that were positively identified by an experienced taxonomist was compiled. The collection included unusual or taxonomically difficult species.

Data collection was coordinated with plant Operations staff to obtain cooling water flow and temperatures (mean, maximum, and minimum intake temperatures) encountered during each sampling period.

2.2.3 Data Management

Field and laboratory data for each 24 hour impingement sample were recorded on forms compatible for computer entry and all data processing activities were recorded on a log

sheet for each batch of data. Following serialization, diga-coding, and QA/QC checks, the data were manually entered into an Excel® spreadsheet. All (i.e., 100 percent) of the manually entered data were then compared against the hardcopy field and laboratory data forms. All errors encountered were then corrected and the data managed in a SAS format (Version 8.2).

Impingement data were normalized to a 24-hour sample. Data extrapolations and calculations were conducted to account for unmeasured (i.e., plus-counted) fish for generating length frequency distribution data for all fish occurring in any given sample. Plus-counted fish were distributed equally among the representative individually measured fish by first assigning a length count of one to all measured fish in a given sample. Second, all plus-counted fish were distributed equally among the representative individually measured fish on a sample-specific and species-specific basis, by dividing the plus-counted fish by the number of fish measured to yield a "length count adjustment factor". Third, the "length count adjustment factor" was then added to the length count to yield an "extrapolated length count". The resultant length distributions were subsequently expanded based on the impingement extrapolations to provide annual and monthly distributions for the most commonly impinged species.

Appendix B provides a raw data listing by sampling event. The number, biomass, and relative abundance of shellfish and fish collected during each impingement sampling event are summarized in Appendix C.

2.2.4 Cooling Water Volume and Temperature

Circulating water volumes and intake water temperatures provided by We Energies were summed on a per-sample event basis. Mean, minimum, and maximum water temperatures were calculated for each sampling period.

2.2.5 Impingement Estimates

Tabular results were prepared that provided the number and weight of each taxon collected during each 24-hr impingement sampling event (Appendix C). These daily results were expanded based on circulating water (CW) flow to yield three-day, four-day, or seven-day estimates that depended on the sampling schedule, which when summed, yielded annual impingement estimates by species. The species-specific impingement estimates, both by number and by weight, were calculated using the following formula:

$$\text{Estimate (3, 4, or 7 day)} = \frac{\text{Number or Weight (Biomass) Collected}}{\text{CW Volume Sampled}} \times CW \text{ Volume}$$

The number and biomass extrapolations were based on the data summarized in Appendix C and were subsequently converted to catch per unit effort (CPE) or number/biomass impinged per million gallons of CW use (Appendix D). These CPE data were then multiplied by the appropriate 3, 4, or 7 day CW flows (Table 2-2) to yield estimates of

the number and biomass of impinged organisms at PBNP over the course of the study (Appendix D).

2.3 QUALITY ASSURANCE/QUALITY CONTROL

A standard operating procedure (SOP) was prepared for PBNP IMECS that included the following elements:

- Personnel;
- Mobilization procedures;
- Site security and safety procedures;
- Equipment and calibration procedures;
- Field collection procedures;
- Sample handling and labeling procedures;
- Sample sorting procedures;
- Sample identification procedures;
- Data management and analysis; and
- Report preparation.

Project specific QC activities included:

- Training – Staff who collected and processed samples were adequately trained for their tasks. This included familiarization with and adherence to the SOP/Study Plan and any additional aspects that were required (e.g., equipment operation, processing/identification, site security and safety procedures);

- Equipment – All equipment used during this study were calibrated and maintained per the EA Quality Control and Procedures Manual or manufacturer's recommendations. Calibrations were appropriately documented;

- Laboratory – All samples were recorded on project-specific sample control sheets. Staff conducting identification of specimens had access to relevant taxonomic literature and a reference collection. A voucher collection of rare or unusual specimens was maintained with verification by a taxonomic expert; and

- Technical Assessments – An experienced senior staff member accompanied field personnel during the first sampling event to observe sampling activities and to verify that the SOP/Study Plan was being followed properly. In addition, senior staff observed initial laboratory and data management activities to verify the same. Variances from approved procedures were corrected. Prior to the first scheduled sampling, a readiness review was conducted to ensure that trained personnel, required equipment, and procedural controls (e.g., SOP/Study Plan) were in place. Two technical audits were conducted during the course of the study and covered all appropriate aspects of the SOP/Study Plan.

3. RESULTS

3.1 ENTRAINMENT CHARACTERIZATION

3.1.1 Plant Operations

3.1.1.1 Generation

PBNP operated at capacity throughout the 24-week entrainment characterization study that was conducted from 19 April through 28 September 2006 (Table 3-1). Both units were online and essentially operated at 100 percent capacity during all entrainment sampling events.

3.1.1.2 Cooling Water Flow

PBNP is equipped with four circulating water pumps to operate the facility's once-through cooling system. All four pumps were in service throughout 22 of the 24 sampling events (Table 3-2). During the other two sampling events, the number of pumps in service ranged from three to four (19-20 April) and two to four pumps (3-4 May). Pumping rates were uniform and at rated capacity throughout all but those two sampling events. Average cooling water flows during the sampling events ranged from 806 MGD (82 percent of capacity) during the 3-4 May sampling event to 979 MGD during 22 sampling events (Table 3-2).

3.1.1.3 Water Temperatures

Entrainment Sampling

Daily minimum and maximum intake temperatures recorded at the PBNP intake during the entrainment study ranged from 42.9 degrees Fahrenheit (°F) during the 10-11 May sampling event to 74.3°F during the 30-31 August sampling event (Table 3-3). Average temperatures ranged from 43.9°F to 70.3°F. Intake temperatures exhibited normal seasonal patterns with gradually increasing temperatures from April through August and then a sharp decline through September (Table 3-3). Although differences in intake temperatures between weekly sampling events typically averaged less than ±5°F, intake temperatures between sampling events did increase by more than 5°F on five occasions (5.9 to 11.8°F) and decreased by more than 5°F on five occasions (5.8 to 15.0°F) (Table 3-3). Temperature changes between weekly sampling events greater than 5°F occurred routinely from mid-June through July and the greatest change occurred in September (Figure 3-1). Rapidly declining water temperatures in September likely represented the affect of fall turnover.

Diel differences were also evident based on the range of intake temperatures recorded during each sampling event. Water temperatures during sampling events varied by 1.0°F to 13.8°F, and averaged 5.1°F (Table 3-3).

Daily minimum and maximum discharge temperatures recorded during the entrainment sampling events ranged from 61.5°F during the 10-11 May sampling event to 93.9°F during the 30-31 August sampling event (Table 3-3). Daily average discharge temperatures ranged from 62.8°F to 90.6°F. Discharge temperatures followed the same seasonal pattern exhibited by the intake temperatures, but ranged from 18.2°F to 24.2°F higher and averaged 19.5°F higher (Table 3-3; Figure 3-1). The median difference between intake and discharge temperatures was 19.2°F during the 24-week study.

Ambient Sampling

Water temperature and dissolved oxygen readings at surface, mid-, and near bottom depths were recorded during day- and night-time sampling events at the three depth contours (Table 3-4). Only mid-depth readings were taken at the 6 to 8-ft. contour. Differences between the day and night water temperatures averaged <1°F at all depths except at the 18-ft contour where the surface day-time temperatures averaged 1.4°F higher (Table 3-5). Average mid-depth temperatures during both day- and night-time sampling events were highest at the 6 to 8-ft contour, but were similar to the surface means at the 18-ft contour. Vertical differences were apparent at the 18-ft and 30-ft contours where surface temperatures averaged 1.7 to 2.7°F warmer than the mid-depth temperatures and 2.8 to 4.6°F warmer than the bottom temperatures. Overall, the water temperatures at the three depth contours followed similar seasonal patterns. The largest differences among the three contours occurred during the 21-22 June and 19 July sampling events (Table 3-4). Overall, the day-time temperatures at the 6 to 8-ft contour were higher than at the offshore contours from mid-June through 19 July.

Dissolved oxygen (DO) concentrations (mg/L) recorded during the ambient sampling events exceeded 8.0 mg/L throughout the study (Table 3-6), which is well above the 6.0 mg/L quality standard for Lake Michigan. Mean DO readings were similar between day- and night-time periods and among the mid-depth readings at the three depth contours. Mean DO increased slightly with depth at the 18-ft and 30-ft contours. Diel and depth differences among depth contours were greatest during the 19-20 April, 24-25 May, and the 12-13 July sampling events, generally reflecting higher day-time DO concentrations at all three depths (Table 3-4). Surface concentrations were most similar between the 18-ft and 30-ft contours from August through September and bottom DO concentrations were similar during all sampling events except during the 19-20 April event.

3.1.2 Entrainment and Ambient Results

Entrainment samples were collected weekly from the PBNP intake forebay with a pump system and offshore ambient samples were collected with paired plankton nets deployed along three depth contours (see Section 2.1 for details). The following sections discuss results from the entrainment and ambient sampling events and compare differences between the two programs in species composition, relative abundance, spatial and seasonal distributions.

3.1.2.1 Species Composition and Relative Abundance

A total of 37,975 "shellfish" and 127 ichthyoplankton specimens representing 15 distinct taxa and five life stages (egg, yolk-sac, post yolk-sac, larvae, and juveniles) occurred in the entrainment samples that were collected concurrently with the ambient offshore samples (Table 3-6). "Shellfish" in the entrainment samples included the amphipods *Gammarus* and *Hyalella azteca*. The majority of *Gammarus* (88 percent) occurred in the entrainment samples. The Wisconsin DNR expressed an interest in the entrainment of the zooplankter *Mysis and Diporeia*, another amphipod that the DNR considers to possibly represent "shellfish" under the Phase II 316(b) rule; however, shellfish is not defined in the rule and the term has generally been assumed to apply to commercial species such as oysters and shrimp. No *Diporeia* and only 4 *Mysis* were collected during this study. Although We Energies agreed to analyze the samples for amphipods and other shellfish (e.g., crayfish and freshwater native mussels), the results indicate that the species of interest to the DNR were absent or nearly absent, this may represent documented population declines in Lake Michigan, especially for *Diporeia* (see Section 4.1). The high occurrence of *Gammarus* in the entrainment samples may represent colonization on the offshore intake crib and/or the intake forebay because of the availability of rocky substrates at those locations.

A total of 37 ichthyoplankton taxa/life stage groups were encountered in the concurrent entrainment and ambient samples, of which 19 occurred in the entrainment samples (Table 3-6). The most abundant ichthyoplankton taxa in the entrainment samples were rainbow smelt (62 percent of total), followed by alewife type eggs (18.1 percent), unidentified eggs (4.7 percent), juvenile alewife (3.2 percent), and unidentified stickleback (2.4 percent) and unidentified Coregoninae (1.6 percent). All other taxa/life stage groups accounted for <1.0 percent of the ichthyoplankton occurring in the entrainment samples. In contrast to the entrainment samples, the offshore contour samples contained 22 to 27 taxa/life stage groups and more than 10 times the number of organisms was collected (Table 3-6). The 18-ft contour samples had the most taxa/life stage groups (27) and more larvae were collected at the 6 to 8-ft contour location. Mean total nearshore densities declined from 191.6 per 1,000 m^3 to 47.5 per 1,000 m^3 offshore at the 30-ft contour.

The relative abundance of ichthyoplankton in samples from the three ambient locations varied widely among each other and with the entrainment samples:

		Relative Abundance (%)			
			Ambient Contour Locations		
Taxa	Life Stage	Entrainment	6 to 8-ft	18 ft	30 ft
Clupeidae	Yolk-sac	--	6.7	11.6	4.9
Alosa	Yolk-sac	--	4.2	16.5	5.6
Yellow perch	Yolk-sac	--	1.0	11.0	16.9
Stickleback	Post Yolk-sac	--	0.2	2.8	5.0
Rainbow smelt	Mixed	62.2	2.2	21.0	45.7
Alewife type	Egg	18.1	73.7	3.7	--

			Ambient Contour Locations		
Taxa	Life Stage	Entrainment	6 to 8-ft	18 ft	30 ft
Unidentified	Egg	4.7	0.8	0.1	0.6
Alewife	Juvenile	3.1	0.1	--	--
Coregoninae	Yolk	1.6	3.9	13.5	0.8
Stickleback	Mixed	2.4	--	3.6	2.4
Common carp	Yolk-sac	0.8	4.6	1.0	0.6
Burbot	Yolk-sac	0.8	0.1	4.7	9.3
Other Taxa	Mixed	6.3	2.7	10.5	8.3
Totals		100.0	100.0	100.0	100.0

Rainbow smelt (all life stages) accounted for 62.2 percent of the total entrainment sample compared to only 2.2 percent in the 6 to 8-ft contour samples. The relative abundance of rainbow smelt increased at the 18-ft and 30-ft contours to 21.0 and 45.7 percent, respectively. The 6 to 8-ft contour samples were dominated by alewife type eggs (73.7 percent); other taxa accounted for less than seven percent of the total number of ichthyoplankton collected at that location. Relative abundance of taxa in the 18-ft contour samples was more evenly distributed as six taxa/life stage groups accounted for more than 10 percent of the total including rainbow smelt (21.0 percent), yolk-sac larvae of unidentified *Alosa* (16.5 percent) and yolk-sac yellow perch (11.0 percent). Early life stages of yellow perch did not occur in the entrainment samples and the highest yellow perch densities occurred in the 30-ft contour samples where they accounted for 16.9 percent of the total sample (Table 3-6). Rainbow smelt (all life stages combined) accounted for 45.7 percent of the ichthyoplankton in the 30-ft contour samples. The majority of rainbow smelt collected from the 30-ft contour were post yolk-sac larvae, whereas juvenile rainbow smelt were more abundant in the entrainment samples (Table 3-6).

Entrained taxa represented fishes common in Lake Michigan based on historical data collected at PBNP from April 1975 through October 1975 (WEPCO 1976a). A total of 91 fish larvae occurred in the entrainment samples collected in the 1975 study with the same fundamental collection system. The entrainment samples contained 57 rainbow smelt (62.6 percent of the larvae), 17 alewife larvae (18.7 percent), 15 sculpin (16.5 percent), and two longnose sucker (2.2 percent). Alewife eggs (203) were the only fish eggs collected during the 1975 study. The relative abundance of early life stages of rainbow smelt and alewife were similar between studies, although alewife eggs were more abundant in the current study than were larval alewife. Samples from the current study contained more taxa than were reported during the 1975 study, including common carp, burbot, unidentified stickleback, *Lepomis*, and several unidentified taxa groups such as Coregoninae, cyprinids, and catostomids (Table 3-6).

The low number of taxa in the entrainment samples relative to the number of fish species known to occur in Lake Michigan and the number of species (40) impinged on the PBNP traveling screens (Section 3.2.2) is typical of entrainment samples, which reflects differences among species regarding spawning characteristics and larval behavior following hatching that results in variable susceptibility of ichthyoplankton to

entrainment. Historical entrainment studies have demonstrated that it is not unusual to have five to 10 taxa comprise ≥90% of entrainment (EPRI 2005), as was the case in the current study.

Taxonomic identifications were made to the lowest practical level based on qualitative characters that change as early development progresses (e.g., pigmentation patterns) or exhibit considerable overlap among species (e.g., myomere counts) and can vary geographically and temporally for a given species (Bosley and Connor 1984). On occasion "type" identifications were made where the characters of a specimen agreed with the taxon to which it was assigned, but the taxonomist could not be 100 percent certain that it in fact it was that taxon. Thus, a "type" designation may not be the taxon indicated, but rather a taxon that shares many of the same larval characteristics with that taxon. The early life stages identified as *Pimephales* type likely represent fathead minnow which were occasionally impinged at PBNP. Fish eggs typically cannot be identified to species or genus, although eggs were placed in four taxa, including alewife type eggs (Table 3-6).

The concurrent entrainment and ambient ichthyoplankton samples were dominated by fish eggs (31.1 percent of total), yolk-sac larvae (42.3 percent), and post yolk-sac larvae (23.1 percent) that collectively accounted for 96.5 percent the total number collected (Table 3-6). Of the four fish eggs taxa, 94 percent were identified as alewife type eggs; the majority of those eggs occurred in the entrainment samples (Table 3-6).

Yolk-sac larvae of 13 taxa were collected during the study, which accounted for 42.3 percent of the ichthyoplankton in the entrainment and ambient samples. Six taxa accounted for 89 percent of the yolk-sac larvae collected, including rainbow smelt, yellow perch, and burbot (Table 3-6). Yolk-sac larvae densities of all three taxa were most abundant in the 18-ft and 30-ft contour samples and were absent (rainbow smelt and yellow perch) or were collected in low (burbot) numbers in the entrainment samples.

Post yolk-sac larvae of 11 taxa were collected. Post yolk-sac rainbow smelt accounted for 73 percent of the post-yolk-sac larvae collected and were most abundant in the 30-ft contour samples (Table 3-6). The other 10 taxa with post yolk-sac larvae accounted for 10 percent or less of the total number collected. Seven taxa were represented by both yolk-sac and post yolk-sac larvae (unidentified Clupeidae, alewife, unidentified *Alosa*, unidentified Coregoninae, rainbow smelt, unidentified stickleback, and burbot).

Juveniles represented <3.0 percent of the total number of ichthyoplankton collected in the entrainment and ambient samples, which primarily represented juvenile rainbow smelt that occurred in the entrainment samples (Table 3-6). Only juvenile rainbow smelt (87) were represented by more than 10 specimens. The low number of juveniles in both the entrainment and ambient samples likely indicates that larger ichthyoplankton move to habitats that make them less susceptible to entrainment and/or their swimming ability improves as they grow, allowing some avoidance of the intake and/or the sampling gear.

3.1.2.2 Size Distribution

A literature review was conducted to provide the range of egg diameters and larval lengths for 15 taxa that were collected during the 2005-06 study (Table 3-7). Reported egg diameters range from 0.8 mm (rainbow smelt and sunfish species) to 4.5 mm (yellow perch). Alewife eggs are relatively small (0.9 - 1.2 mm), as are rainbow smelt eggs (0.8 – 1.3 mm). Yellow perch eggs are somewhat larger (1.7 – 4.5 mm) and are spawned as gelatinous strands. Lengths of yolk-sac larvae are more variable than egg diameters. Of the 24 taxa listed in Table 3-7, sunfish species yolk-sac larvae are the smallest (2.0 – 5.0 mm) and lake whitefish are the largest (8.8 – 15.0 mm). Yolk-sac larvae develop into post yolk-sac larvae at about 4.0 mm (e.g., alewife and sunfish species) to 15.0 mm (bloater). Post yolk-sac yellow perch are about 8.0 mm. Development of these 24 taxa to juveniles starts at about 8.0 mm (slimy sculpin) to 34 mm (lake whitefish). Alewife juveniles are 19.0 – 32.2 mm and juvenile yellow perch are about 20.0 – 40.0 mm.

These data may be used to evaluate alternative technologies (e.g., slot-size for wedge wire screens or mesh size for filter barriers) for reducing entrainment; however, as will be demonstrated, the offshore location of the PBNP intake results in reduced entrainment relative to EPA's baseline intake that meets the entrainment performance standard of the Phase II 316(b) rule (Section 4.1.2).

3.1.2.3 Depth Distribution

Ambient shellfish and ichthyoplankton samples were collected at mid-depth along the 6 to 8-ft contour and at the surface, mid-depth, and bottom at the 18-ft and 30-ft contours. Results from those samples show that average surface densities of both shellfish and ichthyoplankton were similar between the 18-ft and 30-ft contours (Table 3-8). The amphipod *Gammarus* accounted for nearly 100 percent of the "shellfish", which had similar surface densities at the two contours (66.7 – 69.7 per 1,000 m^3). Average total ichthyoplankton densities were also similar between contours (52.0 – 53.4 per 1000 m^3). Notable differences at the taxa/life stage level between the two offshore contours included higher densities of yolk-sac larvae of unidentified Clupeidae, *Alosa,* and Coregoninae at the 18-ft contour and higher densities of post yolk-sac rainbow smelt and yolk-sac yellow perch at the 30-ft contour (Table 3-8). Of the 28 ichthyoplankton taxa/life stage groups that occurred in the surface samples from both contours, 24 occurred in the 18-ft contour samples and 20 occurred in the 30-ft samples. None of the taxa that occurred only in samples at one or the other contour were abundant.

Mid-depth samples were collected at all three depth contours and, as for the surface samples at the 18-ft and 30-ft contours, the average mid-depth total "shellfish" and ichthyoplankton densities were similar (Table 3-8). Differences at the taxa/life stage level between the mid-depth densities at the 18-ft and 30-ft contours were essentially the same as was observed for the surface samples, although mid-depth yolk-sac yellow perch densities were similar between contours. However, yolk-sac yellow perch densities in the 30-ft contour surface samples were nearly four to five times greater than in the mid-depth samples at the 18-ft and 30-ft contours. Mid-depth densities of "shellfish" and

ichthyoplankton at the 6 to 8-ft contour averaged nearly three- to four-fold greater than the average mid-depth densities at the 18-ft and 30-ft contours (Table 3-8). Those differences largely reflect higher densities of *Gammarus* and alewife type eggs; the latter accounted for 72 percent of the ichthyoplankton in the 6 to 8-ft contour samples. Other taxa with higher densities in the mid-depth nearshore contour samples included yolk-sac larvae of unidentified Clupeidae and common carp. Other taxa/life stage differences between the onshore contour samples and the two offshore contours were generally small, less than ±4 organisms per 1000 m^3. Post yolk-sac rainbow smelt densities were much lower in the nearshore contour than in either the 18-ft or the 30-ft contour. Average densities of unidentified Coregoninae were identical in the 6 to 8-ft and 18-ft contour samples and both were much higher than in the 30-ft contour samples (6.9 vs. 0.4 per 1,000 m^3).

Densities in bottom samples collected from the 18-ft and 30-ft contours were similar, as were densities in the surface and mid-depth samples (Table 3-8). *Gammarus* densities were somewhat higher in the 30-ft contour samples (100.3 vs. 72.4 per 1,000 m^3), whereas total ichthyoplankton densities were nearly identical (51.6 – 53.5 per 1,000 m^3). Of the 26 ichthyoplankton taxa/life stage groups that occurred in the combined bottom samples, 20 and 22 taxa/life stage groups occurred in the 18-ft and 30-ft contour samples, respectively. Nine taxa/life stage groups were more abundant in the 18-ft contour samples, primarily unidentified Clupeidae, *Alosa*, Coregoninae, unidentified catostomid, and yellow perch (Table 3-8). Five taxa/life stage groups were more abundant in the 30-ft contour samples with total rainbow smelt densities (9.3 vs. 29.7 per 1,000 m^3) exhibiting the largest difference between contours.

In summary, the primary difference among densities in samples collected at the three depth contours was higher onshore densities of *Gammarus* and total ichthyoplankton (Figure 3-2), which primarily reflected densities of alewife type eggs. The surface and mid-depth samples at the 18-ft and 30-ft contours were similar, whereas the bottom samples from the 30-ft contour had higher densities of *Gammarus* and the 18-ft samples had slightly higher densities of total ichthyoplankton. Differences between the three contours were primarily due to densities of a few taxa including three unidentified taxa (Clupeidae, *Alosa*, and Coregoninae), rainbow smelt, yellow perch, and slimy sculpin.

3.1.2.4 Onshore-Offshore Distribution

The lateral distribution of *Gammarus* and total ichthyoplankton followed the same trend as the depth distributions because of the similarity in densities among sampling depths. Total ichthyoplankton densities in the 6 to 8-ft contour samples averaged nearly four times higher than in the 18-ft and 30-ft contour samples and nearshore *Gammarus* densities were twice as high (Table 3-9). Higher nearshore densities primarily reflect greater densities of alewife type eggs and unidentified Clupeidae yolk-sac larvae. The most abundant taxa in the 18-ft contour samples were post yolk-sac rainbow smelt, yolk-sac yellow perch, and yolk-sac larvae of three unidentified taxa (*Alosa*, Clupeidae, and Coregoninae). Post yolk-sac rainbow smelt and yolk-sac yellow perch were the most

abundant taxa/life stage group in the 30-ft contour samples, where their densities were higher than in either the 6 to 8-ft contour or the 18-ft contour samples.

3.1.2.5 Seasonal Abundance

Weekly entrainment estimates for *Gammarus* and total ichthyoplankton were low from mid-April through June and peaked in late July and August (Figure 3-3). The majority of ichthyoplankton (74 percent) were entrained from 4 June through 5 August with peak entrainment occurring during the week of 23-29 July when an estimated 4.4 million ichthyoplankton were entrained, representing 41 percent of the annual estimate. Ninety percent of the July peak were rainbow smelt; which accounted for 70 percent of the estimated total entrainment of rainbow smelt, all life stages combined. The amphipod *Gammarus* was entrained throughout the 24-week study, but 75 percent were entrained over a five-week period from early August through early September (Figure 3-3).

The 2006 entrainment study indicated spawning of resident species in the vicinity of PBNP occurs primarily from April through August (Figure 3-3). Only unidentified Coregoninae occurred in the entrainment samples collected the week of 16-22 April and only burbot were entrained the next two weeks, from 23 April through 6 May. Depending on species, coregonids spawn from late fall through early spring (Becker 1983) and burbot is one of the earliest spawning fish species in Lake Michigan that typically spawns before ice-out (University of Wisconsin Sea Grant Program 2006). These early spawning species occurred as yolk-sac larvae only once (unidentified Coregoninae) or twice (burbot) during the 24-week study. Post yolk-sac larvae and juveniles of these two taxa did not occur in the entrainment samples. Following the initial three weeks of the study, ichthyoplankton did not occur in the entrainment samples collected over a four-week period from 7 May through 3 June (Figure 3-3). Several different taxa/life stages occurred sporadically from 11 June through 1 July when estimates remained less than 400,000 ichthyoplankton per week. Entrainment rates increased when alewife type eggs and juvenile rainbow smelt began to be entrained in early July. Alewife type eggs were entrained through the first week of August and juvenile rainbow smelt were entrained from 16-22 July through the completion of the study in late September (Figure 3-4). Rainbow smelt were collected more frequently than any other taxa and occurred in samples from eight of the 24 sampling events, followed by alewife type eggs (four events), juvenile alewife (four events), and unidentified eggs (three events). Seasonal trends for the majority of taxa/life stages collected during this study were difficult to establish as most taxa occurred only once (15 taxa/life stages) or twice (5 taxa/life stages) suggesting they had limited vulnerability to entrainment at PBNP.

3.2 IMPINGEMENT CHARACTERIZATION

3.2.1 Plant Operations

3.2.1.1 Generation

Generation loads during the 12-month impingement study at the PBNP averaged 999 megawatts (MW) or 95 percent of the total rated capacity of the facility (Table 3-10). Both units were online and essentially operated at 100 percent capacity during 69 of the 80 impingement sampling events. Plant loads were at 50 percent when one or the other unit was offline. Unit 1 was offline during the 14-15 December 2005 sampling event and when online, had an average output of 533 MW. Unit 2 was offline for 10 sampling events from mid-October 2006 through mid-November 2006 (Table 3-10). When online, Unit 2 had an average output of 540 MW. Total plant output during the 80 impingement sampling events ranged from 533 MW to 1,085 MW.

3.2.1.2 Cooling Water Flow

PBNP is equipped with four circulating water pumps to operate the facility's once-through cooling system. Cooling water requirements during the 80 impingement sampling events typically required two (22 sampling events) or four pumps (50 sampling events). On two occasions in November 2006 three pumps were in service (Table 3-2). Pumping rates were uniform throughout all but six of the impingement sampling events; pumping rates were variable twice in April and October 2006, once each in May and September 2006 (Table 3-11).

Average cooling water flows during the sampling events ranged from 374 MGD during the 23-24 October 2006 sampling event to 979 MGD during 54 sampling events primarily from mid-March through early October 2006 (Table 3-2). Median pump flows (979 MGD) represented 97 percent of the facility's design maximum pumping rate (1,008 MGD). The lowest flows were associated with unit outages, which occurred once at Unit 1 (December 2005) and 10 times at Unit 2 (mid-October through mid-November 2006).

3.2.1.3 Water Temperatures

Daily minimum and maximum intake temperatures recorded at the PBNP intake during the impingement sampling events ranged from 33.6°F during the 22-23 February 2006 sampling event to 74.3°F during the 30-31 August 2006 sampling event (Table 3-3). Daily average temperatures ranged from 35.0°F to 71.2°F. Intake temperatures exhibited normal seasonal patterns with summer highs and winter lows; however, the average daily temperatures occasionally varied widely between consecutive sampling events. Although weekly differences between average intake temperatures were typically less than ±3°F, intake temperatures did increase or decrease by as much as 15°F across consecutive weekly sampling events. Intake temperatures declined by about 6°F to 15°F on six occasions from July through October when intake temperatures were apparently affected by upwelling or fall turnover (Figure 3-5).

Diel differences were also evident based on the range of intake temperatures recorded during each sampling event. Water temperatures during the 24-hr sampling events varied by 1.0°F to 15.4°F, and averaged 4.9°F (Table 3-12).

Daily minimum and maximum discharge temperatures recorded during the impingement sampling events ranged from 34.9°F during the 14-15 December 2005 sampling event to 93.9°F during the 30-31 August 2006 sampling event (Table 3-12). Daily average temperatures ranged from 50.2°F to 91.0°F. Discharge temperatures followed the same seasonal trend exhibited by the intake temperatures, but ranged from 9.4°F to 33.6°F higher and averaged 20.8°F higher (Table 3-12; Figure 3-5). The median difference between intake and discharge temperatures during the impingement sampling events was 19.2°F.

3.2.2 Impingement Results

3.2.2.1 Species Composition

Impingement samples collected from the PBNP traveling screens from December 2005 through November 2006 included 40 fish species and one crayfish (Table 3-13). The Great Lakes crayfish is a native species associated with the rocky Great Lakes shoreline. The remaining four fish taxa represented unidentified fish and alewife type. For the total species counts genus level identifications (e.g., unid. *Lepomis*) are counted as a "species" only when no species (e.g., bluegill) of that genus were collected.

Of the 17 fish families represented in the impingement samples, 19 of 40 species collected represented three families – minnows (7), salmonids (7), and sunfish (5). The remaining 14 families were represented by three or fewer species and nine were represented by single species – lake sturgeon, rainbow smelt, central mudminnow, trout-perch, burbot, white perch, yellow perch, freshwater drum, round goby (Table 3-13). Thirty native species and 10 introduced/invasive fish species were impinged during the 12-month study. Introduced species were alewife, four trout and salmon species, rainbow smelt, common carp, white perch, threespine stickleback, and round goby. Alewife became a key component of the Lake Michigan fish community after it was established in the 1950s and is the primary forage fish utilized by the introduced salmonids (Madenjian et al. 2006). Additional exotic species that are well established in Lake Michigan include common carp, threespine stickleback, white perch, and round goby. In addition to the salmonids, impinged game fish and food fish species included lake whitefish, bloater, black bullhead, channel catfish, smallmouth bass, bluegill, black crappie, and yellow perch (Table 3-13).

Shellfish or fish species listed as endangered or threatened by the U.S. Fish and Wildlife Service (USFWS 2007) were not collected during the study. A single lake sturgeon, which is listed by the State of Wisconsin as a species of special concern, was collected (WDNR 2007). WDNR regulations for special concern species range from full protection to no protection. Protection for lake sturgeon is regulated through open/closed fishing seasons.

Species composition of samples collected during the current study was generally similar to that encountered during the March 1975 thru February 1976 study (WEPCO 1976a). A total of 32 species and one hybrid was collected in the earlier study compared to 40 species in the current study (Table 3-13). Twenty-seven of the 46 species encountered during impingement sampling at PBNP were common to both studies including alewife, rainbow smelt, spottail shiner, and yellow perch (Table 3-13). Species only encountered in the current study included three exotic species that were either not known to occur in Lake Michigan in the 1970s or occurred in low numbers – white perch, threespine stickleback, and round goby (Lyons et al. 2000). Slightly fewer salmonid species were collected in the current study (7) than in the 1975-76 study (8). In contrast, more sunfish species were collected during the 2005-06 study (6) than in the 1975-76 study (2). Despite similar species compositions, there were greater differences in relative abundance in both numbers and biomass between studies primarily because of higher impingement rates of alewife and lower rates of rainbow smelt in the current study (Section 3.2.2.2).

3.2.2.2 Relative Abundance

A total of 1.6 million fish and crayfish weighing approximately 6,134 kilograms (kg) were collected during the 12-month impingement study at PBNP (Table 3-14). A total of 167 Great Lakes crayfish was collected, representing the only "shellfish" collected during the study. Alewife accounted for over 99 percent of the total impingement and almost 93 percent of the total biomass. Two other forage species, the introduced rainbow smelt and native spottail shiner, ranked second and third numerically, accounting for 9,144 (0.6 percent) and 1,276 (0.1 percent) individuals that collectively weighed approximately 60 kg. Gizzard shad (738) ranked fourth, accounting for <0.1 percent of the total number of fish collected and 0.2 percent of the biomass. Other species represented by more than 100 individuals in the samples were mottled sculpin (627), yellow perch (579), ninespine stickleback (556), threespine stickleback (517), white sucker (198), slimy sculpin (135), and bloater (105). As a group, those eleven species (all forage species except yellow perch, white sucker, and bloater) plus the alewife "type" taxon represented 99.98 percent of the total number of fish collected and 97.71 percent of the total biomass.

The relative abundance of the 10 most common species impinged during the current study was somewhat different than encountered during the 1975-76 study (WEPCO 1976a); primarily reflecting more alewife and fewer rainbow smelt and slimy sculpin in 2005-06:

	2005-06		1975-76	
Species	Number	%	Number	%
Alewife	1,595,015	99.1	265,644	84.8
Rainbow smelt	9,144	0.6	43,416	13.8
Spottail shiner	1,276	0.1	19	<0.1
Gizzard shad	738	<0.1	577	0.2
Mottled sculpin	627	<0.1	0	0.0
Yellow perch	579	<0.1	66	<0.1
Ninespine stickleback	556	<0.1	212	<0.1
Threespine stickleback	517	<0.1	0	0.0

	2005-06		1975-76	
Species	Number	%	Number	%
White sucker	198	<0.1	26	<0.1
Slimy sculpin	135	<0.1	2,927	0.9

Note: Both studies were conducted over a 12-month period using 24 hr. sampling events that totaled 88 in 1975-76 and 80 in 2005-06.

The two most abundant species (alewife and rainbow smelt) accounted for 98.6 to 99.7 percent of the total number collected in each study. Notable differences between studies included both substantial increases and deceases in impingement of five species -- the number of alewife, spottail shiner, and yellow perch collected in the current study was several fold greater compared to the 1975-76 study, whereas the number of rainbow smelt and slimy sculpin was several fold lower in 2005-06.

Alewife biomass was lower during the current study (5,702.6 kg) than in the 1975-76 study (8,115.6 kg) despite the higher number impinged, suggesting that the alewife impinged in 2005-06 were smaller. The differences in biomass between studies for the other common species followed the same trend as did the number collected:

	Current Study		1975-76 Study	
Species	Biomass	%	Biomass	%
Alewife	5,702.6	93.0	8,115.6	94.1
Rainbow smelt	51.4	0.8	236.5	2.7
Spottail shiner	8.4	0.1	0.5	<0.1
Gizzard shad	13.5	0.2	10.8	0.1
Mottled sculpin	3.6	0.1	0.0	0.0
Yellow perch	8.6	0.1	11.4	0.1
Ninespine stickleback	1.3	0.0	4.8	0.1
Threespine stickleback	0.7	0.0	0.0	0.0
White sucker	200.2	3.3	11.0	0.1
Slimy sculpin	0.8	0.0	10.8	0.1

Note: Both studies were conducted over a 12-month period using 24 hr. sampling events. A total of 88 studies were conducted in 1975-76 and 80 in 2005-06.

A total of 698 gamefish and panfish species weighing 61 kg were collected representing <0.1 percent of the total number collected and 1.0 percent of the biomass. Yellow perch was the most abundant sportfish (579 individuals weighing 8.7 kg) accounting for <0.1 percent of the total number and <0.2 percent of the biomass. Thirty-four of the impinged sportfish were introduced salmonids.

Twenty-nine of the 40 fish species impinged during the study were represented by <80 specimens (i.e., < 1 specimen per sampling event) and 20 of those species were represented by fewer than 10 specimens. Eight species/taxa were each represented by a single specimen (Table 3-15). All but two (alewife and rainbow smelt) of the 40 species accounted for <0.5 percent of the total number and all but three (alewife, rainbow smelt, and white sucker) accounted for less than three percent of the total biomass (Table 3-14).

Total biomass rankings were different than the numerical rankings as only the most abundance species (alewife and rainbow smelt) also had high total biomass (Table 3-14).

The biomass of seven species, including white sucker (200.2 kg), burbot (30.7 kg), and freshwater drum (17.5 kg), had high biomass relative to their numerical rankings because of their larger average size compared to the more numerous forage species (Section 3.2.3).

The majority of species collected at PBNP were infrequently impinged during the study. Only eight fish species occurred in more than 50 percent of the sampling events and none of the species were sampled during all 80 sampling events (Table 3-15). The two most abundant species were collected during 62 (alewife) and 67 (rainbow smelt) of the 80 sampling events. Other commonly impinged species that occurred in at least 40 sampling events (50 percent) included mottled sculpin (71) threespine stickleback (50), white sucker (46), spottail shiner (45), and ninespine stickleback (43). Most of the impinged taxa occurred in less than a third of the sampling events. Overall, 29 of the 44 impinged fish taxa occurred in fewer than 16 of the 80 (<20 percent) sampling events and 11 taxa occurred only once or twice during the study.

High occurrence of just a few species also occurred during the 1975-76 study when rainbow smelt, slimy sculpin, alewife, and ninespine stickleback were the only species that occurred in more than 50 percent of the 88 sampling events (Table 3-15). Several differences were apparent for the abundant species that were collected during both studies:

	2005-06		1975-76 Study	
Species	Occurrence (No. Events)	%	Occurrence (No. Events)	%
Alewife	62	78	59	67
Rainbow smelt	67	84	81	92
Spottail shiner	45	56	13	15
Gizzard shad	31	39	29	33
Mottled sculpin	71	89	0	0
Yellow perch	52	65	28	32
Ninespine stickleback	43	54	58	66
White sucker	46	58	15	17
Slimy sculpin	34	43	79	90

Note: Both studies were conducted over a 12-month period using 24 hr. sampling events. A total of 88 studies were conducted in 1975-76 and 80 for the 2005-06.

Species that occurred more frequently during the current study included spottail shiner, mottled sculpin, yellow perch, and white sucker; whereas rainbow smelt and slimy sculpin occurred more frequently during the 1975-76 study. The frequency of occurrence of alewife and gizzard shad was similar between studies.

3.2.2.3 Size Distributions

The majority of organisms impinged at PBNP were primarily small fish representing juveniles of larger species (e.g., salmonids) or juveniles and adults of smaller species (e.g., alewife and rainbow smelt). Measured total lengths of impinged fish ranged from a 29 millimeter (mm) alewife to an 864 mm burbot. Twenty-two species had average total

lengths <100 mm and 10 species had average lengths between 100 mm and 199 mm (Table 3-16). The remaining taxa had average lengths ranging from 225 mm (Chinook salmon and black bullhead) to 433 mm (white sucker). Larger fish primarily represented a few mature fish, including lake sturgeon, burbot, trout and salmon, white sucker, longnose sucker, channel catfish, and freshwater drum.

The following sections provide an overview of the length frequency distributions of species commonly impinged at PBNP during the 12-month study. The length frequency distributions are based on adjustments to the measured fish to account for plus counts and extrapolated to reflect the estimated number of fish impinged on an annual and monthly basis.

Alewife

Alewife with total lengths ranging from 29 mm to 215 mm, representing 16 consecutive 10-mm size classes, were impinged during the study (Tables 3-14 and 3-15). Approximately 91 percent of the alewife were between 60 mm and 109 mm in length with a modal peak between 80 - 99 mm (Table 3-17). Alewife were absent from the traveling screens from December 2005 through March 2006 and were impinged from April 2006 through November 2006 (Table 3-18). This pattern fits the seasonal movement of alewife in Lake Michigan where they spend the winter offshore in deep water and move to the shallow shoreline waters in the spring and "crowd" the shoreline in the summer (Becker 1983). Alewife <100 mm impinged from August through November 2006 represent primarily young-of-year (YOY) from the 2006 year-class or yearling fish from the 2005 year-class (Table 3-18). Recruitment of the 2006 year-class was evident in August when the smallest alewife were impinged. Alewife >100 mm in Lake Michigan primarily represent one-year old or older fish (Madenjian et al. 2006).

Gizzard Shad

Gizzard shad with total lengths ranging from 58 mm to 463 mm, representing 19 consecutive 10-mm size classes were impinged (Tables 3-14 and 3-15). Approximately 78 percent of the impinged gizzard shad were <140 mm and 64 percent were between 90 mm and 119 mm with a modal peak at 100-109 mm (Table 3-17). Adult gizzard shad (>179 mm) were infrequently impinged accounting for only five percent of the impinged gizzard shad. Gizzard shad from the 2006 year-class occurred on the screens from August through November 2006 as represented primarily by fish <110 mm.

Salmonids

Total lengths of impinged salmonids (coregonids, trout, and salmon) ranged from a 37 mm bloater to a 756 mm lake trout (Table 3-16). Mean lengths were shortest for bloater (84 mm) and Coho salmon (93 mm), and longest for brown trout (431 mm) and round whitefish (369 mm). Few mature salmonids were collected; all Coho salmon were <110 mm and all except one Chinook salmon was <180 mm (Table 3-16). Although a few

larger brown trout were impinged, the majority (77 percent) were less than 270 mm. Lake trout were represented primarily by a few larger individuals (17 of 31).

Rainbow Smelt

Total lengths of impinged rainbow smelt ranged from 30 mm to 195 mm and averaged 108 mm (Table 3-16). Fish representing 17 consecutive 10-mm size classes were impinged and fish between 80 mm and 139 mm accounted for approximately 82 percent of the impinged rainbow smelt. Rainbow smelt <90 mm impinged from December 2005 through February 2006 were likely from the 2005 year classes based on growth data from the Great Lakes (Becker 1983). Recruitment of YOY from the 2006 year-class was indicated by the impingement of rainbow smelt <60 mm from August through November 2006 (Table 3-19).

Spottail Shiner

Total lengths of impinged spottail shiner ranged from 47 mm to 130 mm and averaged 91 mm (Table 3-16). Impinged spottail shiners were represented by 10 consecutive 10-mm size classes exhibiting one modal peak at 80-99 mm (Table 3-17). Mature spottail shiner (>69 mm; Becker 1983) represented approximately 98 percent of the impinged spottail shiner.

Yellow Perch

Total lengths of impinged yellow perch ranged from 48 mm to 342 mm and averaged 88 mm (Table 3-16). Impinged yellow perch were represented by 25 size classes exhibiting two distinct size groups, <199 mm and >239 mm (Table 3-17). Fish >239 mm represented adults and accounted for less than three percent of the impinged yellow perch, whereas fish < 120 mm represented YOY and juveniles that accounted for approximately 97 percent of the total number impinged. The majority of yellow perch <70 mm were likely YOY from the 2005 and 2006 year-classes. Fish from the 2005 year-class were impinged from December 2005 through February 2006 and YOY from the 2006 year-class were impinged from late July through November 2006 (Table 3-20).

3.2.2.4 Seasonal Abundance

Estimated impingement at PBNP during the 12-month impingement study ranged from only seven fish during the week of 19-25 March 2006 to 1.8 million fish during a four-day period from 7-10 June 2006 (Figure 3-6). Median and average total impingement (fish and crayfish) for the 80 extrapolation periods was 108,669 and 2,521 organisms, respectively. The majority were fish, as only 707 "shellfish" (i.e., Great Lakes crayfish) were impinged. Approximately 95 percent of the estimated impingement occurred from 23 April through 5 August 2006 (Figure 3-6).

Total impingement estimates mirrored the seasonal impingement of alewife (Figure 3-7), which accounted for more than 99 percent of the total annual impingement and was the

most abundant species during 58 of the 62 sampling events that alewife were collected. Alewife numbers were low on the four occasions when other species (mottled sculpin and white sucker) were more abundant than alewife. Estimated impingement of alewife at PBNP ranged from none during the first 18 weeks of the study, December 2005 through early April 2006, to 1.8 million during a four-day period from 7-10 June 2006 (Figure 3-7). That impingement rate occurred during a period of stable pump flows (Table 3-11) and steady intake and discharge temperatures (Table 3-12). Alewife die offs occur every year in Lake Michigan in the early summer following the spawning season. Alewife is a marine species living in a freshwater system and is easily stressed from temperature changes as well as osmotic stress from living in freshwater. The absence of alewife during the winter and early spring is consistent with their offshore/onshore movements in Lake Michigan (Becker 1983). Median and average alewife impingement per extrapolation period was 2,176 and 107,805, respectively.

Alewife occurred on the screens after intake temperatures reached 45°F and rates remained high through early June when water temperatures averaged approximately 48°F to 52°F (Figure 3-7). Impingement of alewife declined precipitously when water temperatures increased above 55°F from August through early September and increased only slightly through the remainder of the study when intake temperatures declined below 50°F (Figure 3-7). Lower rates in the fall and early winter were presumably related to offshore movement to deeper water for the winter.

Rainbow smelt was the second most abundant species impinged at PBNP, occurring in 67 of the 80 samples and accounting for 0.4 percent of the total estimated impingement. Impingement of rainbow smelt ranged from none during 13 of the 80 sampling periods, to 7,931 during a four-day period from 1-3 October 2006 (Figure 3-8). Median and average rainbow smelt impingement was 484 and 56 per extrapolation period, respectively. Impingement rates were highest in October 2006 when 48 percent of the rainbow smelt was impinged (Figure 3-8). Impingement of rainbow smelt was generally lowest when intake temperatures were highest, from mid-June through September 2006.

Yellow perch was the most abundant game/food fish impinged at PBNP. Although yellow perch occurred in 52 of the 80 samples, they accounted for <0.1 percent of the total estimated impingement. Impingement of yellow perch ranged from none during 28 of the 80 sampling periods, to 1,122 during a seven-day period from 11-17 December 2006 (Figure 3-9). Median and average yellow perch impingement per extrapolation period was 41 and 6, respectively. Impingement rates were highest in the winter (December 2005 through early March 2006) when 56 percent of the yellow perch was impinged (Figures 3-9). Impingement of yellow perch was consistently low as intake temperatures increased above 40°F and remained low into the summer when intake temperatures were 50°F to 55°F. Impingement was somewhat higher as intake temperatures declined through the fall, but there was no clear response to water temperature as indicated by the relatively high estimate for 22-25 November 2006 compared to lower impingement prior to and following that sampling event when water temperatures were stable (Figure 3-9).

Seasonal impingement estimates of five other commonly impinged species were variable. Gizzard shad were impinged primarily in the winter (December – February) and from the late summer through November (Figure 3-10). Nearly 50 percent of the total gizzard shad estimate occurred in February, October, and November as a result of three sampling events. Gizzard shad were not impinged from late March through late August and 69 percent were impinged from October through completion of the study (Figure 3-10). Spottail shiner exhibited similar seasonal trends with the 68 percent of the estimated impingement occurring from mid-September through mid-October (Figure 3-11). Mottled sculpin, which was the most frequently encountered species, exhibited variable rates from December through late August when estimates per extrapolation period were typically less than 50 fish (Figure 3-12). Impingement rates of mottled sculpin increased from late August through early October when 45 percent of the estimated impingement occurred.

The two common stickleback species exhibited different seasonal impingement rates (Figure 3-13). The native ninespine stickleback was encountered in 43 of 80 sampling events, but nearly 97 percent of the estimated impinged occurred from mid-April through early August. The exotic threespine stickleback occurred in slightly more sampling events and was more abundant than were ninespine stickleback from December through March (Figure 3-13).

The seasonal patterns of other species impinged at PBNP were not evaluated because of infrequent occurrence and/or were impinged in low numbers.

4. DISCUSSION

Results from the entrainment and impingement study conducted at PBNP from December 2005 through November 2006 provided data to meet Phase II 316(b) rule requirements to characterize fish and shellfish susceptible to entrainment and impingement "in the vicinity" of the CWIS. The study provided:

- Taxonomic identification of fish and shellfish and their life stages that were entrained and impinged at the facility;
- Determination that no State or Federal endangered or threatened species were entrained or impinged at the facility;
- Abundance and temporal entrainment and impingement data;
- Documentation of current entrainment and impingement of fish and shellfish; and
- Determination of an entrainment and impingement "baseline calculation" at the facility.

The primary goal of the entrainment and impingement studies was to collect the data necessary to determine the "calculation baseline" for PBNP. As provided by § 125.93 of the Phase II rule for existing facilities, the calculation baseline is an estimate of impingement mortality and entrainment losses that occur assuming that the:

- Facility CWIS was designed as a once-through system;
- The intake structure opening is located at, and the face of the standard 3/8-inch mesh traveling screens are oriented parallel to the shoreline near the surface of the source waterbody (in this case Lake Michigan); and
- Current operational practices, procedures, and structural configuration at the facility are those that are maintained without structural or operational controls for the purposes of reducing impingement mortality.

The rule allows for the baseline calculation to be estimated using current entrainment and impingement data collected in the vicinity of the CWIS structure and/or through the use of data from other facilities with comparable design, operational, and environmental conditions. The baseline calculation can also be estimated using historical data or by using source water biological data. Specifications were added to the final definition of baseline calculation to allow credit in reducing impingement mortality and entrainment due to screen configurations and placement of the opening in the water column (§ 125.93). EPA also allows an "as built" approach where facilities can simply use current levels of impingement mortality and entrainment losses as the baseline calculation.

Historical studies at power plants located along Lake Michigan indicate that entrainment and impingement resulting from the operation of offshore intakes like that at PBNP is less than rates at onshore intakes that meet or are similar to a baseline facility (CDM/Limnetics 1977; Spigarelli et al. 1981). Therefore, the entrainment and impingement estimates from the current study were adjusted to allow PBNP credit for locating its intake offshore, and in the case of impingement, credited for installing an acoustic deterrent system to reduce impingement of alewife. A combination approach, as allowed by the rule, was applied to determine the baseline calculation from the annual estimates of entrainment losses and impingement mortality at PBNP.

The study estimates utilized actual pump records and results of the December 2005 through November 2006 study. The CWIS does not fit the above definition of a "baseline" facility because of its offshore location and implementation of measures to reduce impingement losses (ENSR 2004). The intake is 1,750 feet offshore and the structure was recently cut down to approximately 11 feet above the lake bottom in an effort to reduce impingement of alewife, which had interacted with the intake structure, especially during the early summer. In addition, a high-frequency acoustic deterrence system is seasonally deployed and has been optimized to deter alewife, the species most commonly impinged at PBNP.

The baseline calculations for PBNP were based on:

1. Use of near shore ambient ichthyoplankton and shellfish abundance data and actual pump records to estimate entrainment losses that would have occurred had the PBNP intake been located on the shoreline; and

2. Use of historical impingement results from onshore and offshore intakes in Lake Michigan to develop ratios for estimating impingement at PBNP had the intake been located on the shoreline.

The following sections discuss the study estimates and baseline calculation for entrainment and impingement at PBNP.

4.1 ENTRAINMENT BASELINE CALCULATION

4.1.1 Study Estimate

The PBNP entrainment study estimate was based on extrapolating results from the 24 weekly entrainment sampling events conducted between 19-20 April and 27-28 September 2006. Sampling results (expressed as number of organisms per 1,000 m^3) were expanded based on actual water use during the entrainment characterization study to yield weekly estimates, which were then summed to yield annual entrainment estimates by taxa and life stage (Table 4-1).

The study estimate for total number of ichthyoplankton entrained at PBNP was 10.7 million fish eggs and larvae (Table 4-1). Early life stages of alewife (including eggs

identified as alewife type) and rainbow smelt collectively accounted for 83.4 percent of the total estimate. Other taxa that contributed more than one percent to the total estimate included sculpin (2.4 percent), burbot (2.3 percent), and stickleback (1.8 percent). Unidentified eggs and larvae contributed 4.2 percent to the total estimate. All taxa/life stage groups except juvenile alewife, alewife type eggs, juvenile rainbow smelt, and unidentified eggs individually accounted for less than two percent the total study estimate.

Entrained game and food fish (other than yellow perch) accounted for four percent (432,609 individuals) of the study estimate (Table 4-1). As a group, forage fish other than alewife and rainbow smelt accounted for about 0.8 million (7.2 percent) of the total estimate and rough fish (common carp and unidentified catostomid) accounted for only 1.2 percent of the study estimate. Taxa/life stage groups that were represented by only one, two or three individuals collectively accounted for 17 percent of the total study estimate.

The 2006 total ichthyoplankton entrainment estimate (10.7 million) was about 60 percent higher than the April – October 1975 estimate (6.7 million) at PBNP (WEPCO 1976a):

		1975		2006	
TAXA	Life Stage	Number	%	Number	%
Alewife	Eggs	4,661,410	69.1	2,197,300	20.5
Alewife	Larvae	416,311	6.2	1,091,888	10.2
Rainbow smelt	Larvae	1,272,080	18.9	5,663,807	52.7
Sculpin	Larvae	349,517	5.2	258,213	2.4
Other	Larvae	44,617	0.7	1,076,867	10.0
Other	Eggs	0	0.0	450,888	4.2
Total Ichthyoplankton	--	6,743,935	100.0	10,738,963	100.0
Gammarus	--	0	0.0	4,057,474,137	99.9
Diporeia	--	13,851,400	57.6	0	--
Mysis	--	10,180,200	42.4	62,838	<0.1
Total Shellfish	--	24,031,600	100.0	4,057,536,975	100.0

The higher 2006 estimate was largely the result of a four-fold increase in the number of entrained rainbow smelt (1.3 million vs. 5.7 million). The majority (94 percent) of the rainbow smelt entrained in 2006 were classified as juveniles. Rainbow smelt were only identified as "larvae" in the 1975 study, whereas in 2006 they were separated into three life stages (post yolk-sac, larvae and juveniles). The number of entrained alewife larvae in 2006 (1.1 million) was three times higher than the 1975 estimate (416,311 larvae). In contrast, the estimated number of alewife eggs entrained in 2006 (including those classified as alewife "type") was 50 percent lower than in 1975 and the estimated number of entrained sculpin was 35 percent lower. Other larval taxa and other fish eggs were much more abundant in the 2006 estimate than in the 1975 estimate.

Entrainment of amphipods varied widely between studies in terms of species and entrainment estimates. *Gammarus* was extremely abundant in the 2006 samples, but absent from the 1975 samples. In contrast, the amphipod *Diporeia* (previously classified

as *Pontiporeia*, which was the nomenclature used in 1975) was very abundant in the 1975 entrainment samples but absent from the 2006 samples. *Diporeia* were historically the dominant benthic macroinvertebrate in the offshore waters of the Great Lakes; however, population declines have been documented throughout the Great Lakes and vast areas of Lake Michigan, Huron, Erie, and Ontario are now devoid of *Diporeia* (Nalepa 2006). The decline of *Diporeia* has been attributed to the spread of dreissenid mussels, but the exact mechanism is uncertain (Nalepa et al. 2006). *Mysis* were entrained during both studies, but were much more abundant in 1975 (10.2 million) than in 2006 (62,838).

4.1.2 Baseline Calculation

The entrainment study estimate represents actual conditions at PBNP that do not meet the definition of EPA's baseline intake. EPA's hypothetical baseline facility is defined as a:

- CWIS that was designed as a once-through cooling system;
- The intake structure opening is located at, and the face of the standard 3/8-inch mesh traveling screens are oriented parallel to the shoreline near the surface of the source waterbody; and
- Current operational practices, procedures, and structural configuration at the facility are those that are maintained without structural or operational controls for the purposes of reducing impingement mortality and/or entrainment losses.

Although PBNP has a once-through cooling system, the intake is located offshore rather than flush with the shoreline of the source waterbody (i.e., Lake Michigan). Total ichthyoplankton densities at the nearshore (6 to 8-ft contour) and offshore locations (18-ft and 30-ft contours) were statistically ($P<0.01$) higher than the entrainment densities (Table 4-2). With one exception, the nearshore densities of the seven tested ichthyoplankton taxa groups were statistically higher than the entrainment densities. Rainbow smelt larvae were the exception; nearshore and entrainment densities were statistically similar. In addition, 6 to 8-ft contour samples had statistically higher ($P<0.1$) densities of Clupeidae larvae, yellow perch, and alewife (including alewife type) eggs than the two offshore contours (Table 4-2). Greater nearshore abundance of ichthyoplankton is consistent with the onshore movements of alewife, rainbow smelt, and yellow perch that typically comprise the majority of entrainment estimates at Lake Michigan power plants (Spigarelli et al. 1981). For example, the 1975 entrainment estimate at We Energies' Oak Creek Power Plant (OCPP), which has an onshore intake, was 15.5 million fish eggs and larvae (WEPCO 1976b) compared to 6.7 million at PBNP during the same period (WEPCO 1976a):

The 2006 ichthyoplankton entrainment and nearshore ambient abundance data were used to estimate relative entrainment losses at PBNP of ichthyoplankton that would have occurred had the PBNP intake been located onshore (i.e., the baseline condition). Mean total ichthyoplankton densities at the 18-ft and 30-ft contours were 2.3 to 2.5 times higher than the mean entrainment density, whereas densities at the 6 to 8-ft contour were 9.1

times higher (Tables 4-3 and 4-4). The 6 to 8-ft contour would represent the primary withdrawal zone for an onshore intake; therefore, as shown below, operation of the offshore intake potentially reduces ichthyoplankton entrainment by 89 percent compared to the higher ichthyoplankton densities at the 6 to 8-ft contour.[2]

% Entrainment Reduction = [(191.6 – 21.0)/191.6)] x 100 = 89%

Entrainment densities and densities at the three depth contours varied widely at the taxa/life stage level (Table 4-3). Taxa/life stages with notably higher densities in the 6 to 8-ft contour samples than in the entrainment samples were alewife type eggs, yolk-sac larvae of unidentified Coregoninae, post yolk-sac rainbow smelt, common carp, and unidentified larvae. Entrainment estimates would increase substantially for those taxa if PBNP had a shoreline intake. Densities of juvenile rainbow smelt, which accounted for nearly 50 percent of the total 2006 entrainment estimate, were much higher in the entrainment samples (12.4 per 1,000 m^3) than in samples from the three depth contours (0.1 to 0.7 per 1,000 m^3). Subsequently, reductions in entrainment estimates through operation of the offshore intake could not be projected for juvenile rainbow smelt.

4.2 IMPINGEMENT BASELINE CALCULATION

4.2.1 Study Estimate

The impingement study estimate for PBNP was based on extrapolating results from 24-hour impingement sampling events conducted between 7 December 2005 and 30 November 2006. Results from 80 sampling events were expanded based on actual circulating water flows to yield 3-day, 4-day, or 7-day estimates that were distributed over the 12-month study based on sampling frequency, which varied seasonally (Table 2-2). Those estimates were then summed to yield annual impingement estimates by taxa. The resulting estimate was approximately 8.7 million fish and crayfish weighing 32,086 kg (Table 4-5). Alewife (including fish identified as alewife "type" and unidentified *Alosa*) accounted for 99.3 percent of the impinged fish and 94.3 percent of the total biomass. Rainbow smelt was the second most impinged species accounting for <0.5 percent (38,709) of the fish and 0.7 percent (221 kg) of the total fish biomass. An estimated 4,864 spottail shiner and 3,262 yellow perch were also impinged. Other species with annual estimates >1,000 were gizzard shad (3,105), threespine stickleback (2,823), ninespine stickleback (2,713), and mottled sculpin (2,763).

Trout, salmon, and game/food fishes accounted for only 4,632 of the estimated 8.7 million fish impinged during the 12-month study, comprising <0.1 percent of the total study estimate and 1.5 percent of the total biomass (Table 4-5). Yellow perch accounted for 73 percent of the food and game fish group and two coregonids (bloater and round whitefish) accounted for another 14 percent. Brown trout was the most commonly impinged salmonid (116); trout and salmon combined accounted for only 188 fish, which is <0.1 percent of the total estimate.

[2] We Energies does not believe that amphipods and zooplankton represent "shellfish" as intended by the Phase II 316(b) rule. Therefore, these organisms were excluded from the entrainment reduction estimate.

The 2005-06 study estimate was eight times higher than the 1975-76 estimate (WEPCO 1976a), largely because of a 10-fold increase in the number of alewife:

	Estimated Number		Estimated Biomass (kg)	
Species/Group	1975-76	2005-06	1975-76	2005-06
Alewife	886,394	8,624,384	41,907	30,249
Rainbow smelt	161,389	38,709	973	221
Trout	452	147	776	124
Salmon	16	41	2	10
Game & Food Fish	979	4,444	86	348
Rough Fish	209	992	57	280
Forage	7,285	24,096	152	854
Total	1,056,724	8,692,813	43,954	32,086

Differences between the two estimates did not follow annual abundance trends of alewife in Lake Michigan as alewife biomass has declined since the late 1980s and the 2005 lake-wide biomass estimate was much lower than in the 1970s (Madenjian at al. 2006) when the 1975-76 study was conducted. Higher impingement during the current study likely represent a combination of factors including patchy distribution of alewife in Lake Michigan, a local die-off and prevailing wind direction. Although alewife abundance has generally declined, increased relative standard errors in recent trawl data suggest that alewife distribution has become more patchy in recent years (Madenjian at al. 2006), so local abundance, for example in the vicinity of the PBNP intake in 2006 may had been much higher than indicated by the lake-wide average.

Summer die-off of alewife is an annual occurrence in Lake Michigan and although cause(s) of those die-offs are difficult to establish, it is likely that a percentage of the alewife impinged during the current study were moribund. Impingement of moribund alewife during baseline monitoring is not addressed by the Phase II 316(b) rule. However, the Rule requires reduction in impingement "mortality", thus intuitively, that reduction applies to fish that were alive when impinged, not fish that are dead or dying. However, determination of the ratio of live and moribund alewife has not been attempted because of logistical problems associated with sampling alewife in the vicinity of intakes and handling stress that make determining survival rates difficult.

Prevailing winds during the 12-month impingement study typically were southwest (225 degrees) to west-southwest (247.5 degrees) based on wind direction data recorded at PBNP (Figure 4-1). Wind direction and impingement rates of alewife were examined from 30 May through 13 June 2006, a period when the maximum alewife impingement rate occurred (Figure 4-2) and included a four-day extrapolation period that accounted for 20 percent (1.8 million) of the total annual alewife estimate (8.6 million). Winds were to the north-northwest (315 - 340 degrees) during that sampling event (Figure 4-2). As shown for the other sampling events, impingement rates were not always higher when prevailing winds were to the north-northwest. Impingement rates of alewife were much lower during the other three sampling events during this 15-day period when the

prevailing winds were to the west-southwest, southwest, and north-northwest. It is difficult to establish a causal effect of wind direction, but winds in Lake Michigan can result in rapid water temperature changes that likely affect fish distribution.

Sections of the acoustic deterrent system malfunctioned during much of the 2005-06 study, which likely contributed to higher alewife impingement than would have occurred if it had been fully operational. Speakers are being repaired prior to deployment for the 2007 alewife season (mid-May through mid-November). A similar system has been shown to reduce the densities of alewife by 96 percent in the vicinity of the James A. Fitzpatrick Nuclear Power Plant intake in Lake Ontario and reduced impingement by 87 percent (Ross et al. 1993). The PBNP acoustic deterrent system was activated on 6 May 2006 and continued in service through 12 September 2006. It was noted when the system was activated that one of the 16 channels spaced around the intake crib was not in service and remained out of service through September. A second channel was not working on 12 May 2006 and a third channel was found to be out of service during a 30 August 2006 inspection. The three non-functioning channels were facing the open lake to the east-northeast. Based on the effectiveness of these systems on deterring alewife, it is likely that a fully functional system would have reduced the number of non-moribund alewife impinged during the summer months when impingement was highest.

In contrast to alewife, the lower impingement rate of rainbow smelt in the current study was consistent with the population decline since the 1970s in Lake Michigan (Madenjian at al. 2006). Impingement of rainbow smelt in 2005-06 was 76 percent less than that the 1975-76 study estimate.

Impingement estimates for trout and salmon were similar between studies and very low relative to the alewife and rainbow smelt estimates. Impingement of the remaining three groups, game and food fish, rough fish and forage species, were higher in 2005-06 than in 1975-76. Increased impingement of game and food fish largely was due to higher impingement of yellow perch, which accounted for 73 percent of game and food fish group. Higher impingement of yellow perch in the 2005-06 study was consistent with a very strong 2005 year-class, which was the highest on record dating back to 1973 (Madenjian et al. 2006) and a 2006 year-class, which was the second strongest since 1995 (Bunnell et al. 2007). The 2005 densities of YOY yellow perch in Lake Michigan averaged 201 per hectare (ha) compared to <10/ha in the 1970s.

Higher impingement of rough fish in 2005-06 largely was due to increased impingement of white sucker as 756 were impinged compared to only 26 white suckers in the 1975-76 study. The increase in forage impingement was due primarily to gizzard shad, spottail shiner, threespine stickleback, ninespine stickleback, and mottled sculpin (Table 4-5). The exotic threespine stickleback, which accounted for 12 percent of the forage total; was not impinged in 1975-76, as its presence in Lake Michigan was unknown at that time (Lyons et al. 2000).

Common fishes collected from the traveling screens at PBNP (e.g., alewife, rainbow smelt, and yellow perch) are known to school at least seasonally. The overall low

relative abundance of non-schooling or more sedentary species with small home ranges (e.g., smallmouth bass, and sunfishes) is typical of impingement at power plant intakes. Impingement of many species during this study appeared to be random based on their infrequent and irregular occurrence, and although other species may be impinged in the future, their abundance on the traveling screens is expected to be low.

High relative abundance of alewife in the impingement samples reflects both their abundance in the source waterbody and their susceptibility to impingement due to their schooling behavior, sensitivity to sudden changes in water temperatures, which weakens them and can lead to mortality, and a life cycle that brings them inshore to spawn in late spring where large natural temperature swings can occur. Although the alewife population in Lake Michigan is landlocked, alewife are basically a saltwater species and are not well adapted to the osmotic stress associated with life in fresh water. Their kidneys are not as large as a true freshwater species, which needs to constantly excrete water out of their bodies. This physiological stress may make them even more susceptible to temperature changes.

Annual differences in the absolute number of impinged fish and their relative abundance have been documented at most facilities where long-term data are available (EPRI, 2004). Variability in year-class strength of alewife, rainbow smelt, and yellow perch could result in order of magnitude differences among years. Based on available data, impingement at PBNP is expected to remain dominated by 10 or fewer species, of which clupeids (especially alewife) will be the most abundant species impinged in terms of numbers and biomass, and the impingement of sportfish should remain relatively low. Additional quantitative studies of impingement at PBNP are unlikely to demonstrate a deviation from this expected pattern.

4.2.2 Baseline Calculation

The study estimate generated from the 12-month impingement study represents actual conditions at PBNP that do not meet the definition of EPA's baseline intake. EPA's hypothetical baseline facility is defined as:

- A CWIS that was designed as a once-through cooling system;
- A facility where the intake structure opening is located at, and the face of the standard 3/8-inch mesh traveling screens are oriented parallel to the shoreline near the surface of the source waterbody; and
- A facility whose current operational practices, procedures, and structural configuration are maintained without structural or operational controls for the purposes of reducing impingement mortality and/or entrainment losses.

Although PBNP has a once-through cooling system, the intake is located offshore rather than flush with the shoreline of the source waterbody (i.e., Lake Michigan) and measures have been taken to further reduce impingement through installation of an acoustic

deterrent system and submerging the intake crib to ~11.5 feet below the surface to reduce impingement of alewife.

Historical impingement data from Lake Michigan power plants indicate that offshore intakes like that at PBNP impinge fewer fish than onshore intakes canals (CDM/Limnetics 1977 and Spigarelli et al. 1981). The historical data indicate that highly variable rates were related to seasonal habitat selection and stock abundance, and to a lesser extent, pumping rates. Seasonal impingement of alewife demonstrates how habitat selection influences impingement rates as higher rates in the early summer reflect inshore spawning migrations rather than seasonal changes in cooling water flow. Die-offs of alewife also occur annually following the inshore migration because alewife are poorly adapted to freshwater. Subsequent reductions in winter (December through March) impingement reflect offshore movement of alewife. Widely variable stock abundance has been well documented in Lake Michigan, especially for the commonly impinged species (alewife, rainbow smelt, yellow perch, and slimy sculpin) that represent important forage species in Lake Michigan (Madenjian et al. 2006).

Deriving an impingement baseline calculation for PBNP is not as straight forward as it was for the entrainment baseline calculation, which used concurrent ambient ichthyoplankton abundance data relative to the direct entrainment estimates to demonstrate that entrainment losses through operation of the offshore PBNP intake was lower than would be projected for an onshore intake (Section 4.1.2). A similar approach for impingement was deemed infeasible because of the mobility of juvenile and adult fish that are susceptible to impingement, which skews size and relative abundance differences between fish caught with sampling gear (e.g., trawls and gill nets) and those impinged. In contrast, ichthyoplankton are easier to sample because of their small size and relative immobility compared to impinged fish, which allowed a direct comparison between near-shore ambient abundance data in Lake Michigan and the entrainment results. Therefore, the impingement study estimate was compared to results from other facilities with onshore and offshore intakes to derive the impingement baseline calculation for PBNP.

Ideally, development of the impingement baseline calculation baseline would be based on data collected during the same time period to reduce the influence of annual changes in fish stocks and at facilities with similar cooling water use, to reduce the potential influence on differences in pump flows. As a result of the Phase II 316(b) rule, most existing facilities have recently conducted or are currently conducting impingement studies; however, those results were not available for use in this analysis because the data are not yet available to the public. One recent study, which is available, was conducted January – September 2004 at We Energies' Port Washington Power Plant (PWPP) that during the study had an average cooling water flow of 281 MGD and a maximum flow of 475.2 MGD. The 2004 study at PWPP (EA 2005) yielded an annual estimate (1.1 to 1.7 million fish) that was similar to a March 1975 – February 1976 estimate (2.0 million fish) at PWPP (WEPCO 1976c). As in the current and historical studies at PBNP, alewife was the overwhelming dominant species. The historical and current studies at PBNP and PWPP also demonstrate that rainbow smelt and yellow perch remain commonly impinged species at both onshore and offshore facilities despite reduced populations in

Lake Michigan, reflecting both their relative abundance and vulnerability to impingement.

The lack of readily available recent and concurrent impingement data from Lake Michigan facilities with onshore and offshore intakes required the use of historical data; therefore impingement data compiled from historical studies conducted in 1975 at 16 facilities on Lake Michigan with offshore and shoreline intakes were used (Spigarelli et al. 1981). The impingement estimates for these facilities were normalized to flow, and the alewife, rainbow smelt, and yellow perch impingement rates (number of fish/million gallons) was calculated for selected power plant intakes. Then an average impingement rate was calculated for each species for the onshore facilities and the offshore facilities. A ratio was developed by dividing the average of the onshore and offshore impingement rates for each species. Those ratios were then applied to the 2005-06 study estimates to derive the impingement baseline calculation.

The selected power plants with offshore intakes were D.C. Cook, Kewaunee, Point Beach, and Bailly. Data for Zion Nuclear Station, another offshore intake along the western shore of Lake Michigan were excluded due to the atypically high impingement during May 1975 (18.3 million alewife) that skewed the 1975 impingement rates. Subsequent studies in 1976 and from 1991 through 1993 at Zion confirmed that the May 1975 total was anomalous as annual estimates ranged from 1.6 to 4.8 million fish (LMS 1993). For onshore canal intakes, data from the Oak Creek, Port Washington, and Waukegan power plants were used. Data for the remaining nine plants listed by Spigarelli et al. (1981) were excluded due to their intake design (e.g., porous dike) or location in harbor/tributary mouths and an adjacent inland lake.

Table 4-6 provides a summary of the design flow, total annual water use, and annual impingement estimates for alewife, rainbow smelt, and yellow perch at the selected seven Lake Michigan power plants during 1975. Based on the mean number impinged, nearly five times (onshore/offshore ratio of 4.9) more alewife were impinged at the onshore intakes compared to the offshore intakes in 1975. The onshore/offshore ratios for rainbow smelt and yellow perch were 3.0 and 0.2, respectively (Table 4-6). These ratios show that on average, 80 percent fewer alewife and 67 percent fewer rainbow smelt were impinged at the offshore intakes compared to onshore intakes that generally fit the regulatory definition of a baseline intake. The low ratio for yellow perch (0.2) suggests that five times more yellow perch are impinged at the offshore intakes. Use of these ratios reduced the study estimates for alewife and rainbow smelt by 80 and 67 percent, respectively and increased the estimated number of impinged yellow perch five-fold (3,262 to 16,309).

Adjusting the number of alewife, rainbow smelt, and yellow perch impinged during the current study yielded an impingement baseline calculation of an estimated 42.4 million fish compared to the 8.7 million study estimate (Table 4-7). Use of the onshore/offshore rations indicated that impingement at the PBNP offshore intake was 80 and 67 percent lower for alewife and rainbow smelt, respectively, than if PBNP had an onshore intake. In contrast, five times more yellow perch were impinged offshore than would have been impinged onshore. The greater calculation baseline primarily reflects the high relative

abundance of alewife. It is likely that onshore/offshore differences in impingement rates exist for other species, especially those associated with onshore habitat (e.g., catfishes and sunfishes). Because alewife and rainbow smelt account for over 99 percent of the impingement at PBNP, the offshore location of its intake nearly meets (79%) the performance standard of an 80 to 95 percent reduction in impingement mortality. Further reductions in alewife impingement are anticipated through the effective operation of the acoustic deterrent system at PBNP.

4.3 SUMMARY

Entrainment results for PBNP were consistent with those from the historical entrainment study conducted in 1975 (WEPCO 1976a). In both studies, early life stages of alewife and rainbow smelt accounted for the majority of entrained ichthyoplankton. Evaluation of concurrent nearshore and offshore abundance data indicated that operation of the PBNP offshore intake reduces entrainment by 89 percent relative to projected entrainment through a hypothetical onshore intake based on statistically higher ichthyoplankton densities along the nearshore (6 to 8-ft) contour. The current study results, as supported by historical entrainment studies at Lake Michigan power plants with onshore and offshore intakes, support an entrainment baseline calculation for PBNP that meets the performance standard of a 60 to 80 percent entrainment reduction based on actual entrainment estimates through its offshore intake and the projected entrainment assuming an onshore baseline intake. An onshore intake would withdraw cooling water from nearshore waters that have significantly higher densities than in the offshore waters where the PBNP intake is actually located.

Impingement results for PBNP were consistent with those during the historical impingement study conducted in 1975-76 (WEPCO 1976a) and the relative susceptibility of the common species in Lake Michigan to impingement. Utilizing historical impingement data from Lake Michigan power plants, an onshore vs. offshore impingement ratio was developed and applied to the current impingement rates at PBNP. Based on this ratio, data indicated that operation of the PBNP offshore intake reduces impingement by 79 percent relative to projected impingement through a hypothetical onshore intake. In addition, a high-frequency acoustic deterrence system is seasonally deployed and has been optimized to deter alewife, the species most commonly impinged at PBNP. A similar acoustic deterrent system has been installed at the James A. Fitzpatrick Nuclear Power Plant intake in Lake Ontario and alone, has reduced impingement by 87 percent (Ross et al. 1993).

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FIGURES

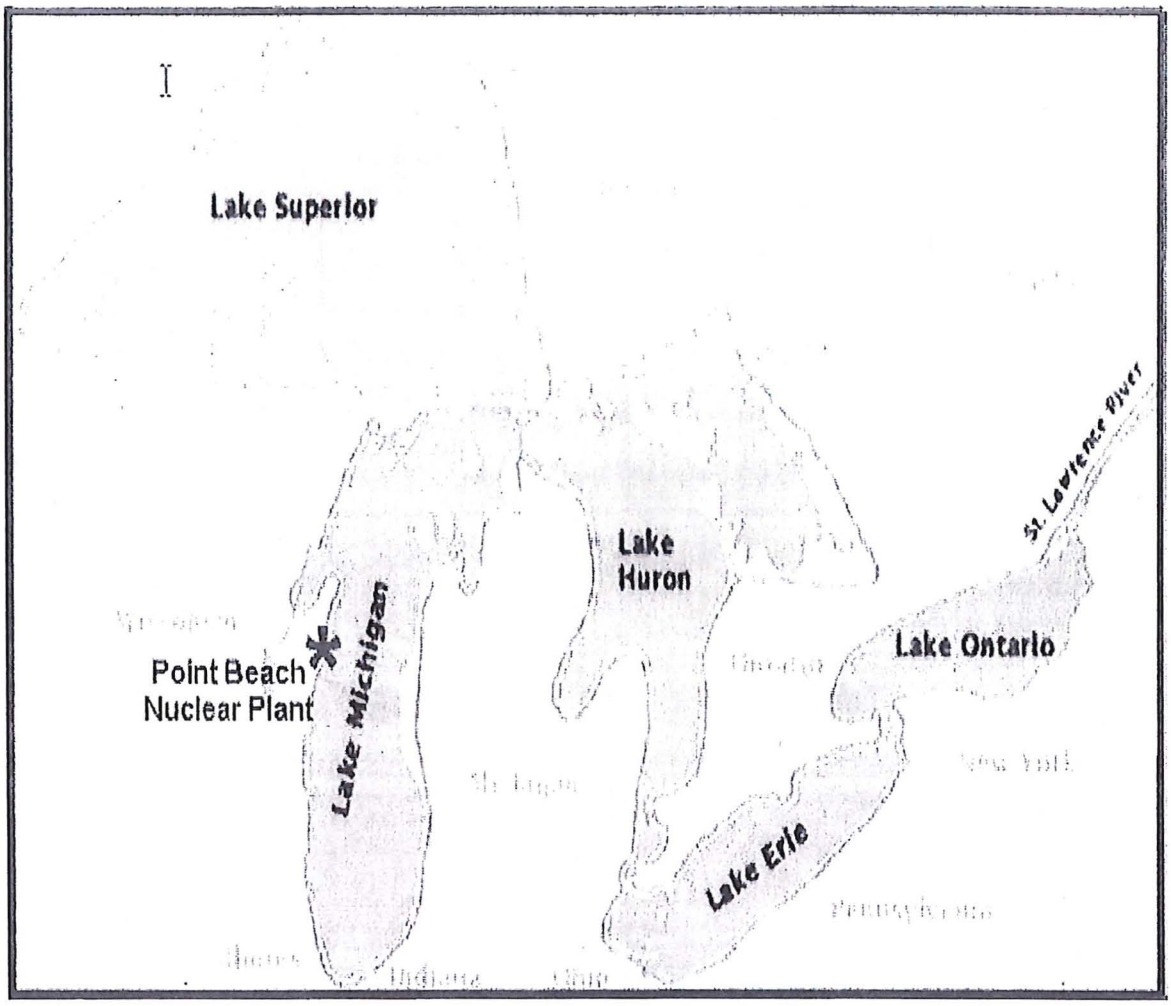

Figure 1-1. General Location Map for the Point Beach Nuclear Plant.

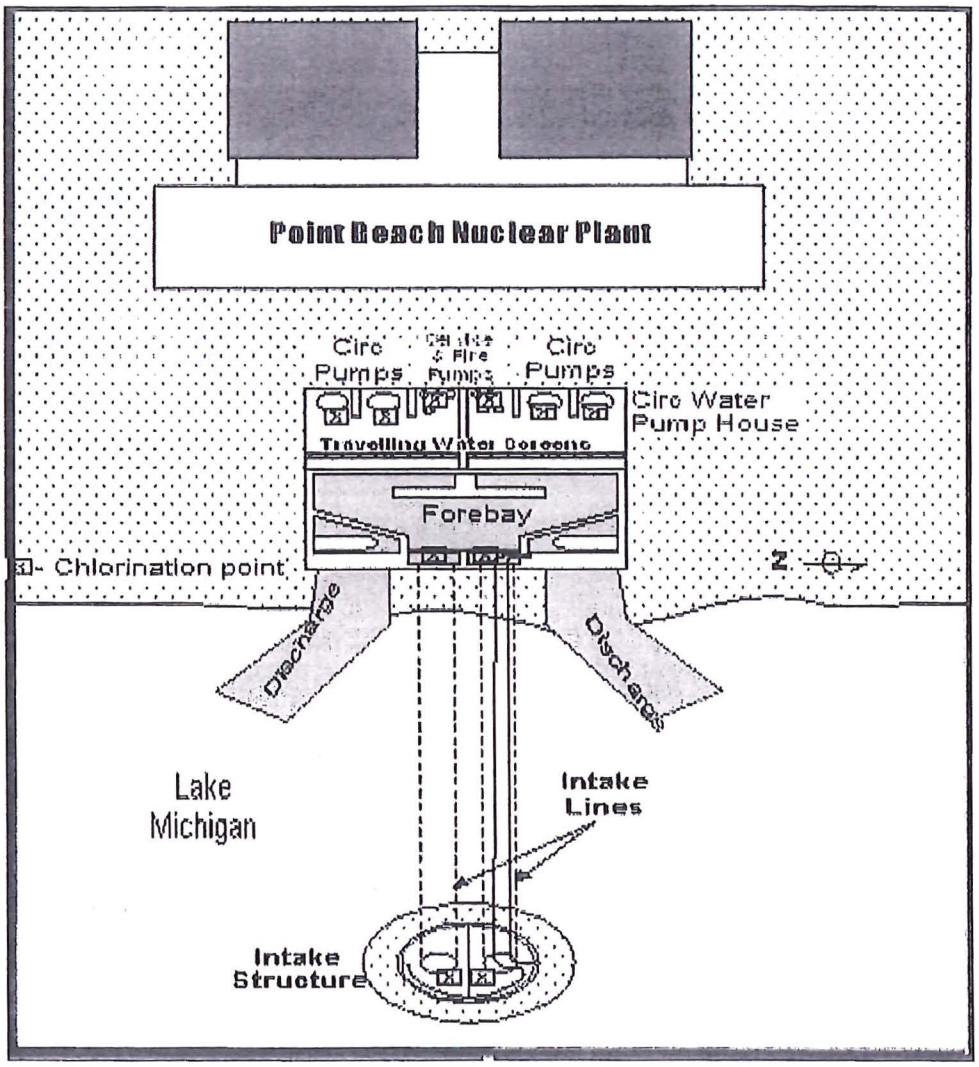

Figure 1-2. General Layout of the Point Beach Nuclear Plant Cooling Water Intake Structure.

SOURCE: Alden Research Laboratory, Inc.

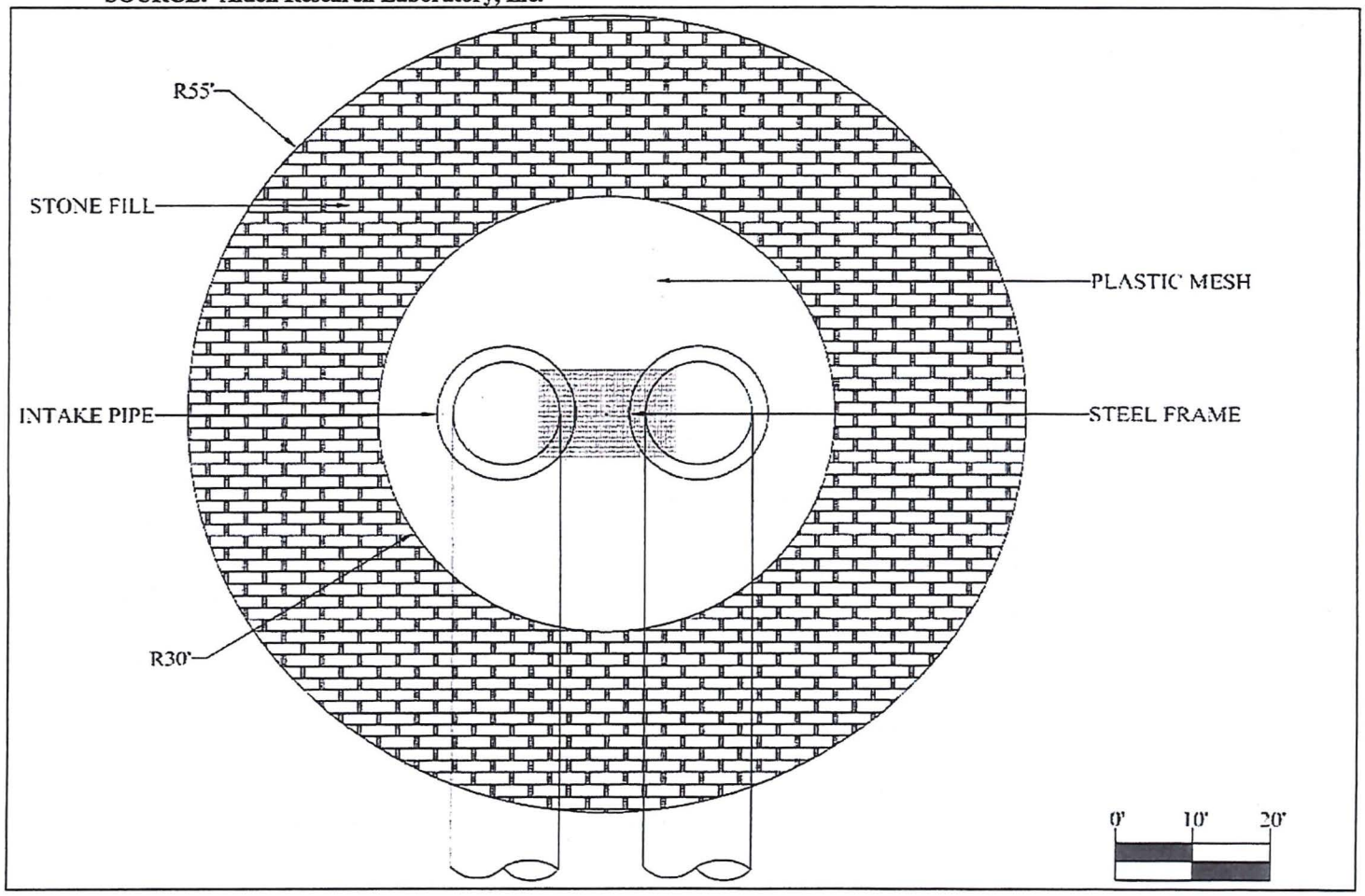

Figure 1-3. Current Offshore Intake Crib – Plan View

SOURCE: Alden Research Laboratory, Inc.

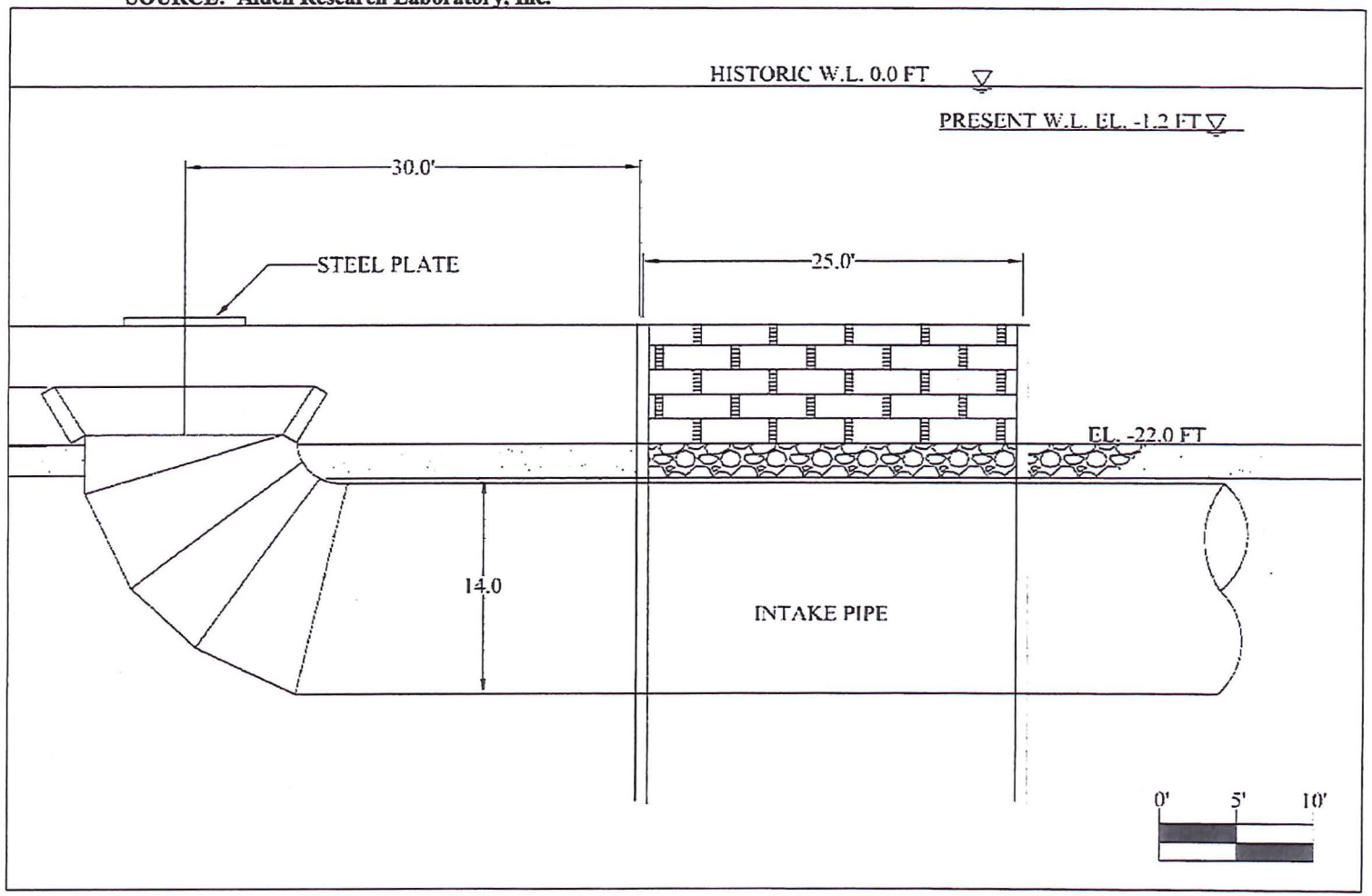

Figure 1-4. Current Offshore Intake Crib – Section View

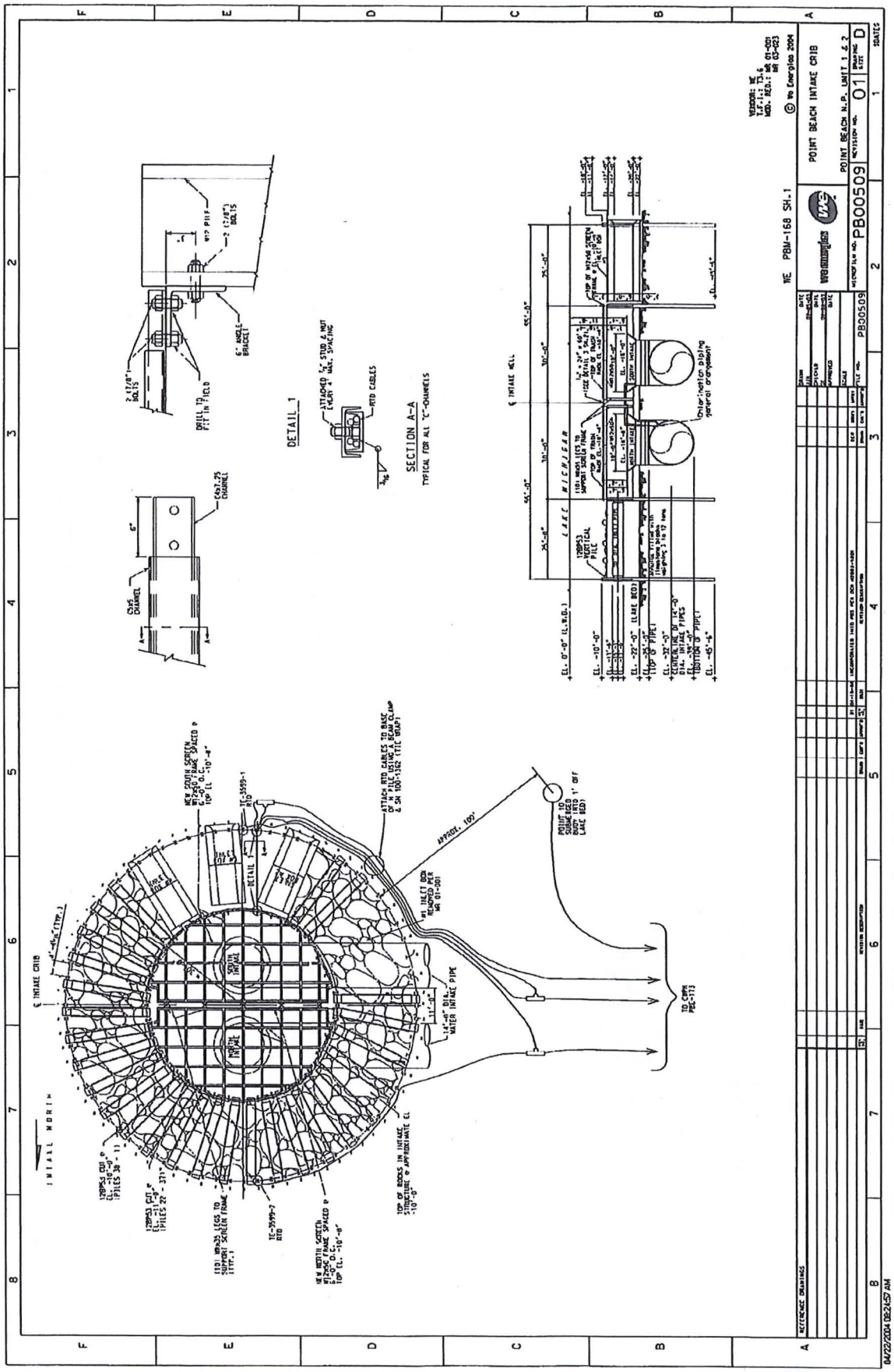

Figure 1-5. Current Offshore Intake Crib—Porous Structure

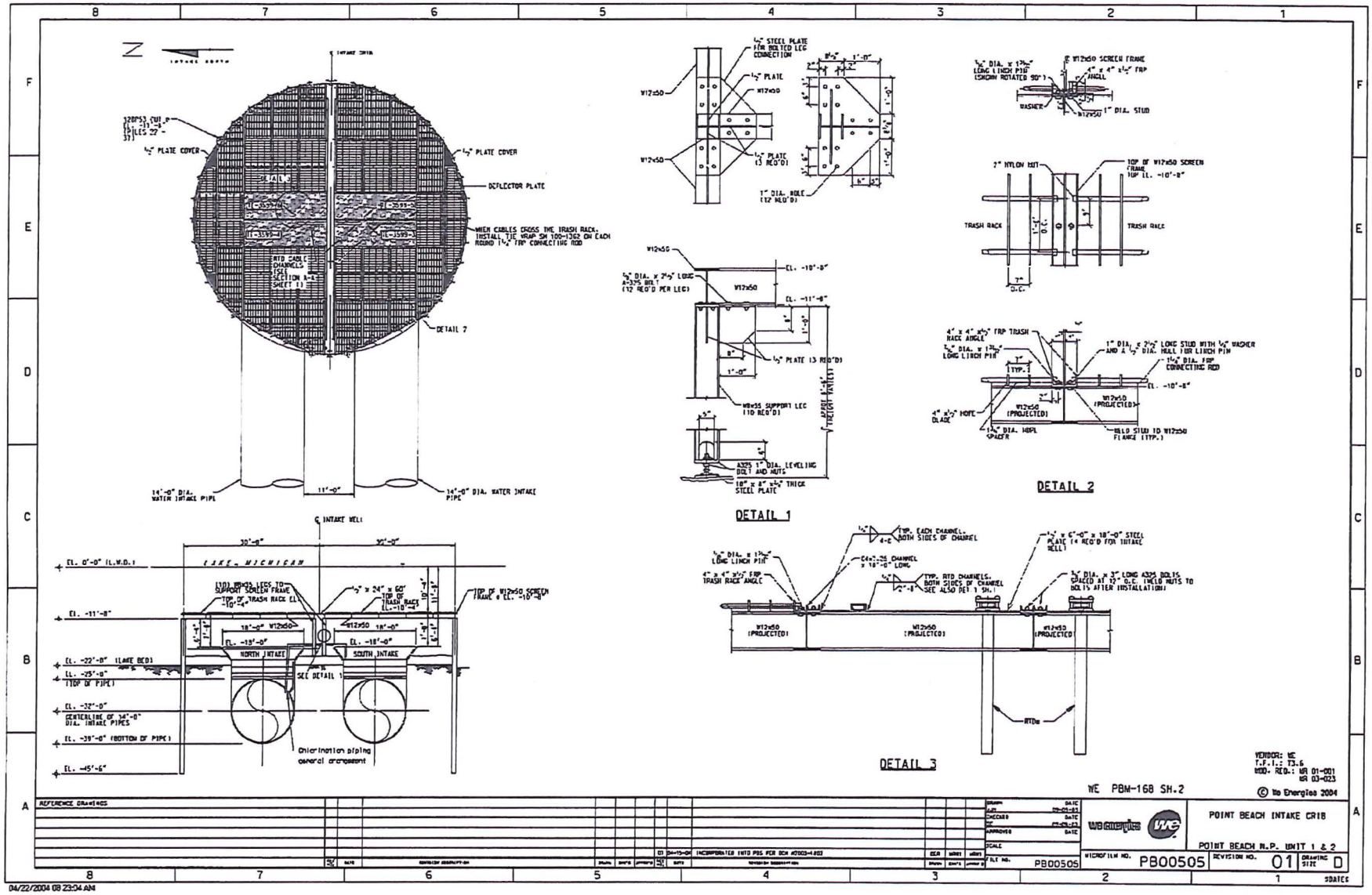

Figure 1-6. Current Offshore Intake Crib—Framework

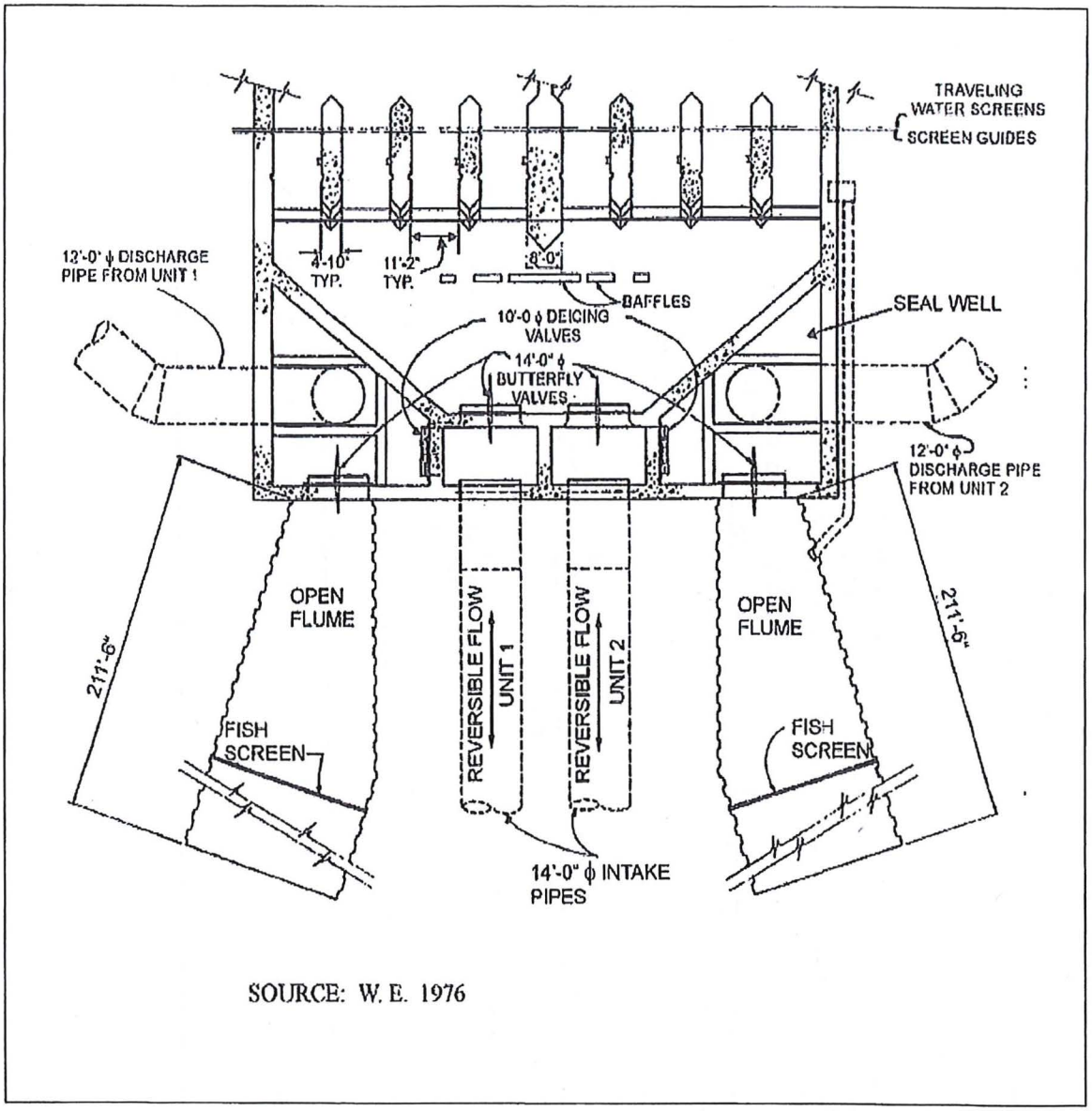

Figure 1-7. Existing Pumphouse – Plan View

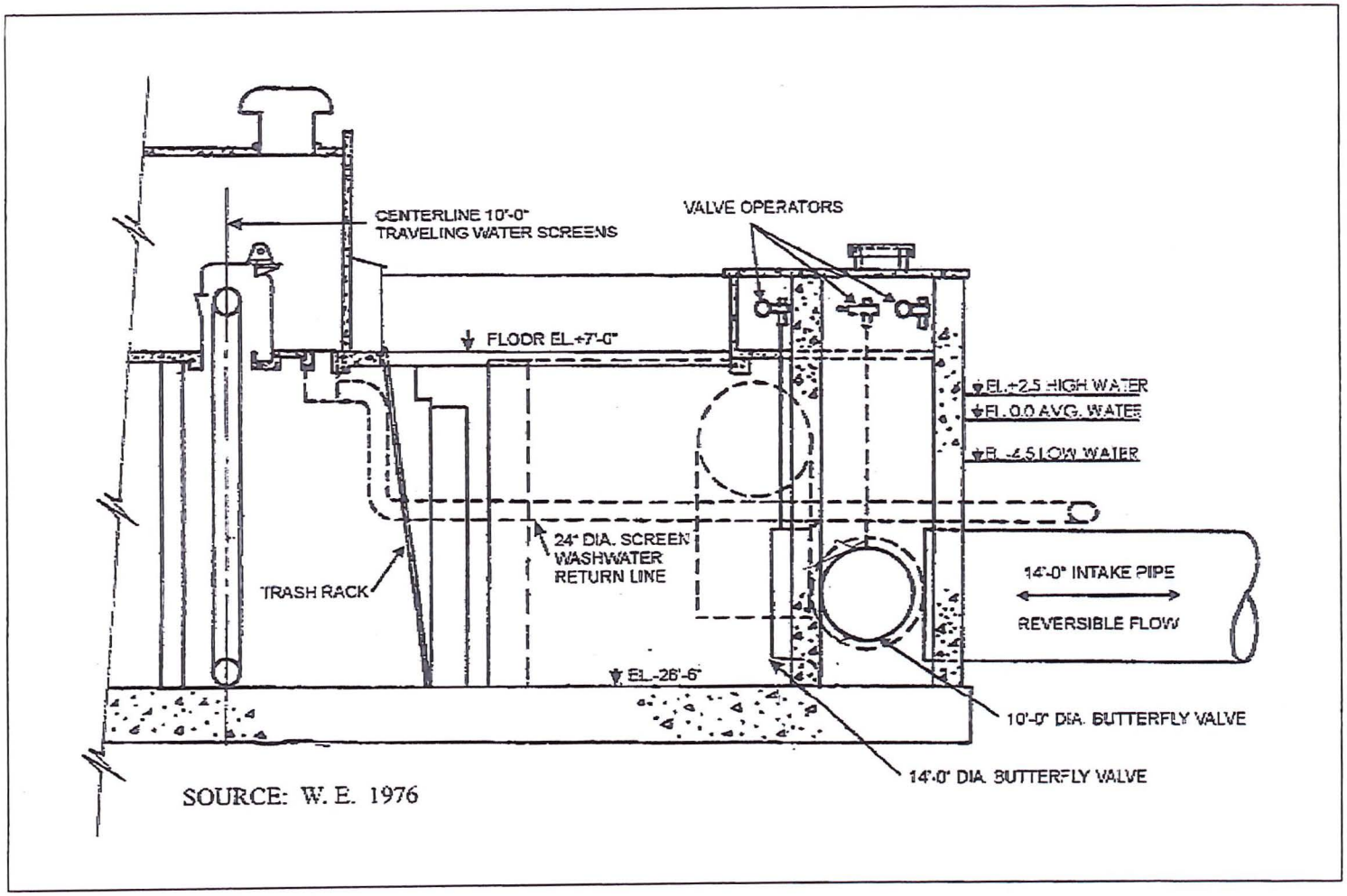

Figure 1-8. Existing Pumphouse – Section View

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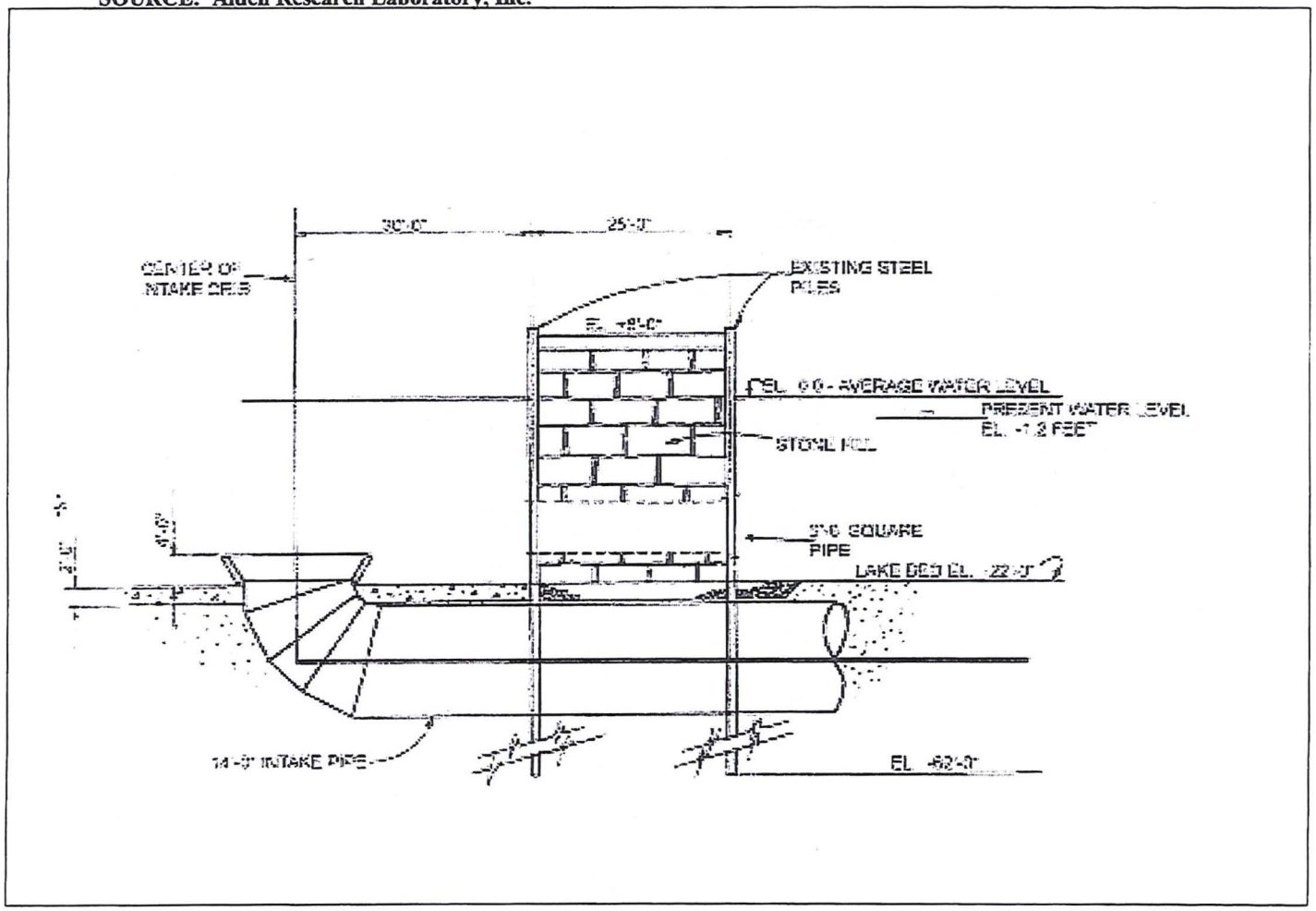


Figure 1-9. Original Offshore Intake Crib – Section View

SOURCE: Alden Research Laboratory, Inc.

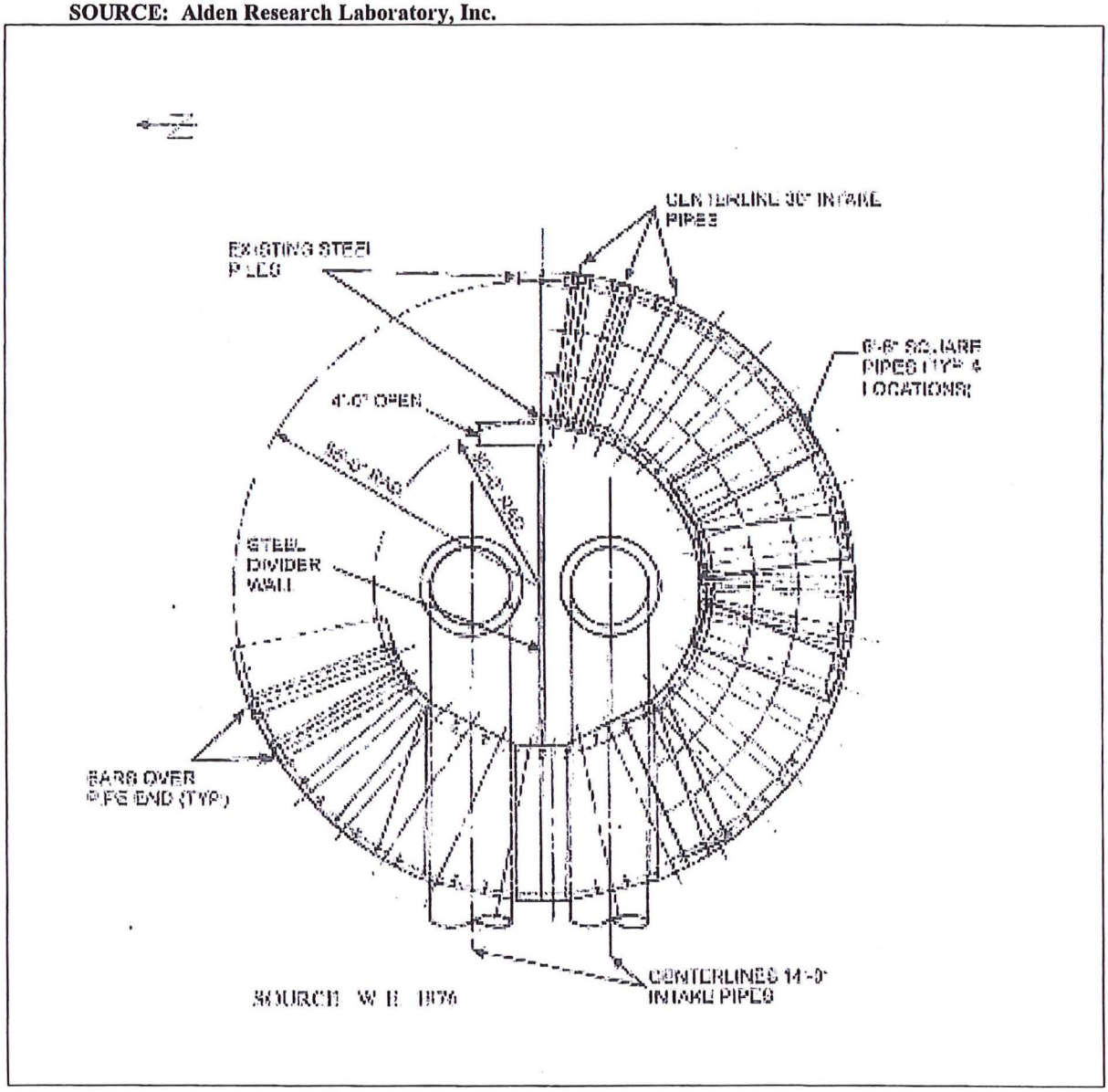


Figure 1-10. Original Offshore Intake Crib – Plan View

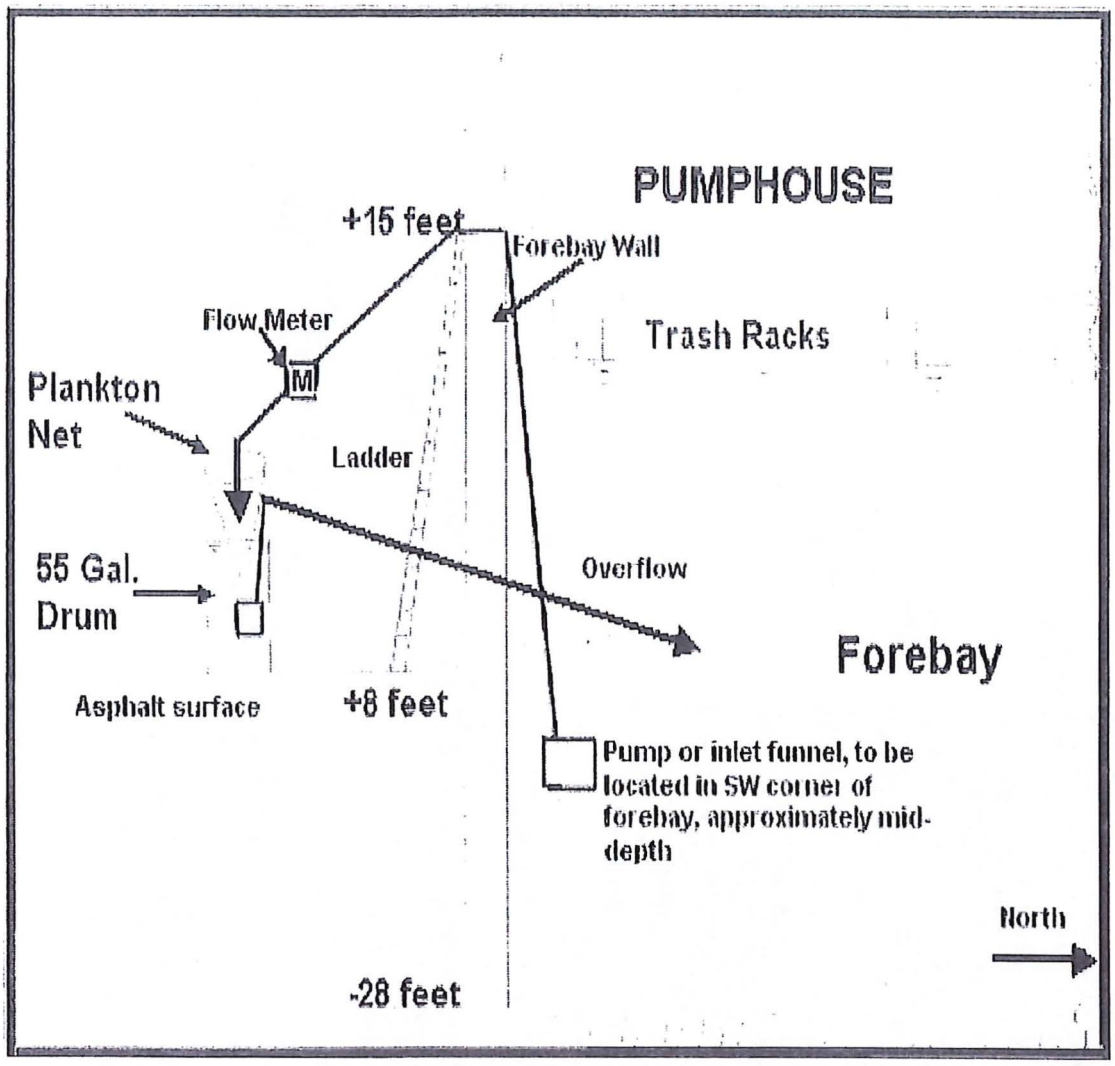


Figure 2-1. Schematic Layout of Entrainment Sampling at Point Beach Nuclear Plant, April through September 2006.

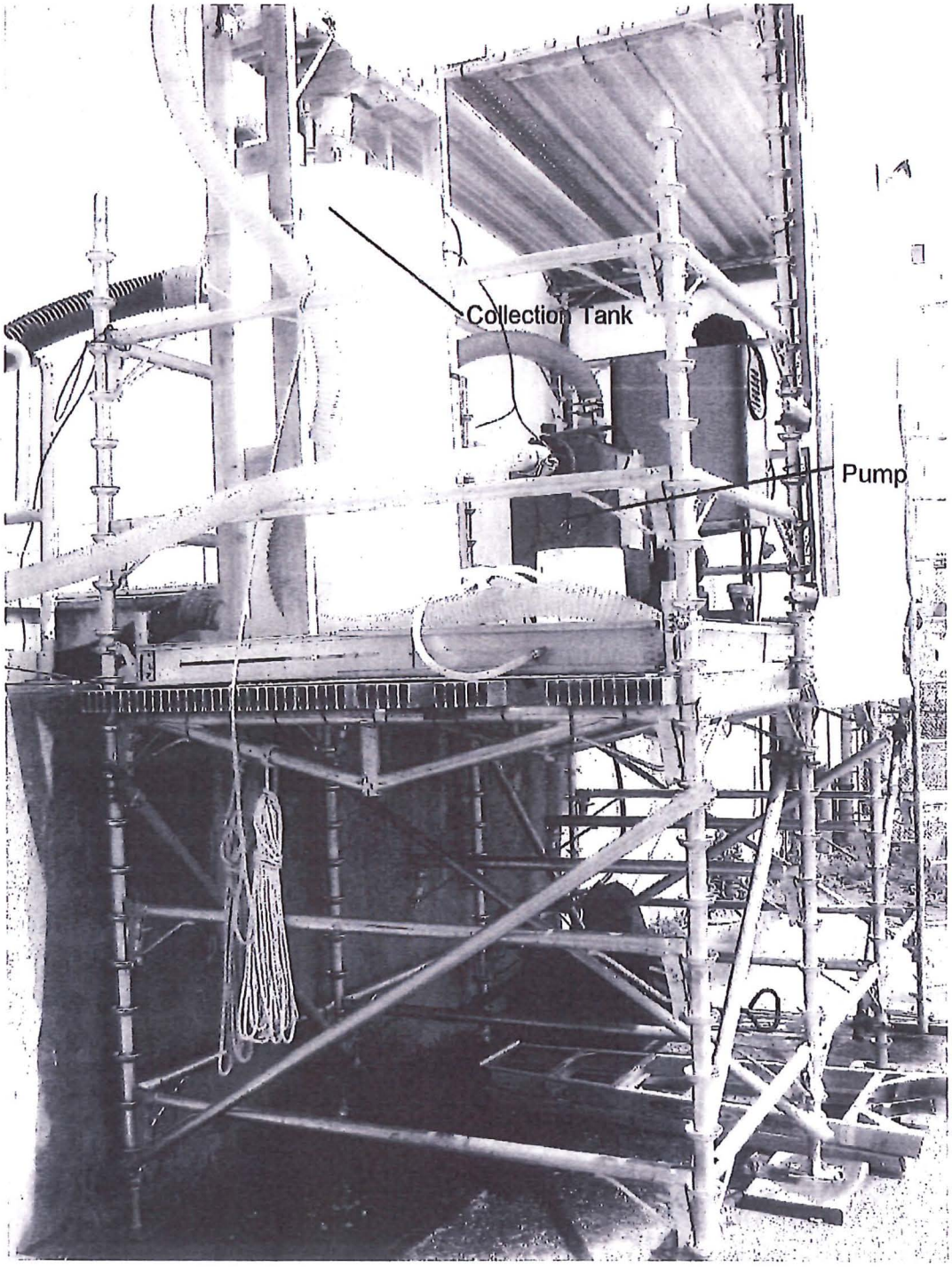


Figure 2-2. Entrainment sampling equipment (pump in center) located on scaffolding along side the intake forebay.

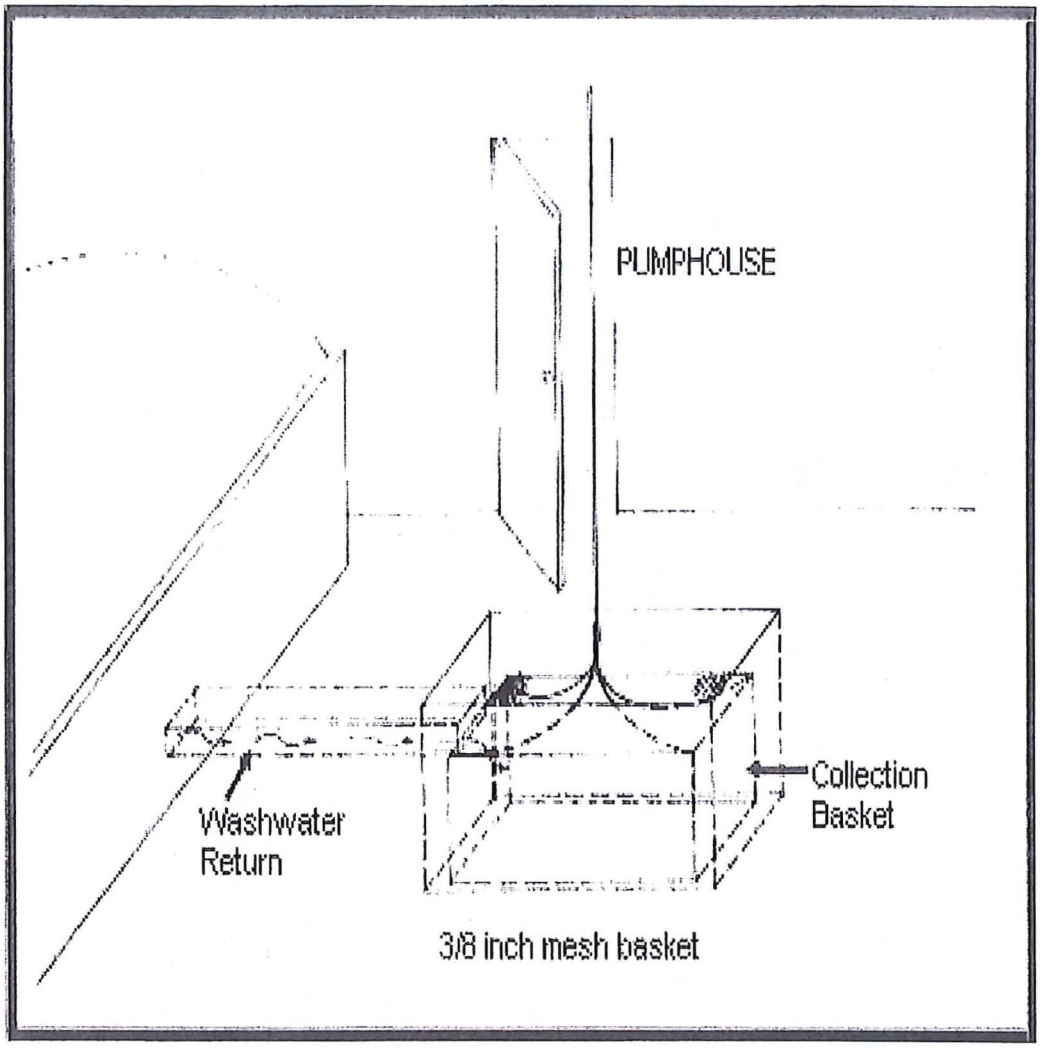


Figure 2-3. Schematic of Collection Basket Layout Used for the Point Beach Nuclear Plant Impingement Study, December 2005 through November 2006.

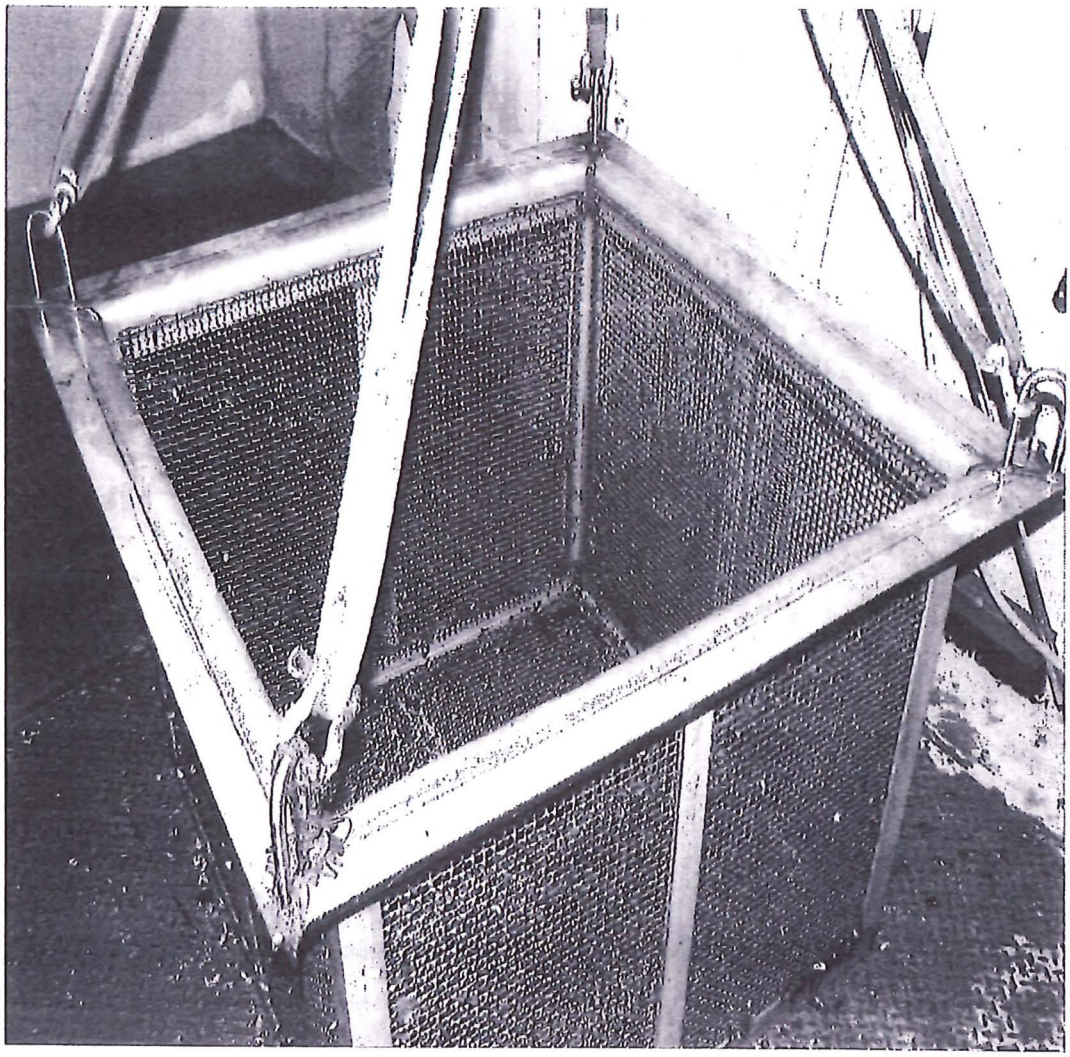


Figure 2-4. Impingement Collection Basket Used at Point Beach Nuclear Power Plant from December 2005 through November 2006.

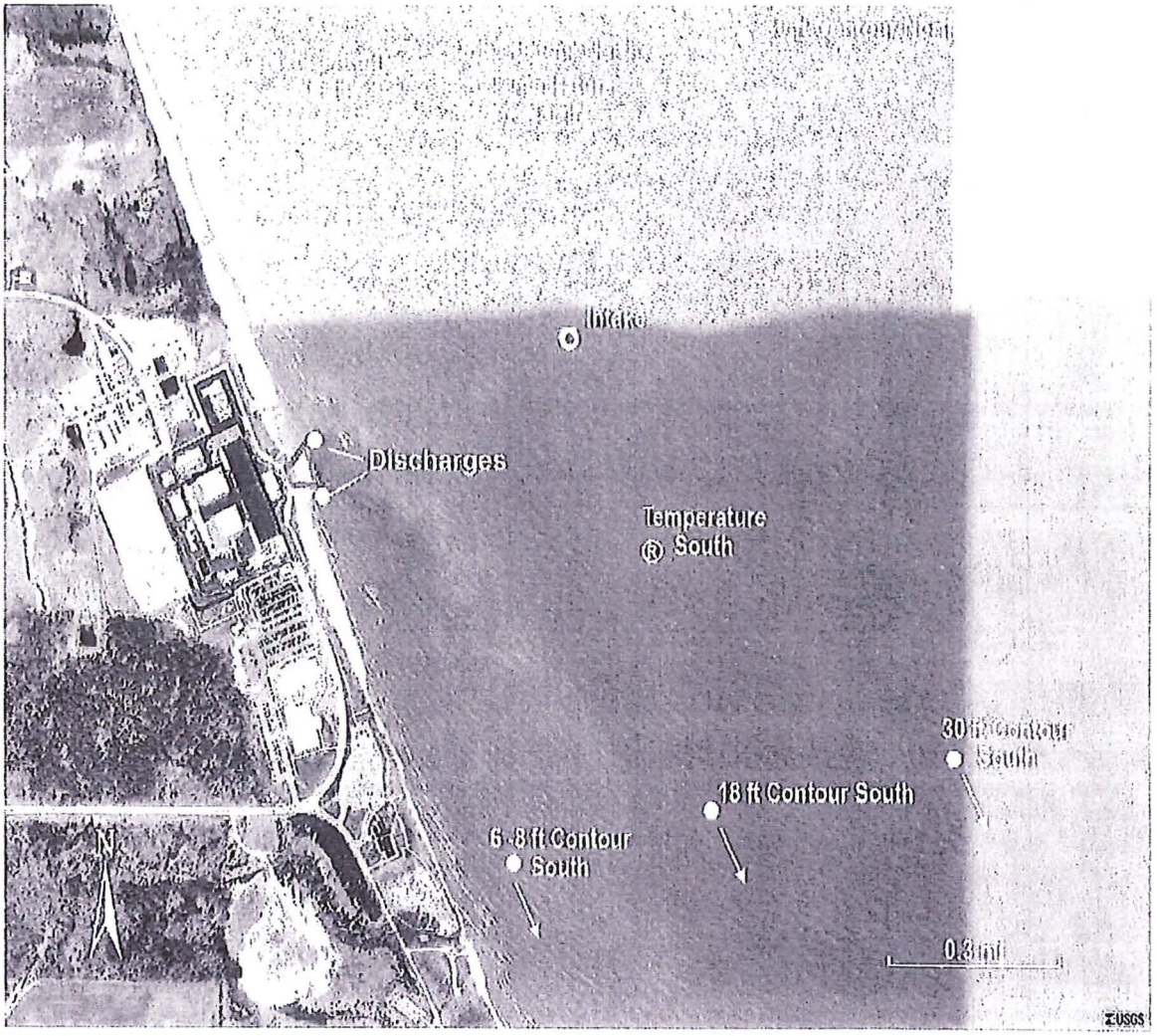


Figure 2-5. Ambient (Offshore) Shellfish and Ichthyoplankton Sampling Locations near the Point Beach Nuclear Plant.

Figure 3-1. Mean Intake and Discharge Temperature During Entrainment Sampling Events at PBNP, April - September 2006.

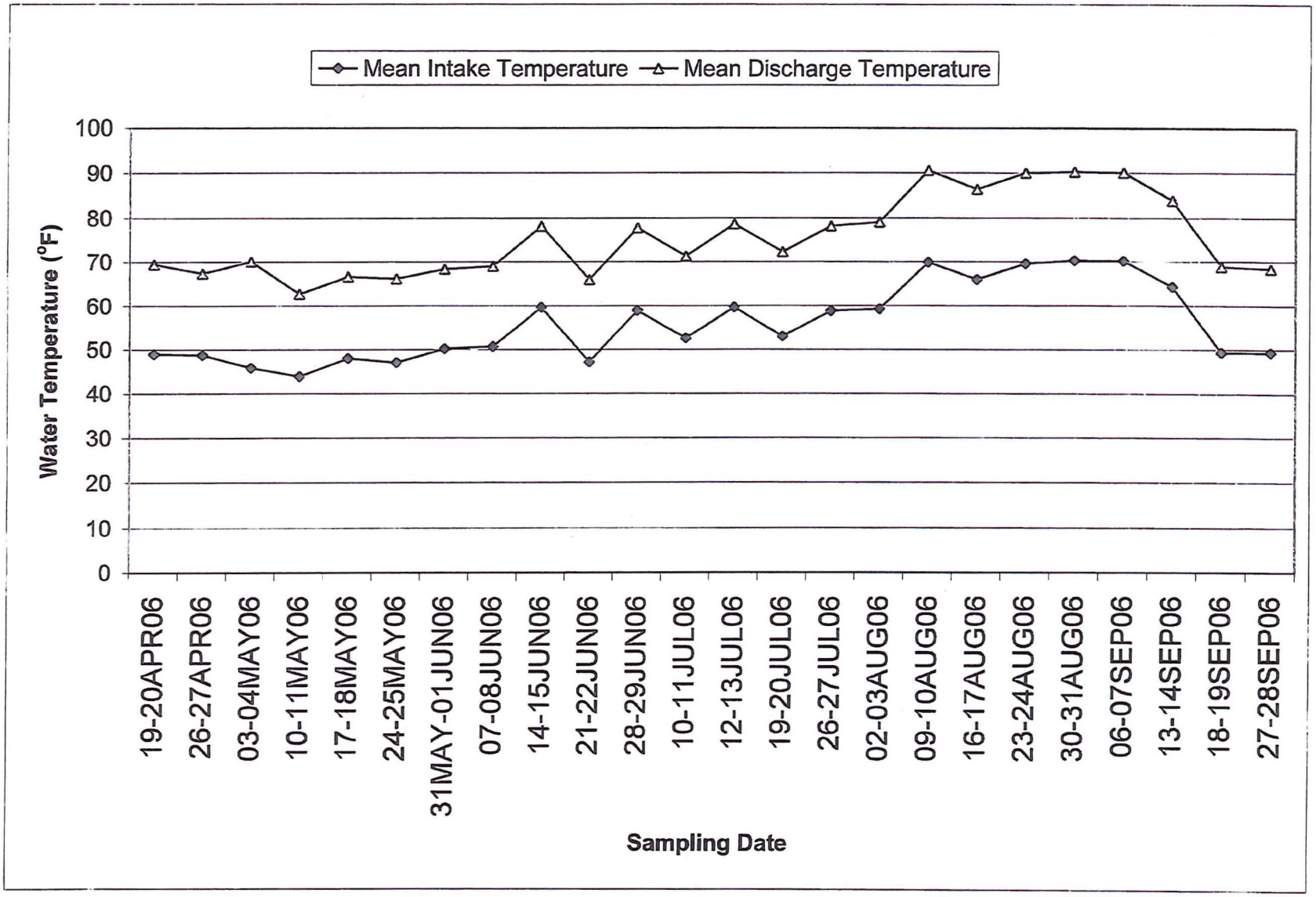
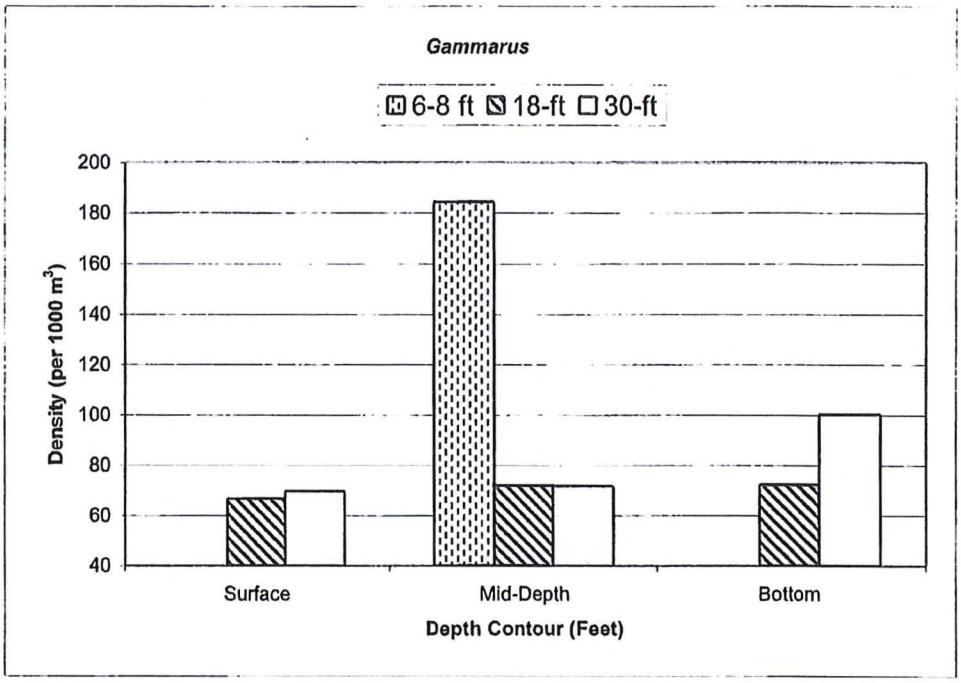


Figure 3-2. *Gammarus* and Total Ichthyoplankton Densities at Three Depth Contours near PBNP, 2006.



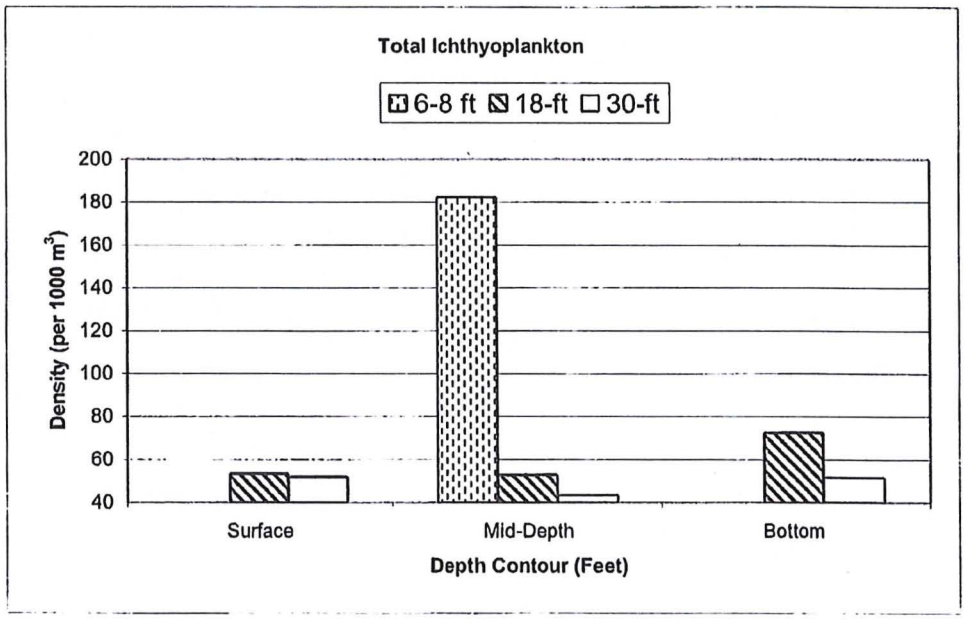


Figure 3-3. Entrainment Estimates of *Gammarus* and Total Ichthyoplankton at the Point Beach Nuclear Plant, April - September 2006.

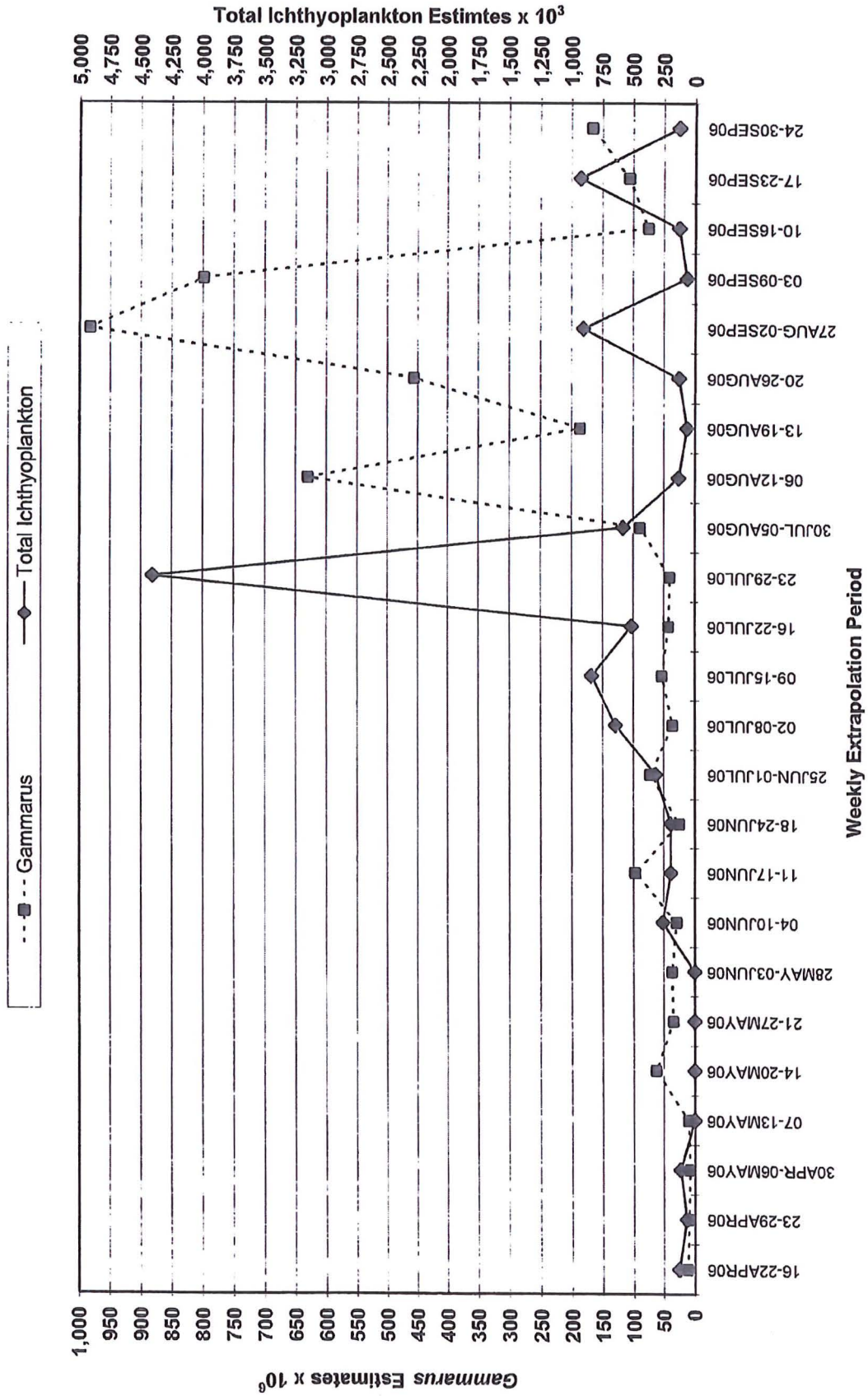


Figure 3-4. Entrainment Estimates of Alewife and Rainbow Smelt at the Point Beach Nuclear Plant, April - September 2006.

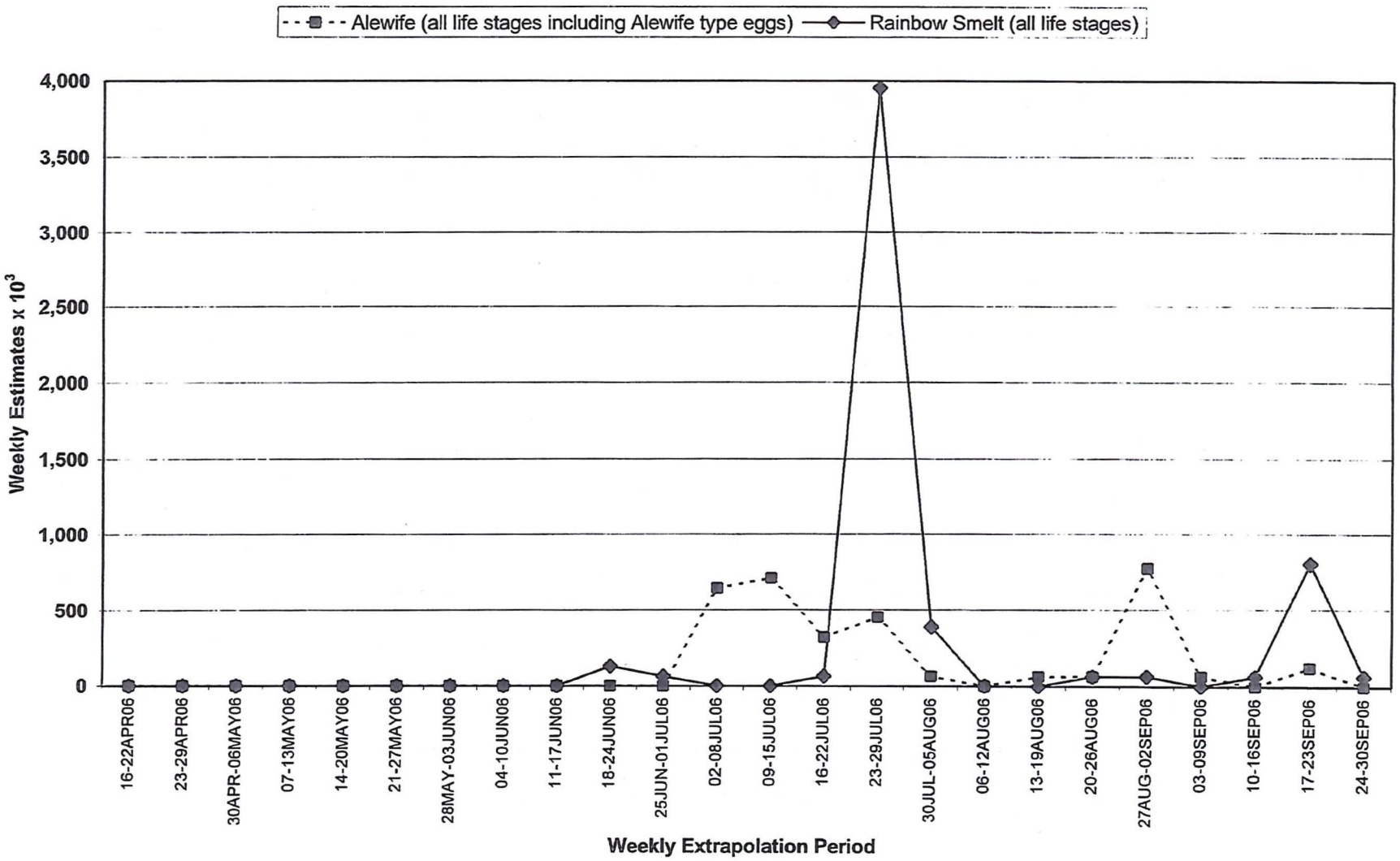


Figure 3-5. Mean Intake and Discharge Temperatures Recorded during Impingement Sampling at PBNP, December 2005 - November 2006.

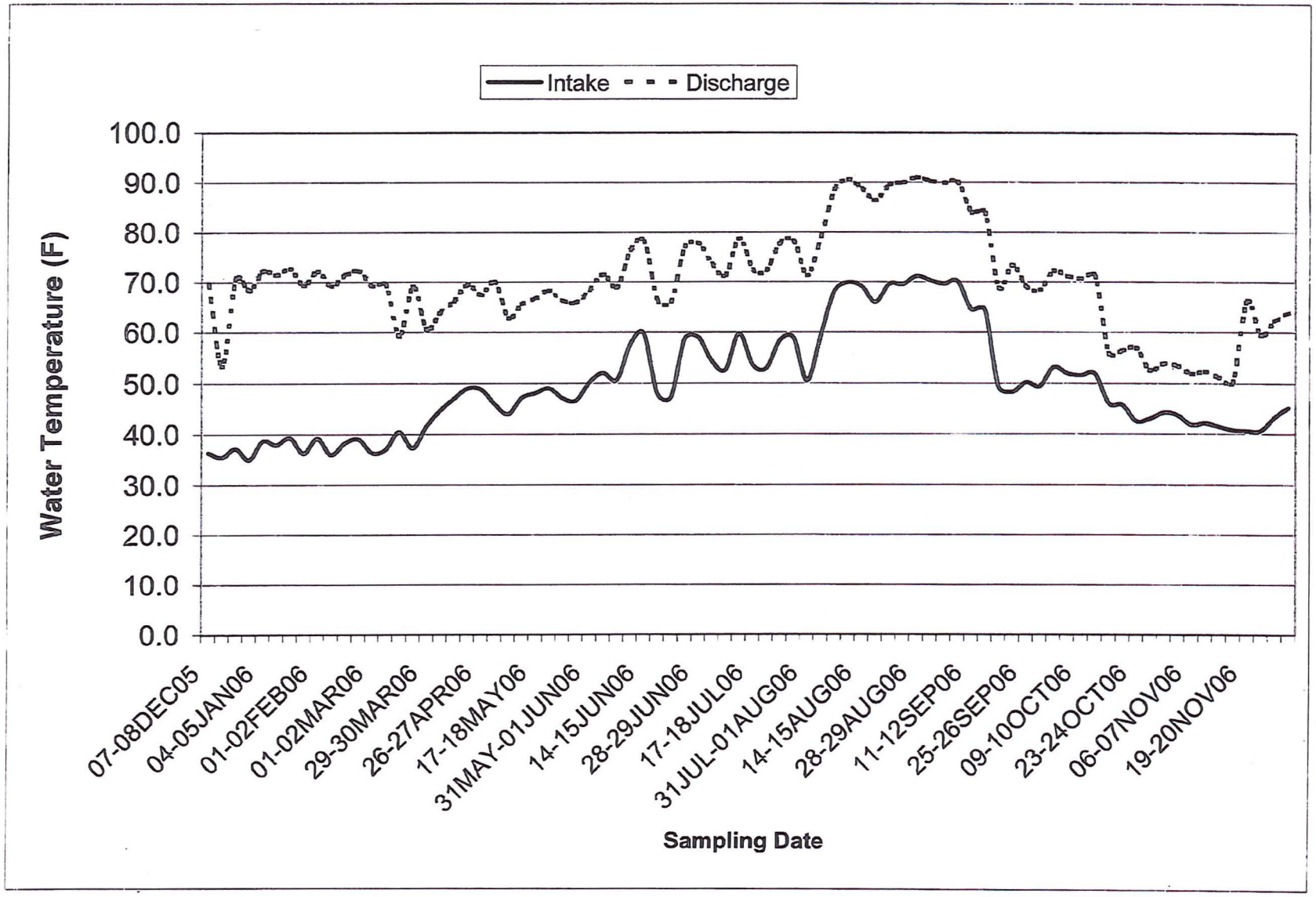


Figure 3-6. Total Impingement Estimates by Extrapolation Period for Point Beach Nuclear Plant, 4 December 2005 - 2 December 2006.

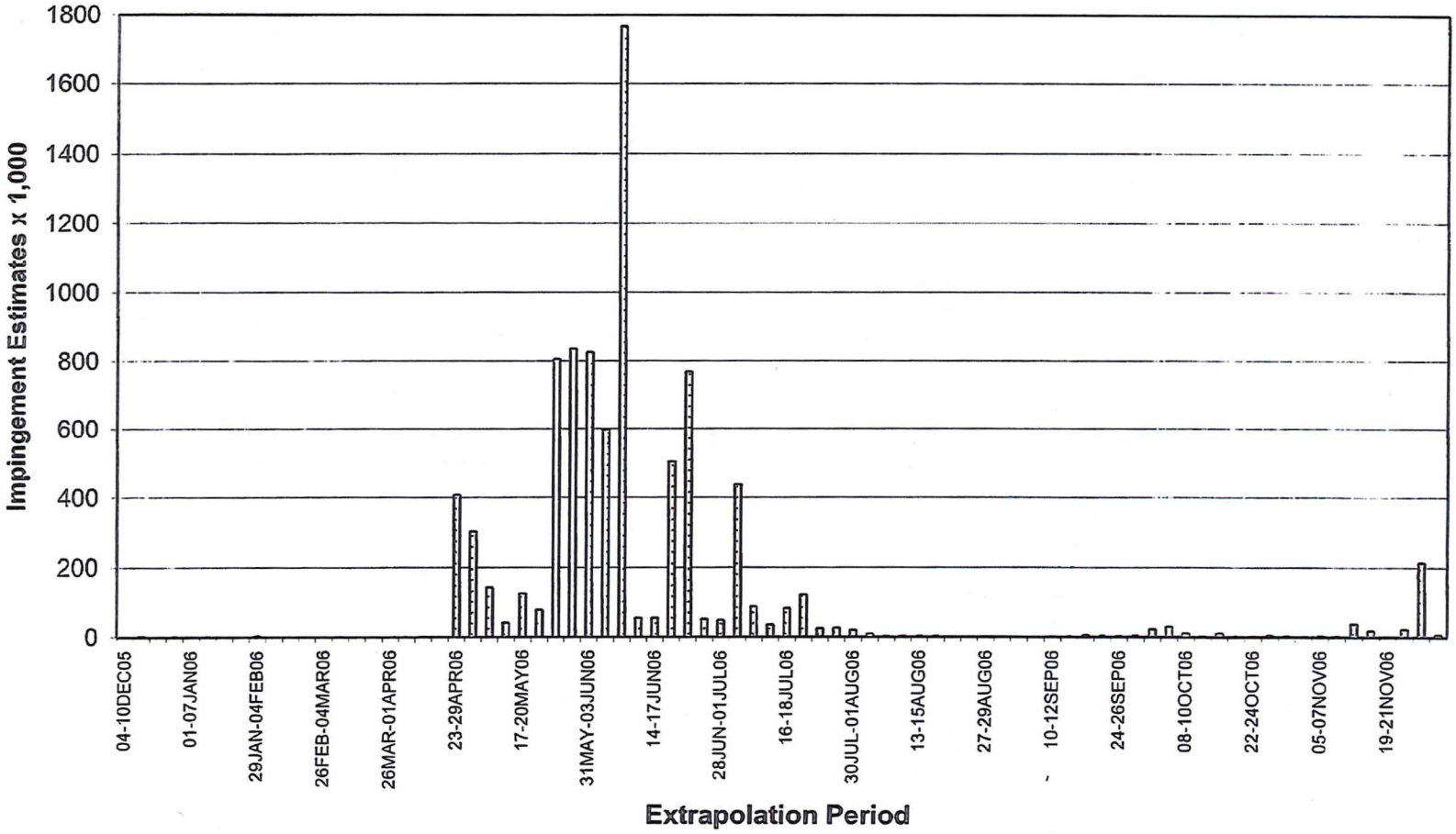
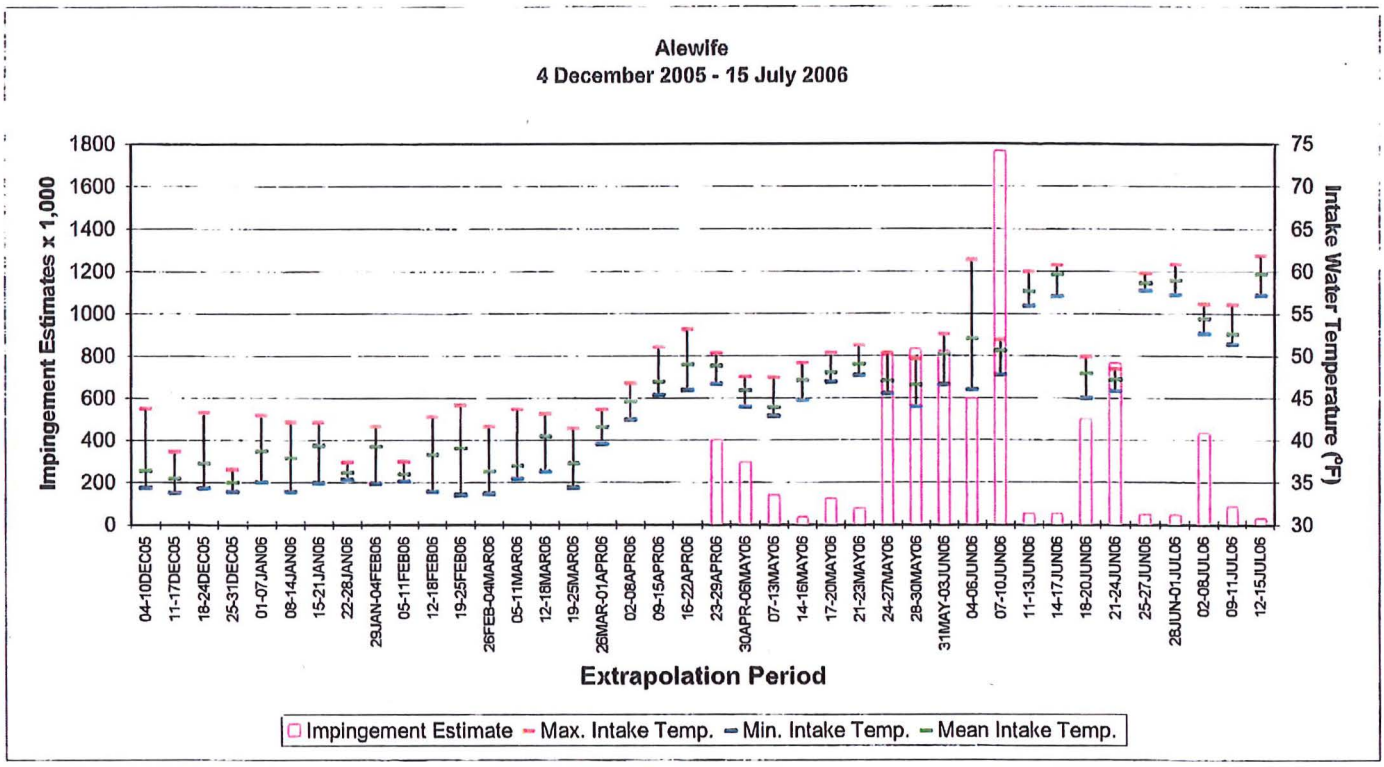


Figure 3-7. Alewife Impingement Estimates vs. Intake Temperatures at PBNP, December 2005 - December 2006.



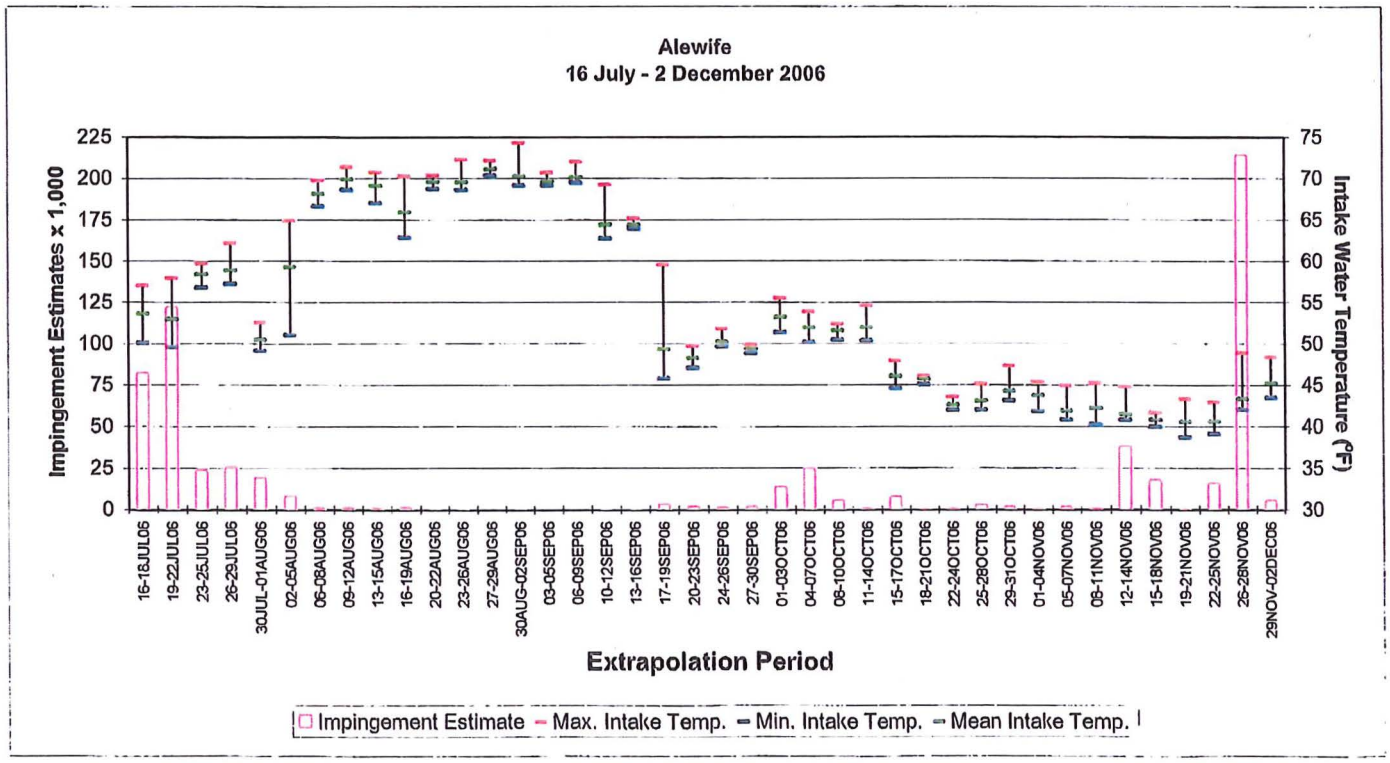
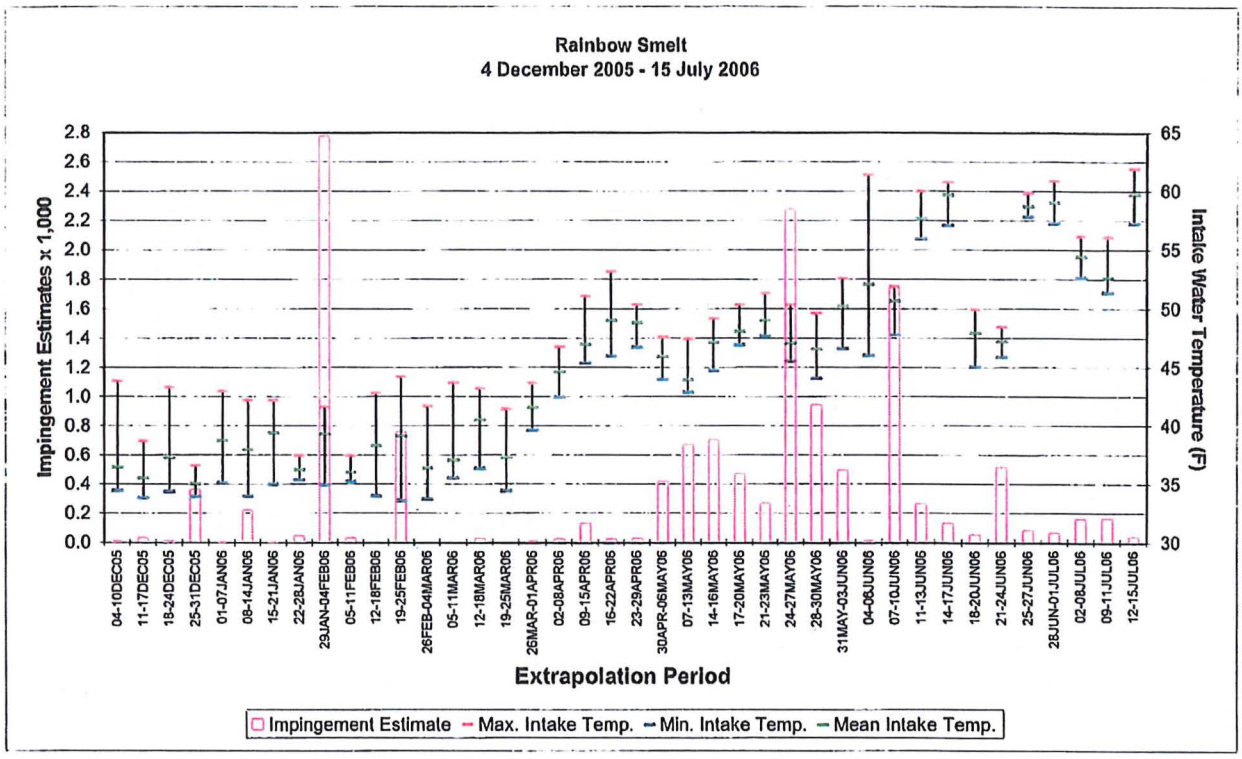


Figure 3-8. Rainbow Smelt Impingement Estimates vs. Intake Temperatures at Point Beach Nuclear Plant, December 2005 - December 2006.



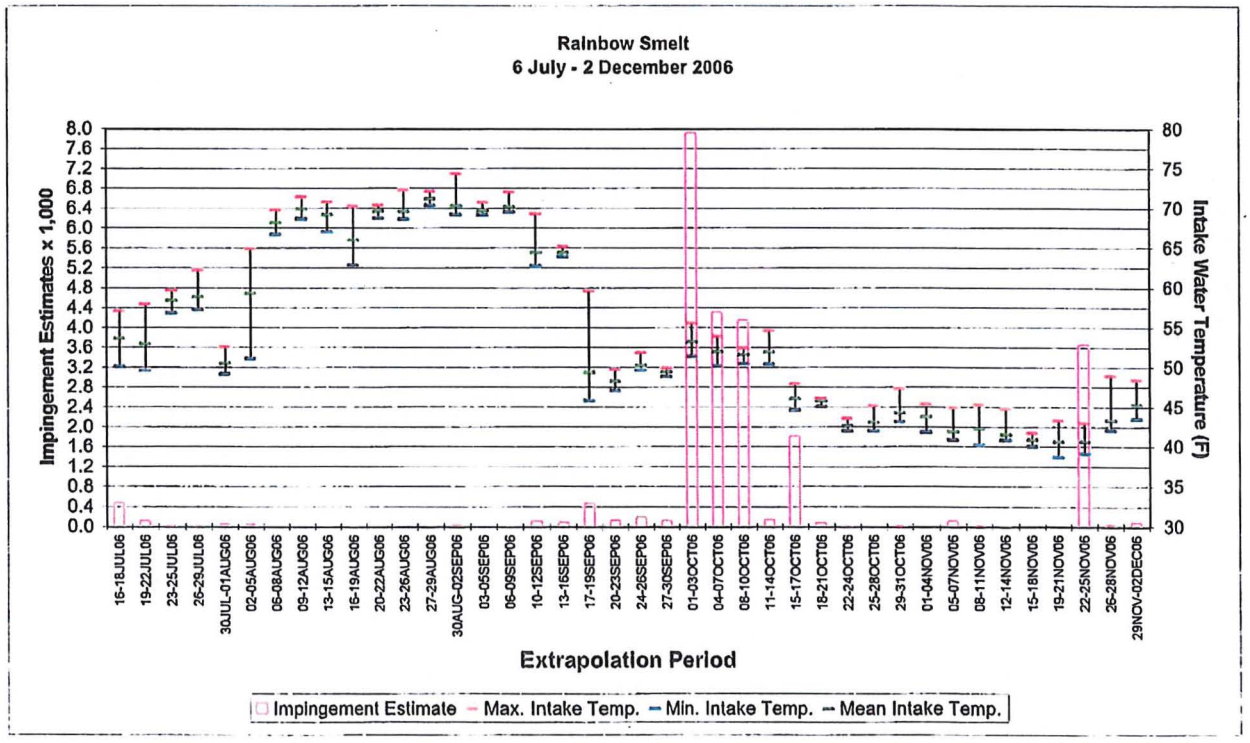
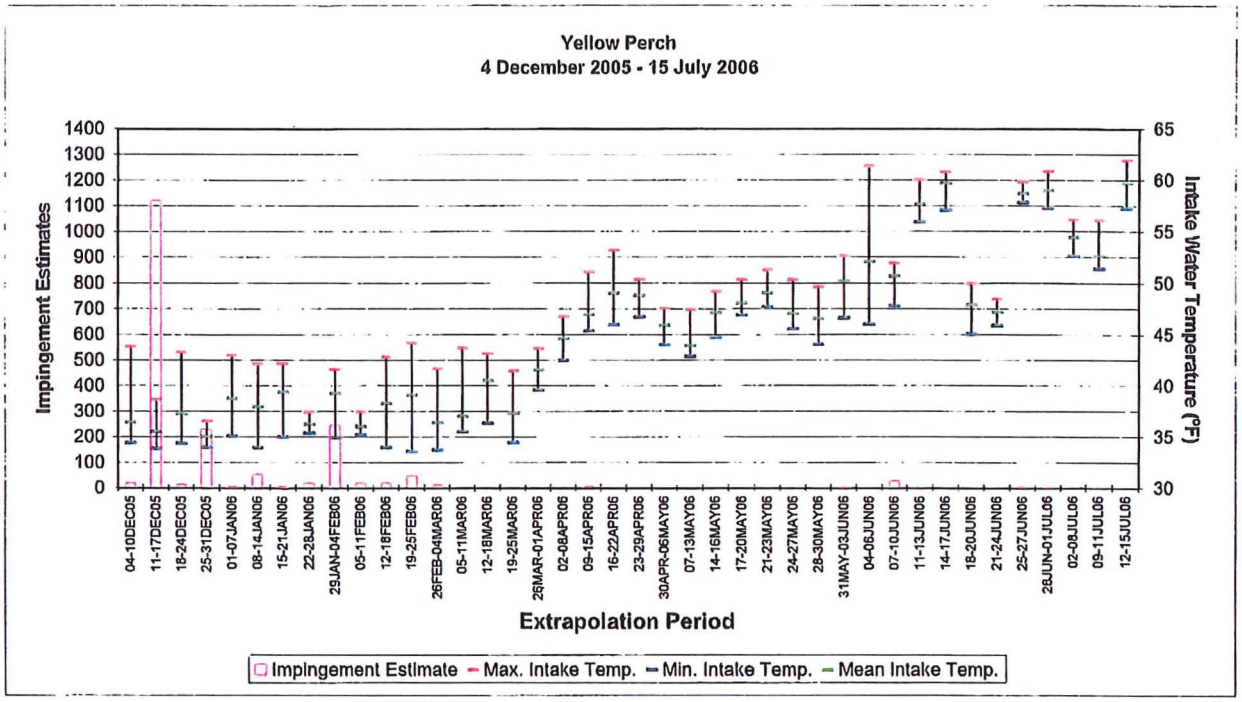


Figure 3-9. Yellow Perch Impingement Estimates vs. Intake Temperatures at Point Beach Nuclear Plant, December 2006 - December 2006.



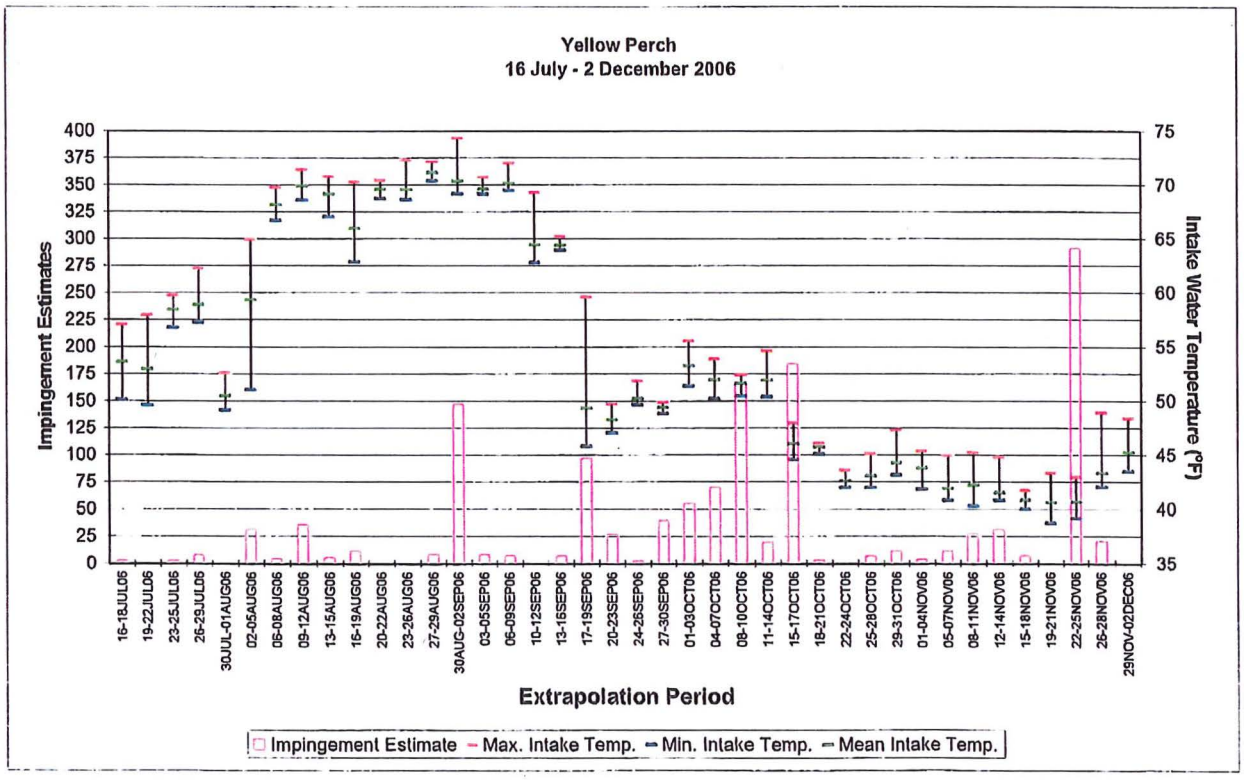


Figure 3-10. Impingement Estimates of Gizzard Shad at PBNP, December 2005 - November 2006.

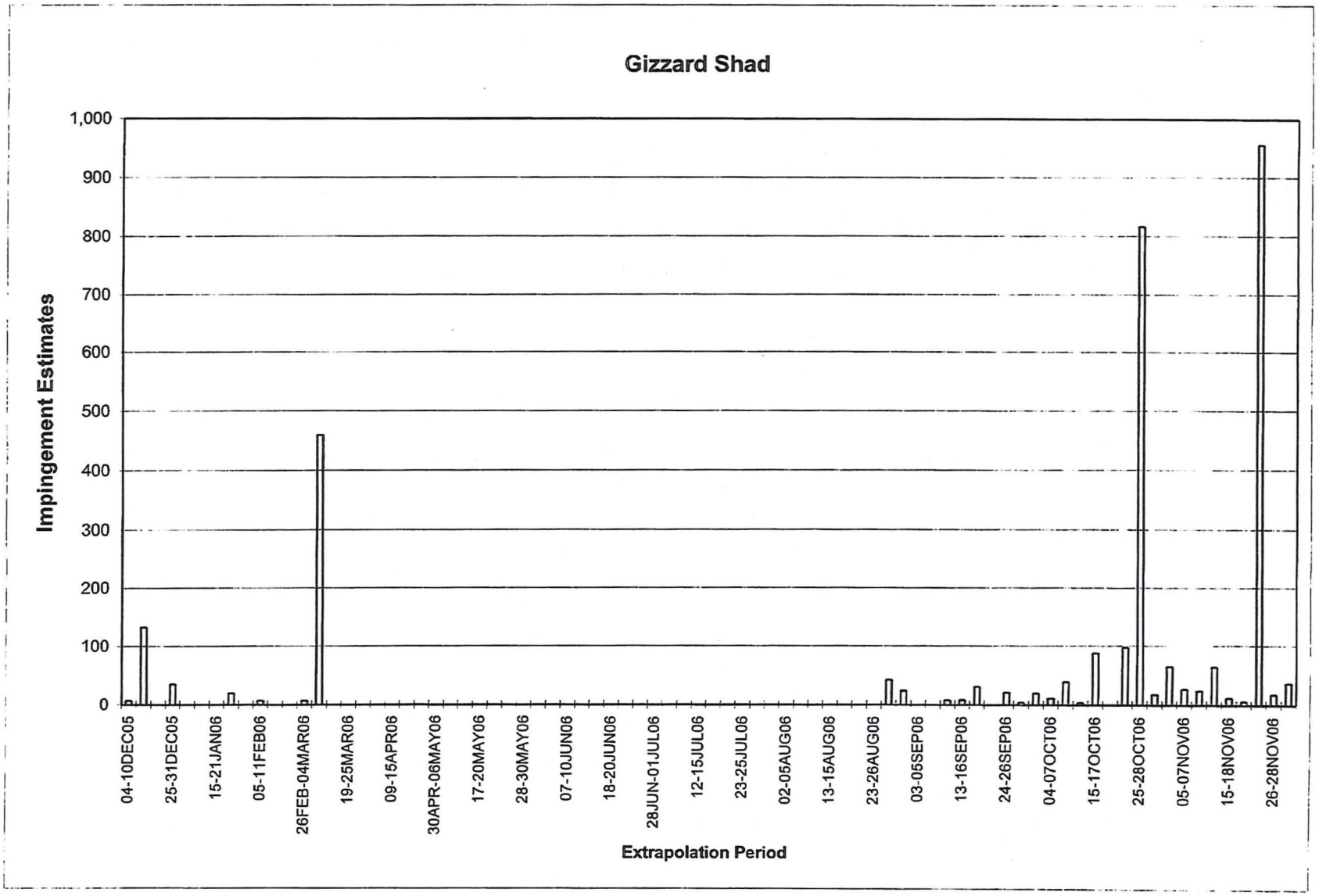


Figure 3-11. Impingement Estimates of Spottail Shiner at PBNP, December 2005 - November 2006.

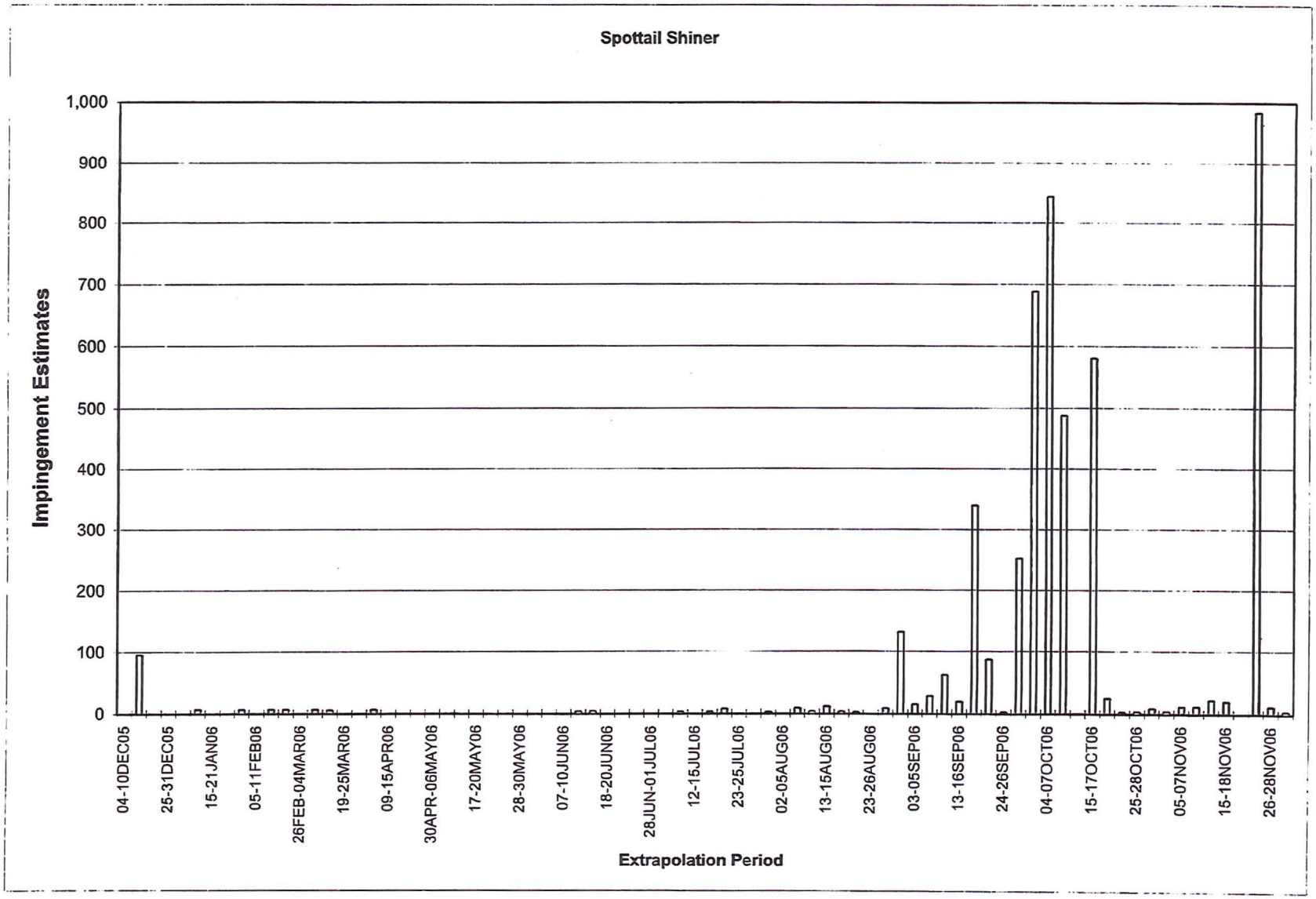


Figure 3-12. Impingement Estimates of Mottled Sculpin at PBNP, December 2005 - November 2006.

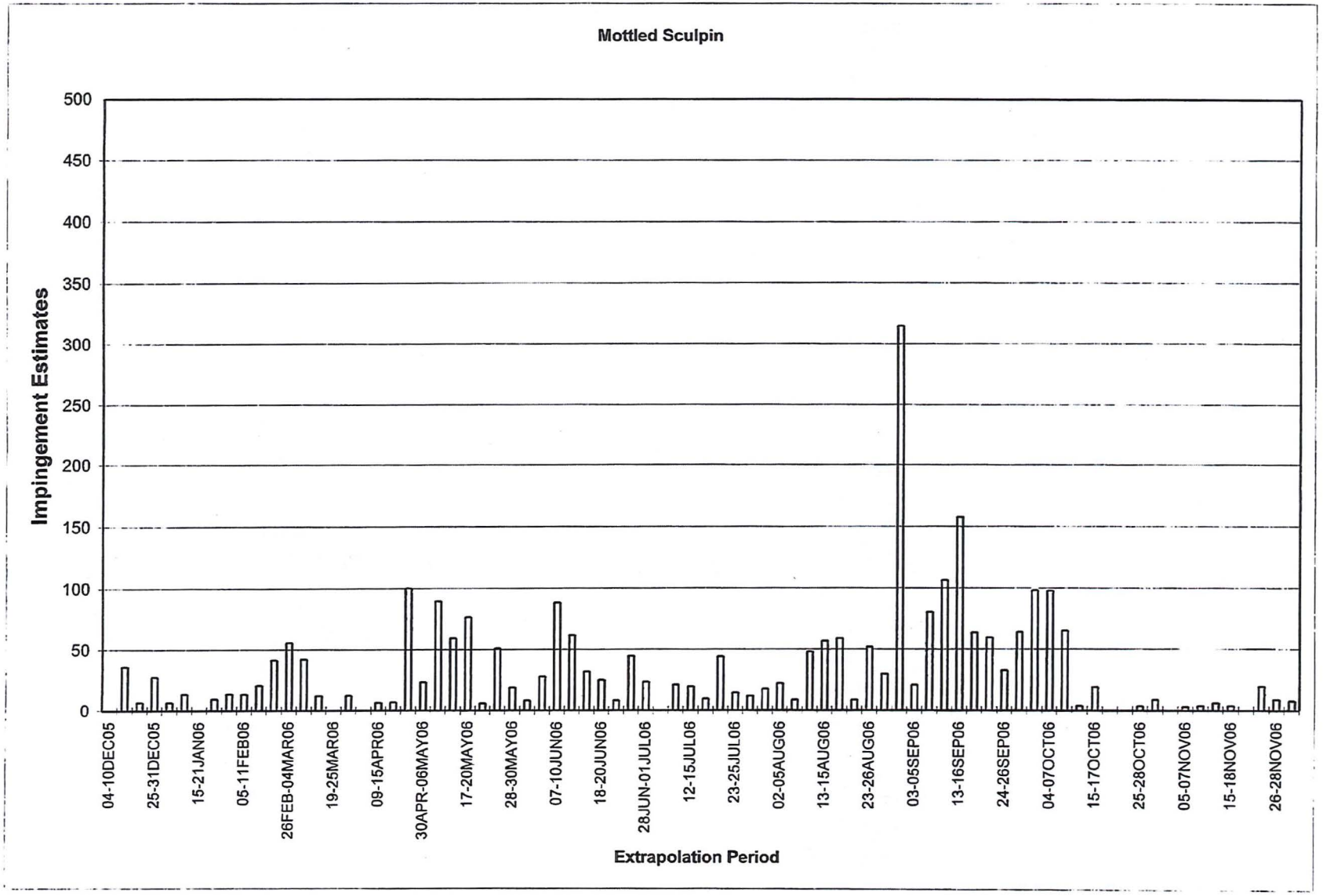
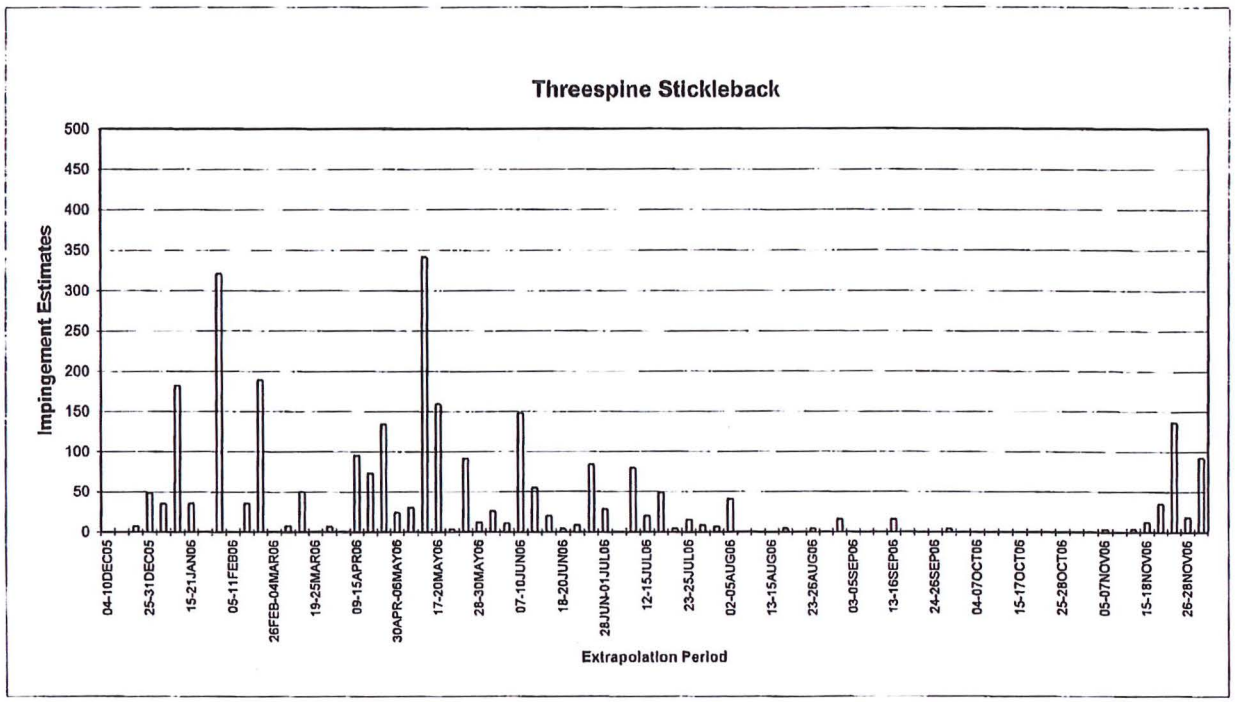
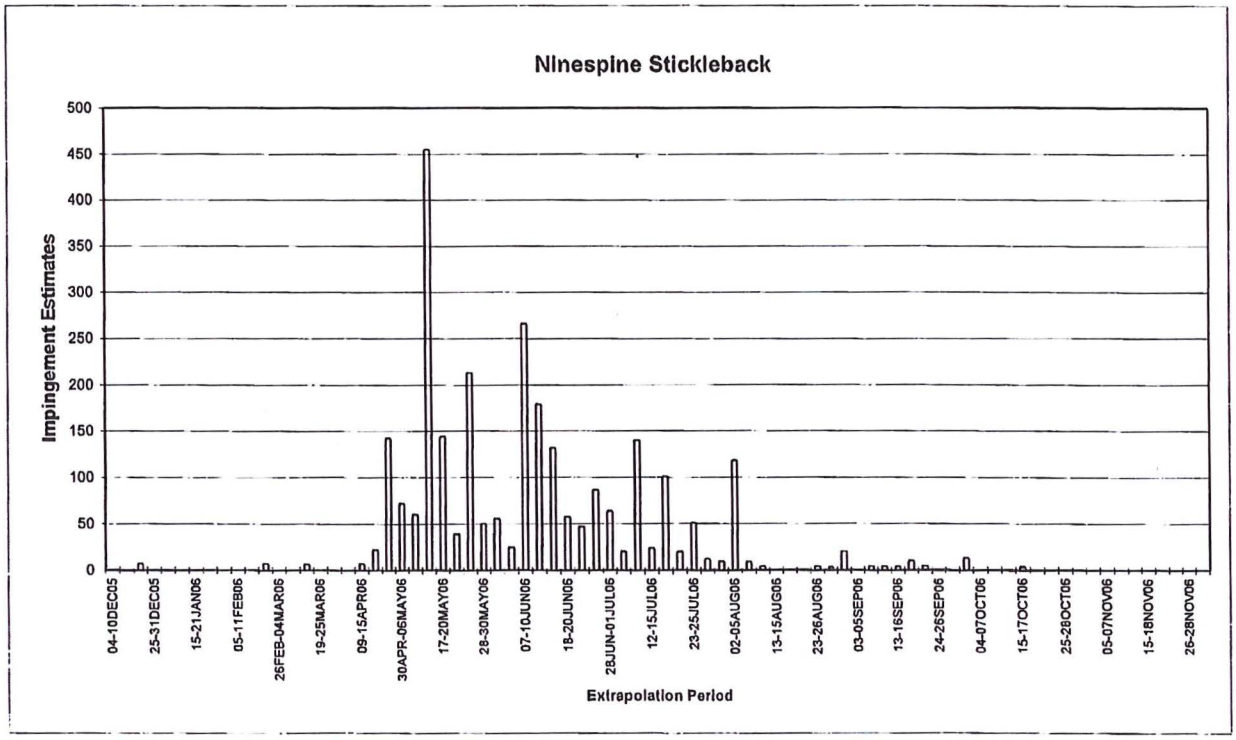


Figure 3-13. Impingement Estimates of Sticklebacks at PBNP, December 2005 - November 2006.





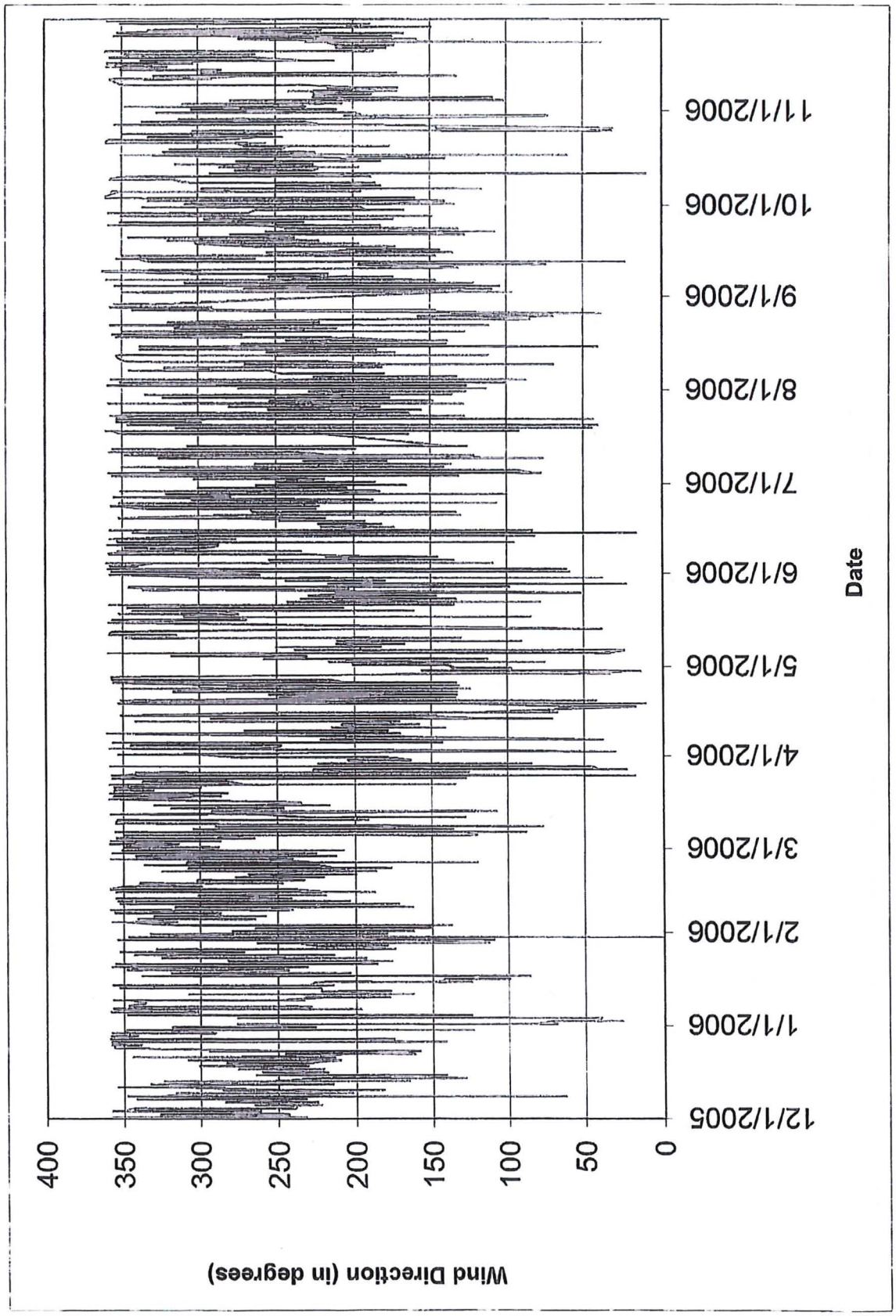
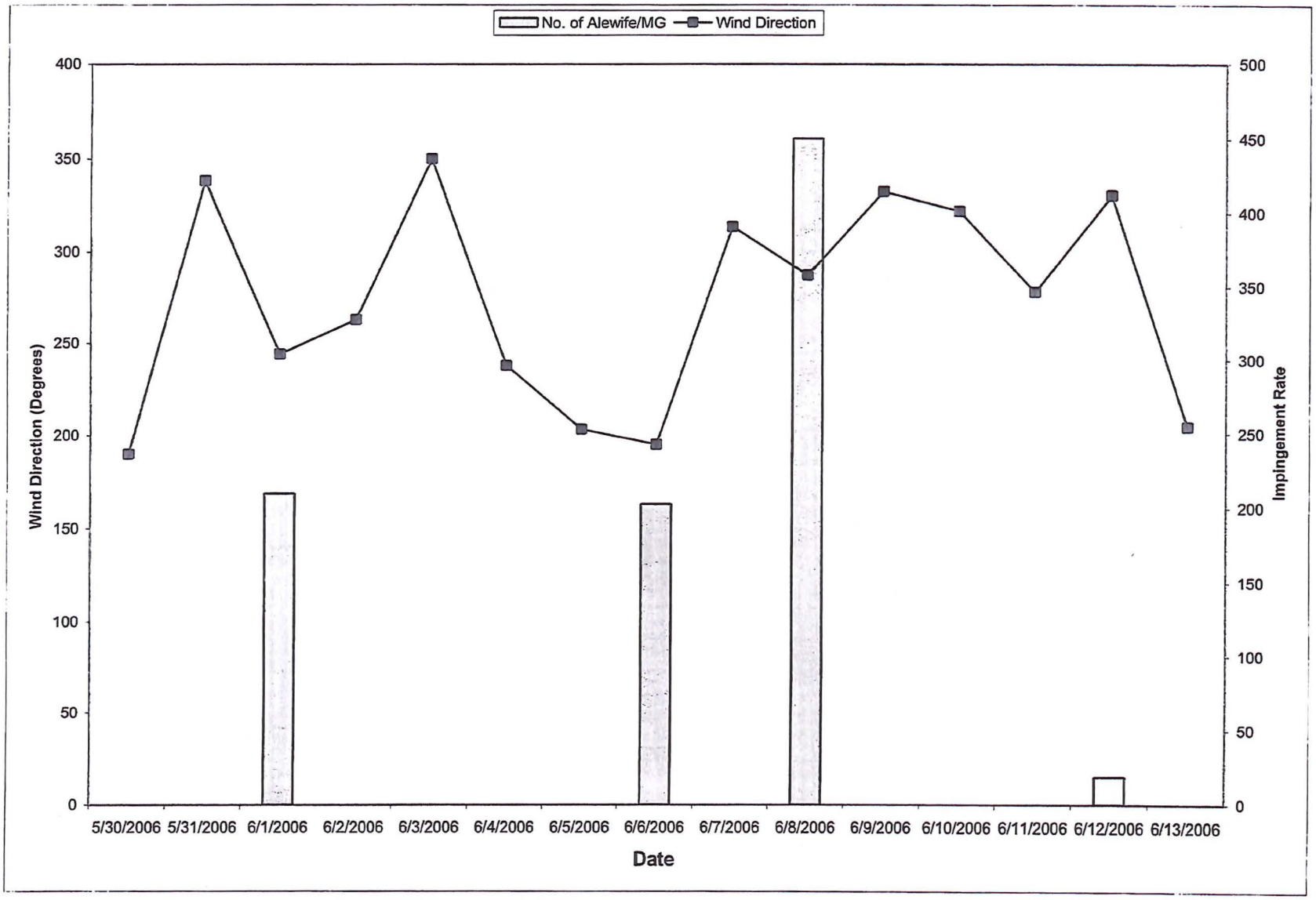


Figure 4-1. Hourly Wind Direction Recorded at Point Beach Nuclear Plant, December 2005 - November 2006.

Figure 4-2. Wind Direction and Associated Impingement of Alewife at PBNP, 30 May - 13 June 2006.



TABLES

Table 2-1. Summary of Sample Volumes and Extapolation Volumes for the Point Beach Nuclear Plant Entrainment Study, April 2006 – September 2006.

Sampling Event	Sampling Period	Sample Volume (gallons x 10^6)	Extrapolation Period	Extrapolation Volume (gallons x 10^6)
1	19-20APR06	0.107935	16-22APR06	6782.4
2	26-27APR06	0.106307	23-29APR06	6854.4
3	03-04MAY06	0.108353	30APR-06MAY06	6180.5
4	10-11MAY06	0.105919	07-13MAY06	6854.4
5	17-18MAY06	0.108685	14-20MAY06	6854.4
6	24-25MAY06	0.105947	21-27MAY06	6854.4
7	31MAY-01JUN06	0.107955	28MAY-03JUN06	6854.4
8	07-08JUN06	0.106165	04-10JUN06	6854.4
9	14-15JUN06	0.106414	11-17JUN06	6854.4
10	21-22JUN06	0.105914	18-24JUN06	6854.4
11	28-29JUN06	0.107460	25JUN-01JUL06	6854.4
12	10-11JUL06	0.106067	02-08JUL06	6854.4
13	12-13JUL06	0.105875	09-15JUL06	6854.4
14	19-20JUL06	0.106945	16-22JUL06	6854.4
15	26-27JUL06	0.105737	23-29JUL06	6854.4
16	02-03AUG06	0.105970	30JUL-05AUG06	6854.4
17	09-10AUG06	0.105851	06-12AUG06	6854.4
18	16-17AUG06	0.109094	13-19AUG06	6854.4
19	23-24AUG06	0.106305	20-26AUG06	6854.4
20	30-31AUG06	0.106000	27AUG-02SEP06	6854.4
21	06-07SEP06	0.106028	03-09SEP06	6854.4
22	13-14SEP06	0.106109	10-16SEP06	6854.4
23	18-19SEP06	0.106116	17-23SEP06	6577.2
24	27-28SEP06	0.106139	24-30SEP06	6854.4

Table 2-2. Summary of Water Use During Impingement Sampling Events and Extrapolation Periods for the Point Beach Nuclear Plant, 4 December 2005 – 2 December 2006.

Sampling Event	Sampling Period	Extrapolation Period	Sample Duration (hours)	Average Intake Flow (MG/hr.)	Sample Volume (gals x 10^6)	Week Weights	Extrapolation Volume (gals x 10^6)
1	07-08DEC05	04-10DEC05	24.00	23.5200	564.4800	1.00	3951.5
2	14-15DEC05	11-17DEC05	13.18	23.5200	310.0720	1.00	3739.4
3	21-22DEC05	18-24DEC05	24.00	23.5200	564.4800	1.00	3951.5
4	28-29DEC05	25-31DEC05	24.00	23.5200	564.4800	1.00	3951.5
5	04-05JAN06	01-07JAN06	24.00	23.5200	564.4800	1.00	3951.5
6	11-12JAN06	08-14JAN06	24.00	23.5200	564.4800	1.00	3951.5
7	18-19JAN06	15-21JAN06	24.00	23.5200	564.4800	1.00	3951.5
8	25-26JAN06	22-28JAN06	17.00	23.5200	399.8400	1.00	3951.5
9	01-02FEB06	29JAN-04FEB06	23.93	23.5200	562.9120	1.00	4009.4
10	08-09FEB06	05-11FEB06	24.00	23.5200	564.4800	1.00	3951.5
11	15-16FEB06	12-18FEB06	23.75	23.5200	558.6000	1.00	3951.5
12	22-23FEB06	19-25FEB06	24.00	23.5200	564.4800	1.00	3951.5
13	01-02MAR06	26FEB-04MAR06	24.00	23.5200	564.4800	1.00	3951.5
14	08-09MAR06	05-11MAR06	23.75	23.5200	558.6000	1.00	3951.5
15	15-16MAR06	12-18MAR06	23.08	40.8000	941.8000	1.00	5869.9
16	22-23MAR06	19-25MAR06	24.25	23.5200	570.3600	1.00	3951.5
17	29-30MAR06	26MAR-01APR06	23.00	40.8000	938.4000	1.00	5973.2
18	05-06APR06	02-08APR06	24.08	40.8000	982.6000	1.00	6854.4
19	12-13APR06	09-15APR06	23.45	40.2375	943.5694	1.00	6368.4
20	19-20APR06	16-22APR06	24.12	38.7231	933.8715	1.00	6782.4
21	26-27APR06	23-29APR06	20.08	40.8000	819.4000	1.00	6854.4
22	03-04MAY06	30APR-06MAY06	23.07	33.6000	775.0400	1.00	6180.5
23	10-11MAY06	07-13MAY06	11.20	40.8000	456.9600	1.00	6854.4
24	15-16MAY06	14-16MAY06	13.30	40.8000	542.6400	0.43	2937.6
25	17-18MAY06	17-20MAY06	19.97	40.8000	814.6400	0.57	3916.8
26	22-23MAY06	21-23MAY06	24.03	40.8000	980.5600	0.43	2937.6
27	24-25MAY06	24-27MAY06	18.63	40.8000	760.2400	0.57	3916.8
28	29-30MAY06	28-30MAY06	18.53	40.8000	756.1600	0.43	2937.6
29	31MAY-01JUN06	31MAY-03JUN06	22.50	40.8000	918.0000	0.57	3916.8

Table 2-2. (cont.)

Sampling Event	Sampling Period	Extrapolation Period	Sample Duration (hours)	Average Intake Flow (MG/hr.)	Sample Volume (gals x 10^6)	Week Weights	Extrapolation Volume (gals x 10^6)
30	05-06JUN06	04-06JUN06	20.50	40.8000	836.4000	0.43	2937.6
31	07-08JUN06	07-10JUN06	3.25	40.8000	132.6000	0.57	3916.8
32	12-13JUN06	11-13JUN06	19.77	40.8000	806.4800	0.43	2937.6
33	14-15JUN06	14-17JUN06	24.12	40.8000	983.9600	0.57	3916.8
34	19-20JUN06	18-20JUN06	22.55	40.8000	920.0400	0.43	2937.6
35	21-22JUN06	21-24JUN06	22.52	40.8000	918.6800	0.57	3916.8
36	26-27JUN06	25-27JUN06	24.07	40.8000	981.9200	0.43	2937.6
37	28-29JUN06	28JUN-01JUL06	24.05	40.8000	981.2400	0.57	3916.8
38	03JUL06	02-08JUL06	8.17	40.8000	333.2000	1.00	6854.4
39	05-06JUL06	NO SAMPLE	0.00	–	–	–	–
40	10-11JUL06	09-11JUL06	20.08	40.8000	819.4000	0.43	2937.6
41	12-13JUL06	12-15JUL06	24.05	40.8000	981.2400	0.57	3916.8
42	17-18JUL06	16-18JUL06	22.12	40.8000	902.3600	0.43	2937.6
43	19-20JUL06	19-22JUL06	23.80	40.8000	971.0400	0.57	3916.8
44	24-25JUL06	23-25JUL06	23.98	40.8000	978.5200	0.43	2937.6
45	26-27JUL06	26-29JUL06	23.83	40.8000	972.4000	0.57	3916.8
46	31JUL-01AUG06	30JUL-01AUG06	23.73	40.8000	968.3200	0.43	2937.6
47	02-03AUG06	02-05AUG06	21.17	40.8000	863.6000	0.57	3916.8
48	07-08AUG06	06-08AUG06	16.08	40.8000	656.2000	0.43	2937.6
49	09-10AUG06	09-12AUG06	23.83	40.8000	972.4000	0.57	3916.8
50	14-15AUG06	13-15AUG06	24.03	40.8000	980.5600	0.43	2937.6
51	16-17AUG06	16-19AUG06	24.33	40.8000	992.8000	0.57	3916.8
52	21-22AUG06	20-22AUG06	24.17	40.8000	986.0000	0.43	2937.6
53	23-24AUG06	23-26AUG06	24.03	40.8000	980.5600	0.57	3916.8
54	28-29AUG06	27-29AUG06	24.00	40.8000	979.2000	0.43	2937.6
55	30-31AUG06	30AUG-02SEP06	24.05	40.8000	981.2400	0.57	3916.8
56	04-05SEP06	03-05SEP06	23.83	40.8000	972.4000	0.43	2937.6
57	06-07SEP06	06-09SEP06	23.80	40.8000	971.0400	0.57	3916.8
58	11-12SEP06	10-12SEP06	19.58	40.8000	799.0000	0.43	2937.6

Table 2-2. (cont.)

Sampling Event	Sampling Period	Extrapolation Period	Sample Duration (hours)	Average Intake Flow (MG/hr.)	Sample Volume (gals x 10^6)	Week Weights	Extrapolation Volume (gals x 10^6)
59	13-14SEP06	13-16SEP06	24.38	40.8000	994.8400	0.57	3916.8
60	18-19SEP06	17-19SEP06	21.42	40.8000	873.8000	0.43	2937.6
61	20-21SEP06	20-23SEP06	23.90	33.1968	793.4035	0.57	3639.6
62	25-26SEP06	24-26SEP06	24.03	40.8000	980.5600	0.43	2937.6
63	27-28SEP06	27-30SEP06	23.92	40.8000	975.8000	0.57	3916.8
64	02-03OCT06	01-03OCT06	21.95	40.8000	895.5600	0.43	2937.6
65	04-05OCT06	04-07OCT06	17.63	40.8000	719.4400	0.57	3916.8
66	09-10OCT06	08-10OCT06	24.20	40.8000	987.3600	0.43	2937.6
67	11-12OCT06	11-14OCT06	24.00	40.8000	979.2000	0.57	3916.8
68	16-17OCT06	15-17OCT06	23.90	25.7520	615.4728	0.43	1998.0
69	18-19OCT06	18-21OCT06	24.00	21.0000	504.0000	0.57	1774.0
70	23-24OCT06	22-24OCT06	24.00	15.6000	374.4000	0.43	1261.4
71	25-26OCT06	25-28OCT06	24.40	21.0000	512.4000	0.57	1938.2
72	30-31OCT06	29-31OCT06	24.00	21.0000	504.0000	0.43	1512.0
73	01-02NOV06	01-04NOV06	23.80	21.0000	499.8000	0.57	2016.0
74	06-07NOV06	05-07NOV06	24.38	21.0000	512.0500	0.43	1512.0
75	08-09NOV06	08-11NOV06	24.03	21.0000	504.7000	0.57	2016.0
76	13-14NOV06	12-14NOV06	23.98	21.0000	503.6500	0.43	1598.4
77	15-16NOV06	15-18NOV06	24.13	31.8000	767.4400	0.57	3052.8
78	19-20NOV06	19-21NOV06	24.00	31.8000	763.2000	0.43	2424.6
79	21-22NOV06	22-25NOV06	24.00	40.8000	979.2000	0.57	3916.8
80	27-28NOV06	26-28NOV06	23.95	40.8000	977.1600	0.43	2937.6
81	29-30NOV06	29NOV-02DEC06	24.00	40.8000	979.2000	0.57	3916.8

Table 2-3. Summary of Debris Volumes, Associated Multiplication Factors, and Total Number of Fish Impinged during Sampling Events that were Subsampled, Point Beach Nuclear Plant, December 2005 - November 2006.

Sampling Period	Total Debris Volume (gal.)	Multiplication Factor	Total No. of Fish in Sample
26-27APR06	80.0	4.00	48,860
17-18MAY06	27.0	1.25	26,441
22-23MAY05	39.5	1.80	26,734
24-25MAY06	118.0	5.90	156,414
29-30MAY04	312.0	15.60	215,303
31MAY-1JUN06	302.0	13.13	193,625
5-6JUN06	164.0	8.20	170,232
19-20JUN06	33.5	7.75	158,077

Table 3-1. Plant Loads during Entrainment Sampling Events, Point Beach Nuclear Plant, 19-20 April 2006 – 27-28 September 2006.

Data for Discrete Entrainment Sampling Periods							
Sampling Period	Generation (MWe)						
	Unit 1			Unit 2			
	Min.	Mean	Max.	Min.	Mean	Max.	Total[1]
19-20APR06	534	535	539	532	542	546	1,077
26-27APR06	535	536	537	543	545	546	1,080
03-04MAY06	527	534	538	536	542	546	1,076
10-11MAY06	535	537	538	544	545	546	1,082
17-18MAY06	536	537	539	543	545	548	1,082
24-25MAY06	534	536	538	543	545	546	1,081
31MAY-01JUN06	533	536	541	543	544	545	1,080
07-08JUN06	534	536	540	543	545	546	1,081
14-15JUN06	529	530	532	537	539	540	1,069
21-22JUN06	536	537	539	545	545	545	1,082
28-29JUN06	526	530	532	537	539	542	1,069
10-11JUL06	532	534	538	542	543	544	1,077
12-13JUL06	527	530	533	536	538	541	1,068
19-20JUL06	527	534	537	537	542	544	1,076
26-27JUL06	527	530	535	535	539	541	1,069
02-03AUG06	528	532	538	535	539	543	1,071
09-10AUG06	521	522	523	524	527	536	1,049
16-17AUG06	519	525	529	525	530	533	1,055
23-24AUG06	518	521	523	524	526	528	1,047
30-31AUG06	517	521	525	523	526	528	1,047
06-07SEP06	515	520	521	525	526	529	1,046
13-14SEP06	524	526	529	531	532	533	1,059
18-19SEP06	521	527	534	527	534	541	1,062
27-28SEP06	534	537	543	542	543	544	1,081

[1]Combined mean generation (MWe) for Units 1 and 2.

Table 3-2. Water Use during Entrainment Sampling at Point Beach Nuclear Plant, 19-20 April 2006 - 27-28 September 2006.

Sampling Period	No. of Circulating Pumps			Intake Flows[1]		
	Min.	Mean	Max.	Min.	Mean	Max.
19-20APR06	3	3.8	4	763	929	979
26-27APR06	4	4.0	4	979	979	979
03-04MAY06	2	3.2	4	564	806	979
10-11MAY06	4	4.0	4	979	979	979
17-18MAY06	4	4.0	4	979	979	979
24-25MAY06	4	4.0	4	979	979	979
31MAY-01JUN06	4	4.0	4	979	979	979
07-08JUN06	4	4.0	4	979	979	979
14-15JUN06	4	4.0	4	979	979	979
21-22JUN06	4	4.0	4	979	979	979
28-29JUN06	4	4.0	4	979	979	979
10-11JUL06	4	4.0	4	979	979	979
12-13JUL06	4	4.0	4	979	979	979
19-20JUL06	4	4.0	4	979	979	979
26-27JUL06	4	4.0	4	979	979	979
02-03AUG06	4	4.0	4	979	979	979
09-10AUG06	4	4.0	4	979	979	979
16-17AUG06	4	4.0	4	979	979	979
23-24AUG06	4	4.0	4	979	979	979
30-31AUG06	4	4.0	4	979	979	979
06-07SEP06	4	4.0	4	979	979	979
13-14SEP06	4	4.0	4	979	979	979
18-19SEP06	4	4.0	4	979	979	979
27-28SEP06	4	4.0	4	979	979	979

[1] Circulating water flow, in millions of gallons per day.

Table 3-3. Water Temperatures Recorded during Entrainment Sampling at Point Beach Nuclear Station, 19-20 April 2006 – 27-28 September 2006.

	Intake Temperature (°F)			Discharge Temperature (°F)		
Sampling Period	Min.	Mean	Max.	Min.	Mean	Max.
19-20APR06	46.0	49.0	53.2	64.7	69.5	83.7
26-27APR06	46.7	48.8	50.4	65.3	67.4	68.8
03-04MAY06	44.0	45.9	47.6	64.0	70.1	80.0
10-11MAY06	42.9	43.9	47.4	61.5	62.8	65.5
17-18MAY06	46.9	48.1	50.3	65.6	66.7	68.8
24-25MAY06	45.5	47.1	50.3	64.5	66.2	70.2
31MAY-01JUN06	46.6	50.2	52.6	65.4	68.4	70.7
07-08JUN06	47.8	50.7	51.9	65.5	69.0	70.4
14-15JUN06	57.1	59.7	60.8	75.9	78.2	79.3
21-22JUN06	45.9	47.2	48.5	64.3	66.0	68.1
28-29JUN06	57.3	59.0	60.9	76.0	77.8	79.9
10-11JUL06	51.4	52.6	56.1	70.1	71.3	74.6
12-13JUL06	57.2	59.7	61.9	75.8	78.7	81.2
19-20JUL06	49.6	53.0	57.9	68.3	72.3	79.4
26-27JUL06	57.3	58.9	62.2	76.3	78.2	81.2
02-03AUG06	51.1	59.3	64.9	71.4	79.1	85.1
09-10AUG06	68.6	69.9	71.4	88.8	90.6	93.3
16-17AUG06	62.9	66.0	70.3	82.3	86.4	91.6
23-24AUG06	68.6	69.6	72.3	88.3	90.0	92.5
30-31AUG06	69.2	70.3	74.3	88.8	90.3	93.9
06-07SEP06	69.5	70.2	72.0	89.0	90.1	91.5
13-14SEP06	63.9	64.4	65.2	83.3	83.9	85.5
18-19SEP06	45.8	49.4	59.6	64.7	68.9	80.8
27-28SEP06	48.9	49.4	49.9	67.8	68.4	69.0

Table 3-4. Summary of Water Temperature and Dissolved Oxygen Readings Recorded during Ambient Sampling at Point Beach Nuclear Plant, 19 April 2006 through 18 September 2006.

			Surface		Mid-Depth		Bottom	
Sampling Date	Depth Contour	Sample Period	Temperature (F)	Dissolved Oxygen (mg/L)	Temperature (F)	Dissolved Oxygen (mg/L)	Temperature (F)	Dissolved Oxygen (mg/L)
19-20APR06	6-8FT	DAY	--	--	51.0	14.2	--	--
		NIGHT	--	--	53.7	10.9	--	--
	18FT	DAY	50.4	15.2	46.5	16.5	45.8	15.0
		NIGHT	51.6	11.9	51.6	12.0	49.9	12.7
	30FT	DAY	50.7	14.5	43.9	17.4	43.9	18.7
		NIGHT	49.7	12.3	47.1	12.9	46.0	13.7
26-27APR06	6-8FT	DAY	--	--	47.2	9.7	--	--
		NIGHT	--	--	48.3	9.7	--	--
	18FT	DAY	46.9	9.8	46.9	9.5	46.8	9.5
		NIGHT	47.6	9.4	47.7	9.7	47.6	9.5
	30FT	DAY	47.0	9.8	47.0	9.7	46.2	9.4
		NIGHT	46.3	9.6	46.3	9.4	46.3	9.5
10MAY06	6-8FT	DAY	--	--	44.9	12.2	--	--
	18FT	DAY	43.4	12.3	43.0	12.3	43.2	12.5
	30FT	DAY	42.2	12.6	42.0	12.5	41.9	12.5
17MAY06	6-8FT	NIGHT	--	--	48.5	10.4	--	--
	18FT	NIGHT	47.9	10.7	47.8	10.6	47.7	10.7
	30FT	NIGHT	51.3	10.5	47.4	11.0	46.1	11.3
24-25MAY06	6-8FT	DAY	--	--	47.6	13.1	--	--
		NIGHT	--	--	54.0	11.1	--	--
	18FT	DAY	48.4	13.0	48.4	13.1	48.3	13.0
		NIGHT	50.6	11.6	50.2	12.0	47.8	12.7
	30FT	DAY	44.3	13.8	44.3	13.6	44.3	13.4
		NIGHT	45.4	13.1	44.9	13.0	45.0	13.1
7-8JUN06	6-8FT	DAY	--	--	50.3	13.4	--	--
		NIGHT	--	--	52.2	13.4	--	--
	18FT	DAY	49.6	13.8	49.2	14.0	49.3	13.9
		NIGHT	55.0	13.1	50.9	13.8	50.8	13.8
	30FT	DAY	47.6	13.9	47.0	13.8	45.2	14.3
		NIGHT	51.8	14.0	48.2	14.6	45.1	14.7
14-15JUN06	6-8FT	DAY	--	--	60.6	11.2	--	--
		NIGHT	--	--	61.8	11.5	--	--
	18FT	DAY	61.4	11.2	59.3	11.6	56.3	12.2
		NIGHT	61.4	11.6	60.0	11.3	59.2	11.4
	30FT	DAY	62.8	11.5	57.6	11.9	55.3	12.0
		NIGHT	58.3	11.2	58.2	11.3	55.5	11.9
21-22JUN06	6-8FT	DAY	--	--	57.4	11.8	--	--
		NIGHT	--	--	46.2	13.4	--	--
	18FT	DAY	59.6	11.9	47.4	12.9	46.4	13.3
		NIGHT	47.1	13.4	46.3	13.3	46.1	13.3
	30FT	DAY	50.6	12.3	47.7	12.6	44.5	13.5
		NIGHT	47.8	13.1	47.8	13.0	46.1	13.2
28-29JUN06	6-8FT	DAY	--	--	62.3	12.0	--	--
		NIGHT	--	--	59.6	12.2	--	--
	18FT	DAY	62.8	11.7	57.9	12.1	56.0	12.6
		NIGHT	59.4	11.0	59.5	11.7	56.8	12.2
	30FT	DAY	58.7	11.8	58.2	11.7	56.7	12.2
		NIGHT	61.2	11.5	59.6	11.6	55.6	12.0

Table 3-4 (Cont.)

			Surface		Mid-Depth		Bottom	
Sampling Date	Depth Contour	Sample Period	Temperature (F)	Dissolved Oxygen (mg/L)	Temperature (F)	Dissolved Oxygen (mg/L)	Temperature (F)	Dissolved Oxygen (mg/L)
5-6JUL06	6-8FT	DAY	--	--	69.1	13.0	--	--
		NIGHT	--	--	58.8	15.5	--	--
	18FT	DAY	68.3	13.2	63.3	13.6	56.4	15.6
		NIGHT	60.9	14.1	56.8	14.7	56.3	14.5
	30FT	DAY	63.1	12.1	62.0	12.9	52.8	15.7
		NIGHT	62.7	12.5	53.7	14.9	53.0	15.4
12-13JUL06	6-8FT	DAY	--	--	61.4	12.5	--	--
		NIGHT	--	--	65.3	11.3	--	--
	18FT	DAY	65.1	11.2	58.7	12.0	58.5	12.1
		NIGHT	64.9	16.2	61.8	11.8	57.8	11.7
	30FT	DAY	61.7	11.5	57.2	11.9	56.7	12.3
		NIGHT	65.0	11.0	58.8	12.2	57.0	12.6
19JUL06	6-8FT	DAY	--	--	61.8	12.9	--	--
		NIGHT	--	--	53.5	14.0	--	--
	18FT	DAY	59.8	12.6	59.6	12.7	53.2	14.5
		NIGHT	57.7	13.4	50.5	14.5	50.1	14.3
	30FT	DAY	62.3	12.3	56.5	13.7	55.6	13.9
		NIGHT	56.0	13.4	48.9	14.6	48.5	14.4
26-27JUL06	6-8FT	DAY	--	--	59.0	12.4	--	--
		NIGHT	--	--	59.6	11.9	--	--
	18FT	DAY	62.7	11.4	60.4	11.7	56.1	12.9
		NIGHT	60.4	11.4	57.2	14.0	55.9	12.5
	30FT	DAY	61.9	11.2	55.9	12.4	54.5	13.1
		NIGHT	62.6	11.0	55.4	12.5	54.3	14.4
9-10AUG06	6-8FT	DAY	--	--	69.4	10.4	--	--
		NIGHT	--	--	70.8	8.6	--	--
	18FT	DAY	72.2	8.8	68.6	9.5	68.5	9.6
		NIGHT	70.7	9.2	69.8	9.3	68.3	8.9
	30FT	DAY	70.5	9.1	69.4	9.2	67.8	9.7
		NIGHT	71.2	9.4	70.3	9.1	68.2	9.5
23-24AUG06	6-8FT	DAY	--	--	69.5	8.3	--	--
		NIGHT	--	--	71.2	8.3	--	--
	18FT	DAY	69.6	8.2	69.6	8.3	69.6	8.3
		NIGHT	70.0	8.7	69.9	8.5	69.5	8.3
	30FT	DAY	70.0	8.4	70.0	8.3	69.9	8.3
		NIGHT	69.8	8.7	69.8	8.6	69.9	8.7
6SEP06	6-8FT	DAY	--	--	70.6	8.5	--	--
		NIGHT	--	--	71.4	8.4	--	--
	18FT	DAY	70.4	9.0	70.5	8.9	70.4	8.9
		NIGHT	70.4	8.5	70.6	8.7	70.6	8.8
	30FT	DAY	70.7	8.8	70.7	8.7	70.6	8.3
		NIGHT	70.7	8.6	70.8	8.9	70.8	8.5
18SEP06	6-8FT	DAY	--	--	60.0	8.5	--	--
		NIGHT	--	--	50.9	8.6	--	--
	18FT	DAY	58.2	8.6	55.9	8.7	49.8	9.3
		NIGHT	50.2	8.5	48.0	8.8	47.8	8.7
	30FT	DAY	52.5	8.5	49.8	8.6	45.5	9.0
		NIGHT	46.8	8.8	46.4	8.7	45.9	8.9

NOTE: -- indicates that a measurement was not taken at bottom or surface depth for sampling sites at 6-8FT.

Table 3-5. Descriptive Statistics for Water Temperature and Dissolved Oxygen Readings Recorded during Ambient Sampling Events in the Vicinity of Point Beach Nuclear Plant, April – September 2006.

	Surface Temperatures (°F)					
	6-8FT		18FT		30FT	
Statistic	DAY	NIGHT	DAY	NIGHT	DAY	NIGHT
MIN	--	--	43.4	47.1	42.2	45.4
MEAN	--	--	59.3	57.9	57.3	57.3
MAX	--	--	72.2	70.7	70.7	71.2
	Mid-Depth Temperatures (°F)					
MIN	44.9	46.2	43.0	46.3	42.0	44.9
MEAN	58.9	57.9	56.6	56.2	55.0	54.6
MAX	70.6	71.4	70.5	70.6	70.7	70.8
	Bottom Temperatures (°F)					
MIN	--	--	43.2	46.1	41.9	45.0
MEAN	--	--	54.7	55.1	53.2	53.3
MAX	--	--	70.4	70.6	70.6	70.8

	Surface Dissolved Oxygen (mg/L)					
	6-8FT		18FT		30FT	
	DAY	NIGHT	DAY	NIGHT	DAY	NIGHT
MIN	--	--	8.2	8.5	8.4	8.6
MEAN	--	--	11.4	11.4	11.4	11.2
MAX	--	--	15.2	16.2	14.5	14.0
	Mid-Depth Dissolved Oxygen (mg/L)					
MIN	8.3	8.3	8.3	8.5	8.3	8.6
MEAN	11.5	11.2	11.7	11.5	11.8	11.6
MAX	14.2	15.5	16.5	14.7	17.4	14.9
	Bottom Dissolved Oxygen (mg/L)					
MIN	--	--	8.3	8.3	8.3	8.5
MEAN	--	--	12.1	11.5	12.3	12.0
MAX	--	--	15.6	14.5	18.7	15.4

Table 3-6. Comparisons of the Number, Density, and Relative Abundance of Shellfish and Ichthyoplankton Among the Four Sampling Locations Near Point Beach Nuclear Plant for Concurrent Sampling Events, April - September 2006.

		Onshore			Offshore Depth Contours								
		Entrainment			6-8 FT			18 FT			30 FT		
Taxa	Life Stage	No.	Density	%	No.	Density	%	No.	Density	%	No.	Density	%
Shellfish													
UNID AMPHIPODA		–	–	–	3	0.4	0.20	–	–	–	–	–	–
Gammarus		37,974	6,289.1	100.00	1,509	185.5	99.80	1,784	71.4	99.89	1,871	74.8	99.89
Hyalella azteca		1	0.2	0.00	–	–	–	–	–	–	–	–	–
Mysis relicta		–	–	–	–	–	–	2	0.1	0.11	2	0.1	0.11
Total Shellfish		37,975	6,289.3	100.00	1,512	185.9	100.00	1,786	71.4	100.00	1,873	74.9	100.00
Ichthyoplankton													
UNID CLUPEIDAE	YOLK-SAC	–	–	–	104	12.8	6.68	153	6.1	11.57	58	2.3	4.88
	POST YOLK-SAC	–	–	–	5	0.6	0.32	30	1.2	2.27	40	1.6	3.36
	LARVAE	1	0.2	0.79	–	–	–	8	0.3	0.61	–	–	–
ALEWIFE	EGG	–	–	–	5	0.6	0.32	–	–	–	7	0.3	0.59
	YOLK-SAC	–	–	–	–	–	–	1	0.0	0.08	3	0.1	0.25
	POST YOLK-SAC	–	–	–	–	–	–	3	0.1	0.23	2	0.1	0.17
	JUVENILE	4	0.7	3.15	1	0.1	0.06	–	–	–	–	–	–
ALEWIFE type	EGG	23	3.8	18.11	1,148	141.2	73.68	49	2.0	3.71	–	–	–
UNID *ALOSA*	YOLK-SAC	–	–	–	65	8.0	4.17	218	8.7	16.49	66	2.6	5.55
	POST YOLK-SAC	–	–	–	10	1.2	0.64	10	0.4	0.76	–	–	–
	JUVENILE	–	–	–	7	0.9	0.45	1	0.0	0.08	–	–	–
UNID COREGONINAE	YOLK-SAC	2	0.3	1.57	60	7.4	3.85	179	7.2	13.54	10	0.4	0.84
	POST YOLK-SAC	–	–	–	–	–	–	13	0.5	0.98	–	–	–
RAINBOW SMELT	YOLK-SAC	–	–	–	13	1.6	0.83	54	2.2	4.08	71	2.8	5.97
	POST YOLK-SAC	1	0.2	0.79	16	2.0	1.03	220	8.8	16.64	469	18.7	39.44
	JUVENILE	75	12.4	59.06	6	0.7	0.39	4	0.2	0.30	2	0.1	0.17
	LARVAE	3	0.5	2.36	–	–	–	–	–	–	1	0.0	0.08
COMMON CARP	YOLK-SAC	1	0.2	0.79	72	8.9	4.62	13	0.5	0.98	7	0.3	0.59
PIMEPHALES type	YOLK-SAC	–	–	–	2	0.2	0.13	5	0.2	0.38	1	0.0	0.08
UNID CYPRINID	YOLK-SAC	1	0.2	0.79	1	0.1	0.06	1	0.0	0.08	–	–	–
	LARVAE	1	0.2	0.79	–	–	–	–	–	–	–	–	–
UNID CATOSTOMINAE	YOLK-SAC	–	–	–	–	–	–	1	0.0	0.08	–	–	–
UNID CATOSTOMID	EGG	1	0.2	0.79	–	–	–	39	1.6	2.95	5	0.2	0.42
BURBOT	YOLK-SAC	1	0.2	0.79	1	0.1	0.06	62	2.5	4.69	110	4.4	9.25
	POST YOLK-SAC	–	–	–	–	–	–	–	–	–	5	0.2	0.42
UNID STICKLEBACK	YOLK-SAC	2	0.3	1.57	–	–	–	47	1.9	3.56	28	1.1	2.35
	POST YOLK-SAC	–	–	–	3	0.4	0.19	37	1.5	2.80	60	2.4	5.05
	LARVAE	1	0.2	0.79	–	–	–	–	–	–	–	–	–
UNID *LEPOMIS*	POST YOLK-SAC	1	0.2	0.79	–	–	–	–	–	–	–	–	–
YELLOW PERCH	YOLK-SAC	–	–	–	15	1.8	0.96	146	5.8	11.04	201	8.0	16.90
UNID PERCID	LARVAE	–	–	–	–	–	–	2	0.1	0.15	–	–	–
SLIMY SCULPIN	POST YOLK-SAC	1	0.2	0.79	1	0.1	0.06	15	0.6	1.13	15	0.6	1.26
DEEPWATER SCULPIN	POST YOLK-SAC	–	–	–	–	–	–	–	–	–	1	0.0	0.08
UNID SCULPIN	POST YOLK-SAC	1	0.2	0.79	–	–	–	–	–	–	9	0.4	0.76
UNIDENTIFIED	EGG	6	1.0	4.72	12	1.5	0.77	1	0.0	0.08	7	0.3	0.59
	YOLK-SAC	–	–	–	1	0.1	0.06	–	–	–	–	–	–
	LARVAE	1	0.2	0.79	10	1.2	0.64	10	0.4	0.76	11	0.4	0.93
Total Ichthyoplankton		127	21.0	100.00	1,558	191.6	100.00	1,322	52.9	100.00	1,189	47.5	100.00

Note: 0.0 denotes values less than 0.05 and 0.00 denotes values less than 0.005. Density=No./1,000m^3.

Table 3-7. Summary of Typical Diameters of Water-hardened Eggs and Length Ranges of Larvae (in mm) for Fishes that were Collected during 316(b) Studies near PBNP

Ichthyoplankton Taxa	Range in size of: Egg Diameter	Yolk Sac Larvae	Post Yolk Sac Larvae	Juvenile Period
Herrings				
GIZZARD SHAD	0.9 - 1.1[1]	3.3 - 6.5[1]	5.5 - 25.0[2]	20 - 50[1]
ALEWIFE	0.9 - 1.2[1]	2.5 - 5.0[1]	4.0 - 19.9[1,2]	19.0 - 32.2[1,2]
Smelts				
RAINBOW SMELT	0.8 - 1.3[1,2]	4.1 - 6.5[2]	6.0 - 33.0[1]	32.0 - 42.0[1]
Trouts and Salmons				
LAKE WHITEFISH	2.3 - 3.0[1]	8.8 - 15.0[1]	14.0 - 25.0[1]	34.0 - 54.0[1]
BLOATER	1.8 - 2.1[1]	7.0 - 15.0[1]	15.0 - 25.0[1]	NA
Carps and Minnows				
COMMON CARP	1.5 - 2.1[1]	3.0 - 8.0[1]	8.0 - 21.0[1]	21.0 - 31.0[1]
COMMON SHINER	1.5 - 1.8[1]	5.0 - 7.0[1]	7.0 - 15.0[1]	15.0 - 16.0[1]
GOLDEN SHINER	1.0 - 1.4[1]	3.0 - 6.0[1]	5.0 - 11.0[1]	14.0 - 21.0[1]
EMERALD SHINER	3.0 - 3.3[1]	4.0 - 5.0[1]	6.0 - 14.9[1]	15.0 - 30.0[1]
SPOTTAIL SHINER	1.0 - 1.4[1]	4.0 - 7.0[1]	7.0 - 11.0[1]	11.0 - 19.0[1]
FATHEAD MINNOW	1.4 - 1.6[1]	4.0 - 6.0[1]	6.0 - 17.0[1]	17.0 - 28.0[1]
Suckers				
LONGNOSE SUCKER	2.9 - 3.1[4]	8.0 - 13.0[1]	11.0 - 23.0[1]	22.8 - 292[4]
WHITE SUCKER	2.0 - 3.6[4]	6.0 - 13.4[4]	11.0 - 28.5[4]	22.8 - 50.0[4]
Cods				
BURBOT	1.0 - 1.9[1,5]	3.5 - 5.0[1,5]	5.0 - 19.0[1]	19.0 - 280-480[1,5]
Sticklebacks				
NINE SPINE STICKLEBACK	1.5 - 1.9[1]	5.0 - 9.0[1]	9.0 - 12.0[1]	NA
THREE SPINE STICKLEBACK	1.5 - 1.9[1]	3.0 - 6.0[1]	6.0 - 11.0[1]	11.0 - 17.0[1]
BROOK STICKLEBACK	1.0 - 1.3[1]	5.0 - 6.0[1]	6.0 - 16.0[1]	16.0 - 18.0[1]
Sunfishes				
GREEN SUNFISH	1.0 - 1.4[1]	3.0 - 6.0[1]	7.0 - 11.0[1]	15.0 - 24.0[1]
PUMPKINSEED	0.8 - 1.2[1]	2.0 - 5.0[1]	4.0 - 15.0[1]	16.0 - 19.0[1]
BLUEGILL	1.2 - 1.4[1]	2.0 - 5.0[1]	5.0 - 12.0[1]	12.0 - 22.0[1]
Perches				
YELLOW PERCH	1.7 - 4.5[3]	4.7 - 8.2[3]	8.0 - 20.0[1]	20.0 - 40.0[1]
Sculpins				
MOTTLED SCULPIN	1.0 - 3.0[1]	6.3 - 8.0[1]	8.0 - 9.0[1]	9.0 - 15.0[1]
SLIMY SCULPIN	2.0 - 3.0[1]	5.7 - 7.5[1]	7.5 - 8.0[1]	8.0 - 11.0[1]
DEEPWATER SCULPIN	NA	8.0 - 10.0[1]	10.0 - 18.0[1]	NA

1. Auer (1982), 2. Wallus, Yeager and Simon (1990), 3. Simon and Wallus (2006), 4. Kay, Wallus and Yeager (1994), 5. Wallus and Simon (2006)

Table 3-8. Number, Density, and Relative Abundance of Shellfish and Ichthyoplankton Collected at Each Depth Along the Offshore Transects Near Point Beach Nuclear Plant, April - September 2006.

SURFACE

Taxa	Life Stage	6-8 FT No.	6-8 FT Density	6-8 FT %	18 FT No.	18 FT Density	18 FT %	30 FT No.	30 FT Density	30 FT %
Shellfish										
Gammarus		--	--	--	593	66.7	100.00	598	69.7	99.67
Mysis relicta		--	--	--	--	--	--	2	0.2	0.33
Total Shellfish		--	--	--	593	66.7	100.00	600	70.0	100.00
Ichthyoplankton										
UNID CLUPEIDAE	YOLK-SAC	--	--	--	57	6.4	12.03	26	3.0	5.83
	POST YOLK-SAC	--	--	--	3	0.3	0.63	12	1.4	2.69
	LARVAE	--	--	--	2	0.2	0.42	--	--	--
ALEWIFE	EGG	--	--	--	--	--	--	1	0.1	0.22
	YOLK-SAC	--	--	--	3	0.3	0.63	1	0.1	0.22
ALEWIFE type	EGG	--	--	--	14	1.6	2.95	--	--	--
UNID ALOSA	YOLK-SAC	--	--	--	115	12.9	24.26	31	3.6	6.95
	POST YOLK-SAC	--	--	--	1	0.1	0.21	--	--	--
	JUVENILE	--	--	--	1	0.1	0.21	--	--	--
UNID COREGONINAE	YOLK-SAC	--	--	--	49	5.5	10.34	3	0.4	0.67
	POST YOLK-SAC	--	--	--	4	0.5	0.84	--	--	--
RAINBOW SMELT	YOLK-SAC	--	--	--	22	2.5	4.64	1	0.1	0.22
	POST YOLK-SAC	--	--	--	92	10.4	19.41	130	15.2	29.15
	JUVENILE	--	--	--	1	0.1	0.21	1	0.1	0.22
COMMON CARP	YOLK-SAC	--	--	--	3	0.3	0.63	6	0.7	1.35
PIMEPHALES type	YOLK-SAC	--	--	--	1	0.1	0.21	--	--	--
UNID CYPRINID	YOLK-SAC	--	--	--	1	0.1	0.21	--	--	--
UNID CATOSTOMINAE	YOLK-SAC	--	--	--	1	0.1	0.21	--	--	--
UNID CATOSTOMID	EGG	--	--	--	--	--	--	2	0.2	0.45
BURBOT	YOLK-SAC	--	--	--	8	0.9	1.69	18	2.1	4.04
UNID STICKLEBACK	YOLK-SAC	--	--	--	10	1.1	2.11	24	2.8	5.38
	POST YOLK-SAC	--	--	--	14	1.6	2.95	18	2.1	4.04
YELLOW PERCH	YOLK-SAC	--	--	--	63	7.1	13.29	160	18.7	35.87
SLIMY SCULPIN	POST YOLK-SAC	--	--	--	1	0.1	0.21	2	0.2	0.45
DEEPWATER SCULPIN	POST YOLK-SAC	--	--	--	--	--	--	1	0.1	0.22
UNID SCULPIN	POST YOLK-SAC	--	--	--	--	--	--	2	0.2	0.45
UNIDENTIFIED	EGG	--	--	--	1	0.1	0.21	2	0.2	0.45
	LARVAE	--	--	--	7	0.8	1.48	5	0.6	1.12
Total Ichthyoplankton		--	--	--	474	53.4	100.00	446	52.0	100.00

Table 3-8 (cont.)

MID-DEPTH

Taxa	Life Stage	6-8 FT No.	6-8 FT Density	6-8 FT %	18 FT No.	18 FT Density	18 FT %	30 FT No.	30 FT Density	30 FT %
Shellfish										
UNID AMPHIPODA		3	0.3	0.19	--	--	--	--	--	--
Gammarus		1,606	184.3	99.81	640	71.9	99.84	641	71.8	100.00
Mysis relicta		--	--	--	1	0.1	0.16	--	--	--
Total Shellfish		1,609	184.7	100.00	641	72.0	100.00	641	71.8	100.00
Ichthyoplankton										
UNID CLUPEIDAE	YOLK-SAC	114	13.1	7.18	71	8.0	15.11	21	2.4	5.41
	POST YOLK-SAC	5	0.6	0.31	11	1.2	2.34	13	1.5	3.35
ALEWIFE	EGG	5	0.6	0.31	--	--	--	1	0.1	0.26
	POST YOLK-SAC	--	--	--	--	--	--	1	0.1	0.26
	JUVENILE	1	0.1	0.06	--	--	--	--	--	--
ALEWIFE type	EGG	1,148	131.8	72.29	26	2.9	5.53	--	--	--
UNID ALOSA	YOLK-SAC	65	7.5	4.09	62	7.0	13.19	22	2.5	5.67
	POST YOLK-SAC	10	1.1	0.63	9	1.0	1.91	--	--	--
	JUVENILE	7	0.8	0.44	--	--	--	--	--	--
UNID COREGONINAE	YOLK-SAC	60	6.9	3.78	61	6.9	12.98	4	0.4	1.03
	POST YOLK-SAC	--	--	--	6	0.7	1.28	--	--	--
RAINBOW SMELT	YOLK-SAC	13	1.5	0.82	26	2.9	5.53	22	2.5	5.67
	POST YOLK-SAC	22	2.5	1.39	80	9.0	17.02	150	16.8	38.66
	JUVENILE	6	0.7	0.38	2	0.2	0.43	1	0.1	0.26
	LARVAE	--	--	--	--	--	--	1	0.1	0.26
COMMON CARP	YOLK-SAC	72	8.3	4.53	4	0.4	0.85	--	--	--
PIMEPHALES type	YOLK-SAC	7	0.8	0.44	1	0.1	0.21	--	--	--
UNID CYPRINID	YOLK-SAC	1	0.1	0.06	--	--	--	--	--	--
UNID CATOSTOMID	EGG	7	0.8	0.44	2	0.2	0.43	3	0.3	0.77
BURBOT	YOLK-SAC	1	0.1	0.06	25	2.8	5.32	44	4.9	11.34
	POST YOLK-SAC	--	--	--	--	--	--	1	0.1	0.26
UNID STICKLEBACK	YOLK-SAC	1	0.1	0.06	30	3.4	6.38	5	0.6	1.29
	POST YOLK-SAC	3	0.3	0.19	6	0.7	1.28	53	5.9	13.66
YELLOW PERCH	YOLK-SAC	15	1.7	0.94	44	4.9	9.36	33	3.7	8.51
UNID PERCID	LARVAE	--	--	--	2	0.2	0.43	--	--	--
SLIMY SCULPIN	POST YOLK-SAC	1	0.1	0.06	2	0.2	0.43	5	0.6	1.29
UNID SCULPIN	POST YOLK-SAC	--	--	--	--	--	--	5	0.6	1.29
UNIDENTIFIED	EGG	12	1.4	0.76	--	--	--	3	0.3	0.77
	YOLK-SAC	1	0.1	0.06	--	--	--	--	--	--
	LARVAE	11	1.3	0.69	--	--	--	--	--	--
Total Ichthyoplankton		1,588	182.3	100.00	470	52.8	100.00	388	43.5	100.00

Table 3-8 (cont.)

BOTTOM

Taxa	Life Stage	6-8 FT No.	6-8 FT Density	6-8 FT %	18 FT No.	18 FT Density	18 FT %	30 FT No.	30 FT Density	30 FT %
Shellfish										
Gammarus		--	--	--	638	72.4	99.84	904	100.3	100.00
Mysis relicta		--	--	--	1	0.1	0.16	--	--	--
Total Shellfish		--	--	--	639	72.5	100.00	904	100.3	100.00
Ichthyoplankton										
UNID CLUPEIDAE	YOLK-SAC	--	--	--	44	5.0	9.34	11	1.2	2.37
	POST YOLK-SAC	--	--	--	16	1.8	3.40	15	1.7	3.23
	LARVAE	--	--	--	6	0.7	1.27	--	--	--
ALEWIFE	EGG	--	--	--	--	--	--	5	0.6	1.08
	YOLK-SAC	--	--	--	--	--	--	2	0.2	0.43
	POST YOLK-SAC	--	--	--	3	0.3	0.64	1	0.1	0.22
ALEWIFE type	EGG	--	--	--	13	1.5	2.76	1	0.1	0.22
UNID *ALOSA*	YOLK-SAC	--	--	--	41	4.7	8.70	13	1.4	2.80
UNID COREGONINAE	YOLK-SAC	--	--	--	69	7.8	14.65	3	0.3	0.65
	POST YOLK-SAC	--	--	--	3	0.3	0.64	--	--	--
RAINBOW SMELT	YOLK-SAC	--	--	--	6	0.7	1.27	50	5.5	10.75
	POST YOLK-SAC	--	--	--	75	8.5	15.92	218	24.2	46.88
	JUVENILE	--	--	--	1	0.1	0.21	--	--	--
COMMON CARP	YOLK-SAC	--	--	--	6	0.7	1.27	1	0.1	0.22
PIMEPHALES type	YOLK-SAC	--	--	--	3	0.3	0.64	1	0.1	0.22
UNID CYPRINID	YOLK-SAC	--	--	--	--	--	--	1	0.1	0.22
UNID CATOSTOMID	EGG	--	--	--	40	4.5	8.49	--	--	--
BURBOT	YOLK-SAC	--	--	--	29	3.3	6.16	48	5.3	10.32
	POST YOLK-SAC	--	--	--	--	--	--	4	0.4	0.86
UNID STICKLEBACK	YOLK-SAC	--	--	--	28	3.2	5.94	9	1.0	1.94
	POST YOLK-SAC	--	--	--	27	3.1	5.73	49	5.4	10.54
YELLOW PERCH	YOLK-SAC	--	--	--	45	5.1	9.55	14	1.6	3.01
SLIMY SCULPIN	POST YOLK-SAC	--	--	--	13	1.5	2.76	9	1.0	1.94
UNID SCULPIN	POST YOLK-SAC	--	--	--	--	--	--	2	0.2	0.43
UNIDENTIFIED	EGG	--	--	--	--	--	--	2	0.2	0.43
	LARVAE	--	--	--	3	0.3	0.64	6	0.7	1.29
Total Ichthyoplankton		--	--	--	471	53.5	100.00	465	51.6	100.00

Note: 0.0 denotes values less than 0.05. Density=No./1,000m^3.

Table 3-9. Number, Density, and Relative Abundance of Shellfish and Ichthyoplankton Collected Along the Offshore Transects Near Point Beach Nuclear Plant, April - September 2006.

Taxa	Life Stage	6-8 FT			18 FT			30 FT			Transects Combined		
		No.	Density	%	No.	Density	%	No.	Density	%	No.	Density	%
Shellfish													
UNID AMPHIPODA		3	0.3	0.19	–	–	–	–	–	–	3	0.0	0.05
Gammarus		1,606	184.3	99.81	1,871	70.3	99.89	2,143	80.8	99.91	5,620	90.9	99.88
Mysis relicta		–	–	–	2	0.1	0.11	2	0.1	0.09	4	0.1	0.07
Total Shellfish		1,609	184.7	100.00	1,873	70.4	100.00	2,145	80.9	100.00	5,627	91.0	100.00
Ichthyoplankton													
ALEWIFE type	EGG	1,148	131.8	72.29	53	2.0	3.75	1	0.0	0.08	1,202	19.4	27.94
RAINBOW SMELT	POST YOLK-SAC	22	2.5	1.39	247	9.3	17.46	498	18.8	38.34	767	12.4	17.83
YELLOW PERCH	YOLK-SAC	15	1.7	0.94	152	5.7	10.74	207	7.8	15.94	374	6.0	8.69
UNID *ALOSA*	YOLK-SAC	65	7.5	4.09	218	8.2	15.41	66	2.5	5.08	349	5.6	8.11
UNID CLUPEIDAE	YOLK-SAC	114	13.1	7.18	172	6.5	12.16	58	2.2	4.46	344	5.6	8.00
UNID COREGONINAE	YOLK-SAC	60	6.9	3.78	179	6.7	12.65	10	0.4	0.77	249	4.0	5.79
BURBOT	YOLK-SAC	1	0.1	0.06	62	2.3	4.38	110	4.1	8.47	173	2.8	4.02
UNID STICKLEBACK	POST YOLK-SAC	3	0.3	0.19	47	1.8	3.32	120	4.5	9.24	170	2.7	3.95
RAINBOW SMELT	YOLK-SAC	13	1.5	0.82	54	2.0	3.82	73	2.8	5.62	140	2.3	3.25
UNID STICKLEBACK	YOLK-SAC	1	0.1	0.06	68	2.6	4.81	38	1.4	2.93	107	1.7	2.49
COMMON CARP	YOLK-SAC	72	8.3	4.53	13	0.5	0.92	7	0.3	0.54	92	1.5	2.14
UNID CLUPEIDAE	POST YOLK-SAC	5	0.6	0.31	30	1.1	2.12	40	1.5	3.08	75	1.2	1.74
UNID CATOSTOMID	EGG	7	0.8	0.44	42	1.6	2.97	5	0.2	0.38	54	0.9	1.26
SLIMY SCULPIN	POST YOLK-SAC	1	0.1	0.06	16	0.6	1.13	16	0.6	1.23	33	0.5	0.77
UNIDENTIFIED	LARVAE	11	1.3	0.69	10	0.4	0.71	11	0.4	0.85	32	0.5	0.74
UNID *ALOSA*	POST YOLK-SAC	10	1.1	0.63	10	0.4	0.71	–	–	–	20	0.3	0.46
UNIDENTIFIED	EGG	12	1.4	0.76	1	0.0	0.07	7	0.3	0.54	20	0.3	0.46
UNID COREGONINAE	POST YOLK-SAC	–	–	–	13	0.5	0.92	–	–	–	13	0.2	0.30
PIMEPHALES type	YOLK-SAC	7	0.8	0.44	5	0.2	0.35	1	0.0	0.08	13	0.2	0.30
ALEWIFE	EGG	5	0.6	0.31	–	–	–	7	0.3	0.54	12	0.2	0.28
RAINBOW SMELT	JUVENILE	6	0.7	0.38	4	0.2	0.28	2	0.1	0.15	12	0.2	0.28
UNID SCULPIN	POST YOLK-SAC	–	–	–	–	–	–	9	0.3	0.69	9	0.1	0.21
UNID CLUPEIDAE	LARVAE	–	–	–	8	0.3	0.57	–	–	–	8	0.1	0.19
UNID *ALOSA*	JUVENILE	7	0.8	0.44	1	0.0	0.07	–	–	–	8	0.1	0.19
ALEWIFE	YOLK-SAC	–	–	–	3	0.1	0.21	3	0.1	0.23	6	0.1	0.14
ALEWIFE	POST YOLK-SAC	–	–	–	3	0.1	0.21	2	0.1	0.15	5	0.1	0.12
BURBOT	POST YOLK-SAC	–	–	–	–	–	–	5	0.2	0.38	5	0.1	0.12
UNID CYPRINID	YOLK-SAC	1	0.1	0.06	1	0.0	0.07	1	0.0	0.08	3	0.0	0.07
UNID PERCID	LARVAE	–	–	–	2	0.1	0.14	–	–	–	2	0.0	0.05
ALEWIFE	JUVENILE	1	0.1	0.06	–	–	–	–	–	–	1	0.0	0.02
RAINBOW SMELT	LARVAE	–	–	–	–	–	–	1	0.0	0.08	1	0.0	0.02
UNID CATOSTOMINAE	YOLK-SAC	–	–	–	1	0.0	0.07	–	–	–	1	0.0	0.02
DEEPWATER SCULPIN	POST YOLK-SAC	–	–	–	–	–	–	1	0.0	0.08	1	0.0	0.02
UNIDENTIFIED	YOLK-SAC	1	0.1	0.06	–	–	–	–	–	–	1	0.0	0.02
Total Ichthyoplankton		1,588	182.3	100.00	1,415	53.2	100.00	1,299	49.0	100.00	4,302	69.6	100.00

Note: 0.0 denotes values less than 0.05. Density=No./1,000m^3.

Table 3-10. Plant Loads during Impingement Sampling Events at Point Beach Nuclear Plant, December 2005 – November 2006.

Data for Discrete Impingement Sampling Periods

Sampling	Generation (MW)						
	Unit 1			Unit 2			
Period	Min.	Mean	Max.	Min.	Mean	Max.	Total[1]
07-08DEC05	532	536	539	536	540	542	1,076
14-15DEC05	0	0	0	534	539	541	539
21-22DEC05	532	536	538	535	539	544	1,075
28-29DEC05	534	537	539	532	541	547	1,077
04-05JAN06	532	534	538	536	539	541	1,073
11-12JAN06	532	534	537	537	539	543	1,074
18-19JAN06	532	534	538	535	539	541	1,073
25-26JAN06	533	535	537	539	540	541	1,076
01-02FEB06	532	534	536	540	542	547	1,076
08-09FEB06	532	535	536	539	542	542	1,076
15-16FEB06	532	534	535	542	543	544	1,077
22-23FEB06	529	532	535	539	541	544	1,073
01-02MAR06	533	535	536	543	544	545	1,078
08-09MAR06	525	533	536	535	543	545	1,076
15-16MAR06	536	537	538	543	547	548	1,084
22-23MAR06	532	534	536	541	543	545	1,077
29-30MAR06	537	538	539	546	547	548	1,085
05-06APR06	525	534	538	532	544	546	1,077
12-13APR06	528	535	537	545	546	548	1,081
19-20APR06	534	535	539	532	542	546	1,077
26-27APR06	535	536	537	543	545	546	1,080
03-04MAY06	527	534	538	536	542	546	1,076
10-11MAY06	535	537	538	544	545	546	1,082
15-16MAY06	536	537	538	545	545	546	1,082
17-18MAY06	536	537	539	543	545	548	1,082
22-23MAY06	533	535	537	542	543	545	1,079
24-25MAY06	534	536	538	543	545	546	1,081
29-30MAY06	528	535	544	544	545	546	1,080
31MAY-01JUN06	533	536	541	543	544	545	1,080
05-06JUN06	530	535	539	537	542	545	1,077
07-08JUN06	534	536	540	543	545	546	1,081
12-13JUN06	530	531	536	537	540	542	1,071
14-15JUN06	529	530	532	537	539	540	1,069
19-20JUN06	533	536	540	544	545	547	1,081
21-22JUN06	536	537	539	545	545	545	1,082
26-27JUN06	530	531	534	538	539	540	1,070
28-29JUN06	526	530	532	537	539	542	1,069
03JUL06	531	533	535	540	542	543	1,075
10-11JUL06	532	534	538	542	543	544	1,077
12-13JUL06	527	530	533	536	538	541	1,068
17-18JUL06	531	533	537	541	542	544	1,075
19-20JUL06	527	534	537	537	542	544	1,076
24-25JUL06	528	529	532	538	539	540	1,068
26-27JUL06	527	530	535	535	539	541	1,069
31JUL-01AUG06	535	537	539	542	544	547	1,081
02-03AUG06	528	532	538	535	539	543	1,071
07-08AUG06	522	524	526	527	529	532	1,053
09-10AUG06	521	522	523	524	527	536	1,049
14-15AUG06	519	522	524	528	529	532	1,050
16-17AUG06	519	525	529	525	530	533	1,055
21-22AUG06	520	521	525	526	527	528	1,048
23-24AUG06	518	521	523	524	526	528	1,047
28-29AUG06	515	519	521	524	526	527	1,045
30-31AUG06	517	521	525	523	526	528	1,047

Table 3-10. (cont.)

Sampling	Generation (MW)						
	Unit 1			Unit 2			
Period	Min.	Mean	Max.	Min.	Mean	Max.	Total[1]
04-05SEP06	515	520	527	523	526	527	1,046
06-07SEP06	515	520	521	525	526	529	1,046
11-12SEP06	515	524	528	531	533	535	1,056
13-14SEP06	524	526	529	531	532	533	1,059
18-19SEP06	521	527	534	527	534	541	1,062
20-21SEP06	526	532	537	532	539	544	1,071
25-26SEP06	535	537	539	541	543	547	1,080
27-28SEP06	534	537	543	542	543	544	1,081
02-03OCT06	530	534	536	533	542	543	1,076
04-05OCT06	530	534	536	541	543	545	1,077
09-10OCT06	533	534	537	541	542	543	1,077
11-12OCT06	529	534	536	542	543	543	1,077
16-17OCT06	534	536	539	0	0	0	536
18-19OCT06	532	537	541	0	0	0	537
23-24OCT06	529	533	540	0	0	0	533
25-26OCT06	534	537	540	0	0	0	537
30-31OCT06	533	537	540	0	0	0	537
01-02NOV06	534	538	542	0	0	0	538
06-07NOV06	536	538	542	0	0	0	538
08-09NOV06	538	539	541	0	0	0	539
13-14NOV06	536	538	541	0	0	0	538
15-16NOV06	537	538	539	0	0	0	538
19-20NOV06	537	538	539	509	536	543	1,073
21-22NOV06	535	537	539	546	548	548	1,085
27-28NOV06	536	537	539	546	547	550	1,085
29-30NOV06	535	536	538	546	547	548	1,083

[1]Combined mean generation (MW) for Units 1 and 2.

Table 3-11. Water Use during Impingement Sampling Events at Point Beach Nuclear Plant, December 2005 - November 2006.

Sampling Period	No. of Circulating Pumps			Intake Flows[1]		
	Min.	Mean	Max.	Min.	Mean	Max.
07-08DEC05	2	2	2	564	564	564
14-15DEC05	2	2	2	564	564	564
21-22DEC05	2	2	2	564	564	564
28-29DEC05	2	2	2	564	564	564
04-05JAN06	2	2	2	564	564	564
11-12JAN06	2	2	2	564	564	564
18-19JAN06	2	2	2	564	564	564
25-26JAN06	2	2	2	564	564	564
01-02FEB06	2	2	2	564	564	564
08-09FEB06	2	2	2	564	564	564
15-16FEB06	2	2	2	564	564	564
22-23FEB06	2	2	2	564	564	564
01-02MAR06	2	2	2	564	564	564
08-09MAR06	2	2	2	564	564	564
15-16MAR06	4	4	4	979	979	979
22-23MAR06	2	2	2	564	564	564
29-30MAR06	4	4	4	979	979	979
05-06APR06	4	4	4	979	979	979
12-13APR06	3	3.9	4	763	966	979
19-20APR06	3	3.8	4	763	929	979
26-27APR06	4	4	4	979	979	979
03-04MAY06	2	3.2	4	564	806	979
10-11MAY06	4	4	4	979	979	979
15-16MAY06	4	4	4	979	979	979
17-18MAY06	4	4	4	979	979	979
22-23MAY06	4	4	4	979	979	979
24-25MAY06	4	4	4	979	979	979
29-30MAY06	4	4	4	979	979	979
31MAY-01JUN06	4	4	4	979	979	979
05-06JUN06	4	4	4	979	979	979
07-08JUN06	4	4	4	979	979	979
12-13JUN06	4	4	4	979	979	979
14-15JUN06	4	4	4	979	979	979
19-20JUN06	4	4	4	979	979	979
21-22JUN06	4	4	4	979	979	979
26-27JUN06	4	4	4	979	979	979
28-29JUN06	4	4	4	979	979	979
03JUL06	4	4	4	979	979	979
10-11JUL06	4	4	4	979	979	979
12-13JUL06	4	4	4	979	979	979
17-18JUL06	4	4	4	979	979	979
19-20JUL06	4	4	4	979	979	979
24-25JUL06	4	4	4	979	979	979
26-27JUL06	4	4	4	979	979	979
31JUL-01AUG06	4	4	4	979	979	979
02-03AUG06	4	4	4	979	979	979

Table 3-11. (cont.)

Sampling Period	No. of Circulating			Intake		
	Min.	Mean	Max.	Min.	Mean	Max.
07-08AUG06	4	4	4	979	979	979
09-10AUG06	4	4	4	979	979	979
14-15AUG06	4	4	4	979	979	979
16-17AUG06	4	4	4	979	979	979
21-22AUG06	4	4	4	979	979	979
23-24AUG06	4	4	4	979	979	979
28-29AUG06	4	4	4	979	979	979
30-31AUG06	4	4	4	979	979	979
04-05SEP06	4	4	4	979	979	979
06-07SEP06	4	4	4	979	979	979
11-12SEP06	4	4	4	979	979	979
13-14SEP06	4	4	4	979	979	979
18-19SEP06	4	4	4	979	979	979
20-21SEP06	2	3.1	4	564	797	979
25-26SEP06	4	4	4	979	979	979
27-28SEP06	4	4	4	979	979	979
02-03OCT06	4	4	4	979	979	979
04-05OCT06	4	4	4	979	979	979
09-10OCT06	4	4	4	979	979	979
11-12OCT06	4	4	4	979	979	979
16-17OCT06	2	2.4	3	504	618	763
18-19OCT06	2	2	2	504	504	504
23-24OCT06	1	1.4	2	297	374	504
25-26OCT06	2	2	2	504	504	504
30-31OCT06	2	2	2	504	504	504
01-02NOV06	2	2	2	504	504	504
06-07NOV06	2	2	2	504	504	504
08-09NOV06	2	2	2	504	504	504
13-14NOV06	2	2	2	504	504	504
15-16NOV06	3	3	3	763	763	763
19-20NOV06	3	3	3	763	763	763
21-22NOV06	4	4	4	979	979	979
27-28NOV06	4	4	4	979	979	979
29-30NOV06	4	4	4	979	979	979

(1) Circulating water flow, in millions of gallons per day.

Table 3-12. Water Temperatures Recorded during Impingement Sampling Events at Point Beach Nuclear Plant, December 2005 – November 2006.

	Intake Temperature (°F)			Discharge Temperature (°F)		
Sampling Period	Min.	Mean	Max.	Min.	Mean	Max.
07-08DEC05	34.4	36.4	43.8	66.3	69.8	77.8
14-15DEC05	33.8	35.5	38.7	34.9	53.5	72.7
21-22DEC05	34.3	37.3	43.3	67.2	70.8	77.7
28-29DEC05	33.9	35.0	36.6	66.7	68.3	70.6
04-05JAN06	35.1	38.7	43.0	67.6	72.2	77.1
11-12JAN06	33.9	38.0	42.2	66.4	71.4	76.2
18-19JAN06	35.0	39.4	42.2	67.4	72.7	75.8
25-26JAN06	35.4	36.2	37.4	67.5	69.4	72.0
01-02FEB06	34.9	39.3	41.6	67.0	72.2	75.2
08-09FEB06	35.2	36.0	37.5	67.3	69.2	71.8
15-16FEB06	34.0	38.3	42.8	65.7	71.4	76.9
22-23FEB06	33.6	39.1	44.2	66.2	72.2	78.6
01-02MAR06	33.7	36.4	41.7	65.3	69.3	75.6
08-09MAR06	35.5	37.0	43.7	66.7	69.4	74.4
15-16MAR06	36.3	40.5	43.2	54.9	59.2	61.8
22-23MAR06	34.4	37.3	41.5	65.3	69.2	73.3
29-30MAR06	39.6	41.6	43.7	58.1	60.6	63.6
05-06APR06	42.5	44.6	46.8	61.2	63.9	68.0
12-13APR06	45.4	47.0	51.1	64.2	66.1	78.8
19-20APR06	46.0	49.0	53.2	64.7	69.5	83.7
26-27APR06	46.7	48.8	50.4	65.3	67.4	68.8
03-04MAY06	44.0	45.9	47.6	64.0	70.1	80.0
10-11MAY06	42.9	43.9	47.4	61.5	62.8	65.5
15-16MAY06	44.7	47.2	49.2	63.3	65.5	67.0
17-18MAY06	46.9	48.1	50.3	65.6	66.7	68.8
22-23MAY06	47.7	49.0	51.3	66.5	68.4	71.8
24-25MAY06	45.5	47.1	50.3	64.5	66.2	70.2
29-30MAY06	44.1	46.6	49.6	62.6	65.9	69.9
31MAY-01JUN06	46.6	50.2	52.6	65.4	68.4	70.7
05-06JUN06	46.0	52.1	61.4	64.8	71.5	81.2
07-08JUN06	47.8	50.7	51.9	65.5	69.0	70.4
12-13JUN06	55.9	57.7	60.0	74.1	76.4	78.7
14-15JUN06	57.1	59.7	60.8	75.9	78.2	79.3
19-20JUN06	45.0	47.9	49.9	63.4	66.4	68.2
21-22JUN06	45.9	47.2	48.5	64.3	66.0	68.1
26-27JUN06	57.8	58.7	59.8	76.0	77.1	78.4
28-29JUN06	57.3	59.0	60.9	76.0	77.8	79.9
03JUL06	52.7	54.4	56.2	71.7	73.6	76.0
10-11JUL06	51.4	52.6	56.1	70.1	71.3	74.6
12-13JUL06	57.2	59.7	61.9	75.8	78.7	81.2
17-18JUL06	50.1	53.6	57.1	69.0	72.4	75.1
19-20JUL06	49.6	53.0	57.9	68.3	72.3	79.4
24-25JUL06	56.8	58.4	59.7	75.8	77.8	79.7
26-27JUL06	57.3	58.9	62.2	76.3	78.2	81.2
31JUL-01AUG06	49.2	50.5	52.6	69.5	71.3	75.0
02-03AUG06	51.1	59.3	64.9	71.4	79.1	85.1

Table 3-12. (cont.)

	Intake Temperature (°F)			Discharge Temperature °F)		
Sampling Period	Min.	Mean	Max.	Min.	Mean	Max.
07-08AUG06	66.7	68.2	69.8	85.6	88.7	91.6
09-10AUG06	68.6	69.9	71.4	88.8	90.6	93.3
14-15AUG06	67.0	69.2	70.8	85.3	88.8	90.2
16-17AUG06	62.9	66.0	70.3	82.3	86.4	91.6
21-22AUG06	68.7	69.6	70.4	88.4	89.5	90.9
23-24AUG06	68.6	69.6	72.3	88.3	90.0	92.5
28-29AUG06	70.4	71.2	72.2	90.1	91.0	92.0
30-31AUG06	69.2	70.3	74.3	88.8	90.3	93.9
04-05SEP06	69.2	69.6	70.7	88.7	89.9	92.6
06-07SEP06	69.5	70.2	72.0	89.0	90.1	91.5
11-12SEP06	62.8	64.5	69.3	82.1	84.0	88.0
13-14SEP06	63.9	64.4	65.2	83.3	83.9	85.5
18-19SEP06	45.8	49.4	59.6	64.7	68.9	80.8
20-21SEP06	47.1	48.3	49.8	66.7	73.3	82.9
25-26SEP06	49.7	50.3	51.9	68.4	69.1	70.5
27-28SEP06	48.9	49.4	49.9	67.8	68.4	69.0
02-03OCT06	51.4	53.3	55.6	70.2	72.2	74.6
04-05OCT06	50.2	52.0	53.9	69.2	71.2	73.4
09-10OCT06	50.5	51.6	52.4	69.3	70.7	71.7
11-12OCT06	50.4	52.0	54.6	69.4	71.2	73.8
16-17OCT06	44.6	46.1	48.0	44.9	55.9	65.7
18-19OCT06	45.1	45.8	46.1	47.6	56.5	64.2
23-24OCT06	42.0	42.6	43.6	44.4	57.0	75.0
25-26OCT06	42.0	43.1	45.1	43.2	52.6	63.8
30-31OCT06	43.1	44.3	47.3	42.8	54.0	65.3
01-02NOV06	41.8	43.8	45.4	44.0	53.5	64.0
06-07NOV06	40.8	41.9	44.9	43.3	51.9	62.8
08-09NOV06	40.3	42.2	45.2	43.9	52.4	63.2
13-14NOV06	40.8	41.5	44.8	42.2	51.2	62.4
15-16NOV06	40.0	40.9	41.7	40.2	50.2	60.2
19-20NOV06	38.7	40.6	43.3	57.1	66.2	75.3
21-22NOV06	39.2	40.7	43.0	57.9	59.5	62.7
27-28NOV06	42.1	43.4	48.9	60.9	62.2	67.1
29-30NOV06	43.5	45.3	48.4	62.3	63.9	66.8

Table 3-13. Family, Common, and Scientific Names of Crayfish and Fishes Collected during Impingement Sampling at Point Beach Nuclear Plant, 1975-1976 and 2005-2006.

Family Name	Common Name	Scientific Name[1]	1975-1976[2]	2005-2006
Cambaridae (Crayfish)	GREAT LAKES CRAYFISH	*Orconectes propinquus*	--	X
Sturgeons	LAKE STURGEON	*Acipenser fulvescens*	--	X
Herrings	ALEWIFE	*Alosa pseudoharengus*	X	X
	GIZZARD SHAD	*Dorosoma cepedianum*	X	X
Carps and Minnows	LAKE CHUB	*Couesius plumbeus*	X	--
	COMMON CARP	*Cyprinus carpio*	X	X
	COMMON SHINER	*Luxilus cornutus*	--	X
	GOLDEN SHINER	*Notemigonus crysoleucas*	--	X
	EMERALD SHINER	*Notropis atherinoides*	X	X
	SPOTTAIL SHINER	*Notropis hudsonius*	X	X
	FATHEAD MINNOW	*Pimephales promelas*	X	X
	LONGNOSE DACE	*Rhinichthys cataractae*	X	X
Suckers	LONGNOSE SUCKER	*Catostomus catostomus*	X	X
	WHITE SUCKER	*Catostomus commersonii*	X	X
North American Catfishes	BLACK BULLHEAD	*Ameiurus melas*	X	X
	CHANNEL CATFISH	*Ictalurus punctatus*	X	X
Pikes	NORTHERN PIKE	*Esox lucius*	X	--
Mudminnows	CENTRAL MUDMINNOW	*Umbra limi*	X	X
Smelts	RAINBOW SMELT	*Osmerus mordax*	X	X
Trouts and Salmons	LAKE WHITEFISH	*Coregonus clupeaformis*	X	X
	BLOATER	*Coregonus hoyi*	X	X
	COHO SALMON	*Oncorhynchus kisutch*	X	X
	RAINBOW TROUT	*Oncorhynchus mykiss*	X	--
	CHINOOK SALMON	*Oncorhynchus tshawytscha*	X	X
	ROUND WHITEFISH	*Prosopium cylindraceum*	X	X
	BROWN TROUT	*Salmo trutta*	X	X
	TIGER TROUT	*S. trutta x Salvelinus fontinalis*	X	--
	BROOK TROUT	*Salvelinus fontinalis*	X	--
	LAKE TROUT	*Salvelinus namaycush*	X	X
Trout-perches	TROUT-PERCH	*Percopsis omiscomaycus*	X	X
Cods	BURBOT	*Lota lota*	--	X
Sticklebacks	BROOK STICKLEBACK	*Culaea inconstans*	X	X
	THREESPINE STICKLEBACK	*Gasterosteus aculeatus*	--	X
	NINESPINE STICKLEBACK	*Pungitius pungitius*	X	X
Sculpins	MOTTLED SCULPIN	*Cottus bairdii*	--	X
	SLIMY SCULPIN	*Cottus cognatus*	X	X
	DEEPWATER SCULPIN	*Myoxocephalus thompsonii*	X	X
Temperate Basses	WHITE PERCH	*Morone americana*	--	X
Sunfishes	GREEN SUNFISH	*Lepomis cyanellus*	--	X
	PUMPKINSEED	*Lepomis gibbosus*	--	X
	BLUEGILL	*Lepomis macrochirus*	X	X
	SMALLMOUTH BASS	*Micropterus dolomieu*	--	X
	LARGEMOUTH BASS	*Micropterus salmoides*	X	--
	BLACK CRAPPIE	*Pomoxis nigromaculatus*	--	X
Perches	YELLOW PERCH	*Perca flavescens*	X	X
Drums	FRESHWATER DRUM	*Aplodinotus grunniens*	--	X
Gobies	ROUND GOBY	*Neogobius melanostomus*	--	X

[1]Fish nomenclature follows Nelson et al. 2004.
[2]WEPCO 1976a.

Table 3-14. Number and Biomass of Shellfish and Fish Collected During Impingement Sampling at Point Beach Nuclear Plant, December 2005 through November 2006.

Common Name	Number Caught		Weight Caught	
	No.	%	KG	%
GREAT LAKES CRAYFISH	167	100.00	--	--
Total Crayfish	167	100.00	--	--
Total Crayfish Species	1			
LAKE STURGEON	1	0.00	0.239	0.00
ALEWIFE	1,595,015	99.07	5,702.552	92.96
ALEWIFE type	785	0.05	2.350	0.04
UNID *ALOSA*	2	0.00	0.002	0.00
GIZZARD SHAD	738	0.05	13.482	0.22
LAKE WHITEFISH	4	0.00	0.147	0.00
BLOATER	105	0.01	0.475	0.01
COHO SALMON	3	0.00	0.021	0.00
CHINOOK SALMON	7	0.00	2.914	0.05
ROUND WHITEFISH	37	0.00	17.116	0.28
BROWN TROUT	15	0.00	14.435	0.24
LAKE TROUT	9	0.00	16.077	0.26
RAINBOW SMELT	9,144	0.57	51.371	0.84
CENTRAL MUDMINNOW	1	0.00	0.005	0.00
COMMON CARP	6	0.00	0.150	0.00
GOLDEN SHINER	1	0.00	0.004	0.00
EMERALD SHINER	1	0.00	0.005	0.00
COMMON SHINER	3	0.00	0.105	0.00
SPOTTAIL SHINER	1,276	0.08	8.360	0.14
FATHEAD MINNOW	4	0.00	0.016	0.00
LONGNOSE DACE	57	0.00	0.591	0.01
LONGNOSE SUCKER	47	0.00	20.619	0.34
WHITE SUCKER	198	0.01	200.230	3.26
BLACK BULLHEAD	32	0.00	6.265	0.10
CHANNEL CATFISH	29	0.00	8.562	0.14
TROUT-PERCH	3	0.00	0.035	0.00
BURBOT	56	0.00	30.737	0.50
BROOK STICKLEBACK	3	0.00	0.006	0.00
THREESPINE STICKLEBACK	517	0.03	0.724	0.01
NINESPINE STICKLEBACK	556	0.03	1.292	0.02
WHITE PERCH	5	0.00	0.379	0.01
GREEN SUNFISH	1	0.00	0.003	0.00
PUMPKINSEED	6	0.00	0.097	0.00
BLUEGILL	7	0.00	0.078	0.00
UNID *LEPOMIS*	1	0.00	0.002	0.00
SMALLMOUTH BASS	12	0.00	3.734	0.06
BLACK CRAPPIE	1	0.00	0.013	0.00
YELLOW PERCH	579	0.04	8.653	0.14
FRESHWATER DRUM	16	0.00	17.492	0.29
ROUND GOBY	9	0.00	0.405	0.01
MOTTLED SCULPIN	627	0.04	3.653	0.06
SLIMY SCULPIN	135	0.01	0.817	0.01
UNID *COTTUS*	1	0.00	0.003	0.00
DEEPWATER SCULPIN	3	0.00	0.027	0.00
Total Fish	1,610,057	100.00	6,134.242	100.00
Total Fish Species	40[a)]			
Total Crayfish and Fish	1,610,224		--	

Notes: 0.00 denotes values less than 0.005.

a). The total species count includes genus level identifications (e.g., unid *Lepomis*) only when no species (e.g., bluegill) of that genus were identified

Table 3-15. Frequency of Occurrence of Impinged Fishes at Point Beach Nuclear Plant, 1975-76 and 2005-06.

	Current Study (2005-06)		1975-76 Study (WEPCO 1976a)	
SPECIES	No. of Occurrences	Percent Occurrence[1]	No. of Occurrences	Percent Occurrence[2]
MOTTLED SCULPIN	71	89%	--	--
RAINBOW SMELT	67	84%	81	92%
ALEWIFE	62	78%	59	67%
YELLOW PERCH	52	65%	28	32%
THREESPINE STICKLEBACK	50	63%	--	--
WHITE SUCKER	46	58%	15	17%
SPOTTAIL SHINER	45	56%	13	15%
NINESPINE STICKLEBACK	43	54%	58	66%
SLIMY SCULPIN	34	43%	79	90%
BURBOT	33	41%	--	--
GIZZARD SHAD	31	39%	29	33%
BLACK BULLHEAD	26	33%	23	26%
LONGNOSE SUCKER	25	31%	20	23%
ROUND WHITEFISH	20	25%	1	1%
LONGNOSE DACE	19	24%	20	23%
BLOATER	15	19%	5	6%
CHANNEL CATFISH	12	15%	1	1%
BROWN TROUT	11	14%	15	17%
SMALLMOUTH BASS	10	13%	--	--
ROUND GOBY	8	10%	--	--
LAKE TROUT	7	9%	38	43%
FRESHWATER DRUM	7	9%	--	--
CHINOOK SALMON	5	6%	--	--
PUMPKINSEED	5	6%	--	--
BLUEGILL	5	6%	28	32%
COMMON CARP	4	5%	11	13%
FATHEAD MINNOW	4	5%	1	1%
WHITE PERCH	4	5%	--	--
LAKE WHITEFISH	3	4%	3	3%
COHO SALMON	3	4%	4	5%
COMMON SHINER	3	4%	--	--
TROUT-PERCH	3	4%	9	10%
DEEPWATER SCULPIN	3	4%	2	2%
ALEWIFE type	2	3%	--	--
BROOK STICKLEBACK	2	3%	1	1%
LAKE STURGEON	1	1%	--	--
UNID ALOSA	1	1%	--	--
CENTRAL MUDMINNOW	1	1%	1	1%
GOLDEN SHINER	1	1%	--	--
EMERALD SHINER	1	1%	4	5%
GREEN SUNFISH	1	1%	--	--
UNID LEPOMIS	1	1%	--	--
BLACK CRAPPIE	1	1%	--	--
UNID COTTUS	1	1%	--	--

[1]Percent occurrence based on 80 sampling events during the 2005-06 study.
[2]Percent occurrence based on 88 sampling events during the 1975-76 study.

Table 3-16. Total Length (mm) Data from Crayfish and Fish Impinged at Point Beach Nuclear Plant, December 2005 - November 2006.

COMMON NAME	MIN LENGTH	MEAN LENGTH	MAX LENGTH
GREAT LAKES CRAYFISH	24	48	81
LAKE STURGEON	366	366	366
ALEWIFE	29	88	215
ALEWIFE type	--	--	--
UNID ALOSA	--	--	--
GIZZARD SHAD	58	115	463
LAKE WHITEFISH	105	156	236
BLOATER	37	84	121
COHO SALMON	85	93	105
CHINOOK SALMON	83	225	702
ROUND WHITEFISH	165	369	471
BROWN TROUT	196	330	713
LAKE TROUT	94	431	756
RAINBOW SMELT	30	108	195
CENTRAL MUDMINNOW	80	80	80
COMMON CARP	62	103	200
GOLDEN SHINER	83	83	83
EMERALD SHINER	95	95	95
COMMON SHINER	97	134	169
SPOTTAIL SHINER	47	91	130
FATHEAD MINNOW	63	68	72
LONGNOSE DACE	55	98	140
LONGNOSE SUCKER	210	321	602
WHITE SUCKER	86	433	584
BLACK BULLHEAD	116	225	279
CHANNEL CATFISH	60	184	650
TROUT-PERCH	102	109	115
BURBOT	66	326	864
BROOK STICKLEBACK	45	68	83
THREESPINE STICKLEBACK	42	55	68
NINESPINE STICKLEBACK	47	68	89
WHITE PERCH	68	139	235
GREEN SUNFISH	56	56	56
PUMPKINSEED	45	82	109
BLUEGILL	55	81	123
UNID LEPOMIS	46	46	46
SMALLMOUTH BASS	92	230	495
BLACK CRAPPIE	100	100	100
YELLOW PERCH	48	88	342
FRESHWATER DRUM	219	416	550
ROUND GOBY	65	130	190
MOTTLED SCULPIN	48	73	122
SLIMY SCULPIN	49	74	109
UNID COTTUS	55	55	55
DEEPWATER SCULPIN	82	98	108

NOTE: -- DENOTES THAT SPECIMENS WERE NOT MEASURED.

Table 3-17. Length Frequency Distributions of Selected Species Impinged at Point Beach Nuclear Plant, 4 December 2005 - 2 December 2006.

LENGTH (mm)	ALEWIFE	GIZZARD SHAD	COHO SALMON	CHINOOK SALMON	BROWN TROUT	LAKE TROUT	RAINBOW SMELT	SPOTTAIL SHINER	YELLOW PERCH
20-29	5	--	--	--	--	--	--	--	--
30-39	--	--	--	--	--	--	1,166	--	--
40-49	822	--	--	--	--	--	1,992	7	31
50-59	8,913	4	--	--	--	--	832	31	260
60-69	452,337	35	--	--	--	--	123	51	817
70-79	1,838,353	59	--	--	--	--	651	781	1,136
80-89	2,754,656	125	5	4	--	--	3,143	1,517	497
90-99	2,008,378	511	5	--	--	14	5,805	1,697	129
100-109	813,660	822	4	--	--	--	4,165	394	50
110-119	378,813	643	--	--	--	--	6,877	285	62
120-129	167,506	171	--	--	--	--	7,293	86	75
130-139	46,125	57	--	5	--	--	4,308	14	54
140-149	31,772	34	--	--	--	--	1,422	--	37
150-159	35,593	95	--	5	--	--	531	--	11
160-169	81,414	169	--	4	--	--	301	--	6
170-179	4,295	210	--	7	--	--	40	--	7
180-189	1,670	69	--	--	--	--	56	--	3
190-199	67	10	--	--	3	--	3	--	4
200-209	--	12	--	--	5	--	--	--	--
210-219	5	7	--	--	12	--	--	--	--
220-229	--	29	--	--	19	--	--	--	--
230-239	--	10	--	--	7	--	--	--	--
240-249	--	--	--	--	12	--	--	--	3
250-259	--	3	--	--	24	--	--	--	6
260-269	--	--	--	--	7	--	--	--	8
270-279	--	12	--	--	--	--	--	--	33
280-289	--	--	--	--	--	--	--	--	7
290-299	--	--	--	--	--	--	--	--	--
300-309	--	3	--	--	--	--	--	--	12
310-319	--	--	--	--	5	--	--	--	--
320-329	--	--	--	--	--	--	--	--	7
330-339	--	--	--	--	--	--	--	--	4
340-349	--	--	--	--	--	--	--	--	4
350-359	--	--	--	--	--	--	--	--	--
360-369	--	--	--	--	--	--	--	--	--
370-379	--	--	--	--	--	--	--	--	--
380-389	--	--	--	--	--	--	--	--	--
390-399	--	--	--	--	--	--	--	--	--
400-409	--	--	--	--	--	--	--	--	--
410-419	--	--	--	--	--	--	--	--	--
420-429	--	--	--	--	--	--	--	--	--
430-439	--	--	--	--	7	--	--	--	--
440-449	--	--	--	--	--	--	--	--	--
450-459	--	3	--	--	--	--	--	--	--
460-469	--	4	--	--	--	--	--	--	--
470-479	--	--	--	--	--	--	--	--	--
480-489	--	--	--	--	--	--	--	--	--
490-499	--	--	--	--	--	--	--	--	--
500-509	--	--	--	--	--	--	--	--	--
510-519	--	--	--	--	--	--	--	--	--
520-529	--	--	--	--	8	--	--	--	--
530-539	--	--	--	--	--	--	--	--	--
540-549	--	--	--	--	--	--	--	--	--
550-559	--	--	--	--	--	--	--	--	--
560-569	--	--	--	--	--	--	--	--	--
570-579	--	--	--	--	--	--	--	--	--
580-589	--	--	--	--	--	--	--	--	--
590-599	--	--	--	--	--	--	--	--	--
600-609	--	--	--	--	--	--	--	--	--
610-619	--	--	--	--	--	--	--	--	--
620-629	--	--	--	--	--	--	--	--	--
630-639	--	--	--	--	--	4	--	--	--
640-649	--	--	--	--	--	--	--	--	--
650-659	--	--	--	--	--	4	--	--	--
660-669	--	--	--	--	4	--	--	--	--
670-679	--	--	--	--	--	--	--	--	--
680-689	--	--	--	--	--	--	--	--	--
690-699	--	--	--	--	--	--	--	--	--
700+	--	--	--	3	3	9	--	--	--
ESTIMATED TOTAL	8,624,384	3,105	14	27	116	31	38,709	4,864	3,262

Table 3-18. Monthly Length Frequency Distributions of Impinged Alewife, Point Beach Nuclear Plant, December 2005 - November 2006.

LENGTH (mm)	DEC 2005	JAN 2006	FEB 2006	MAR 2006	APR 2006	MAY 2006	JUN 2006	JUL 2006	AUG 2006	SEP 2006	OCT 2006	NOV 2006
20-29	--	--	--	--	--	--	--	--	5	--	--	--
30-39	--	--	--	--	--	--	--	--	--	--	--	--
40-49	--	--	--	--	--	--	--	--	16	20	786	--
50-59	--	--	--	--	7	7,182	--	--	16	1,022	685	--
60-69	--	--	--	--	32,600	184,677	202,485	23,406	224	2,458	5,765	722
70-79	--	--	--	--	113,996	648,207	842,601	186,918	1,680	1,503	15,821	27,627
80-89	--	--	--	--	146,472	738,997	1,480,058	240,884	2,905	1,109	14,108	130,122
90-99	--	--	--	--	56,954	444,607	1,191,518	199,143	2,581	606	7,404	105,565
100-109	--	--	--	--	8,141	139,343	506,593	128,766	3,628	887	5,722	20,580
110-119	--	--	--	--	8,141	97,617	226,239	34,998	1,731	415	3,436	6,236
120-129	--	--	--	--	24,410	41,366	83,459	14,101	432	453	2,402	883
130-139	--	--	--	--	--	3,660	35,320	--	216	412	1,490	5,028
140-149	--	--	--	--	8,134	17,502	1,097	1,757	334	476	1,100	1,372
150-159	--	--	--	--	--	--	33,021	389	448	467	1,212	57
160-169	--	--	--	--	8,134	--	69,308	2,629	417	363	507	55
170-179	--	--	--	--	--	1,589	--	1,653	198	310	535	10
180-189	--	--	--	--	--	795	--	389	293	80	48	65
190-199	--	--	--	--	--	--	--	--	29	38	--	--
200-209	--	--	--	--	--	--	--	--	--	--	--	--
210-219	--	--	--	--	--	5	--	--	--	--	--	--
ESTIMATED TOTAL	--	--	--	--	406,989	2,325,547	4,671,700	835,033	15,154	10,620	61,019	298,322

Table 3-19. Monthly Length Frequency Distributions of Impinged Rainbow Smelt, Point Beach Nuclear Plant, December 2005 - November 2006.

LENGTH (mm)	DEC 2005	JAN 2006	FEB 2006	MAR 2006	APR 2006	MAY 2006	JUN 2006	JUL 2006	AUG 2006	SEP 2006	OCT 2006	NOV 2006
30-39	82	--	285	--	--	--	--	--	12	4	777	6
40-49	249	7	860	--	7	124	--	--	--	18	721	6
50-59	34	--	480	--	--	245	6	3	--	8	55	--
60-69	--	--	31	--	--	40	15	13	5	17	--	3
70-79	19	7	71	--	34	61	70	21	13	207	136	12
80-89	--	38	228	--	--	92	100	84	5	225	2,098	274
90-99	22	114	643	6	34	196	142	136	15	275	3,455	768
100-109	7	87	491	6	27	289	277	196	30	124	1,860	770
110-119	--	14	194	12	68	1,585	1,116	268	4	153	2,845	616
120-129	14	14	56	--	15	1,809	920	191	29	105	3,105	1,037
130-139	--	7	56	13	34	807	360	97	3	53	2,559	320
140-149	--	--	111	--	7	298	183	79	--	4	563	176
150-159	--	--	--	6	--	174	169	16	--	--	159	7
160-169	--	--	15	--	--	31	40	--	--	4	207	4
170-179	--	--	--	--	--	33	--	4	--	--	--	3
180-189	--	--	56	--	--	--	--	--	--	--	--	--
190-199	--	--	--	--	--	--	--	--	--	--	3	--
ESTIMATED TOTAL	428	287	3,576	44	225	5,783	3,397	1,110	115	1,197	18,543	4,002

Table 3-20. Monthly Length Frequency Distributions of Impinged Yellow Perch, Point Beach Nuclear Plant, December 2005 - November 2006.

LENGTH (mm)	DEC 2005	JAN 2006	FEB 2006	MAR 2006	APR 2006	MAY 2006	JUN 2006	JUL 2006	AUG 2006	SEP 2006	OCT 2006	NOV 2006
40-49	31	--	--	--	--	--	--	--	--	--	--	--
50-59	198	--	35	--	--	--	--	--	9	13	3	3
60-69	504	42	107	--	--	--	3	3	5	35	78	41
70-79	462	24	121	7	7	--	4	--	18	66	226	202
80-89	187	24	42	--	--	--	4	--	16	29	119	76
90-99	7	--	28	7	--	--	--	--	29	7	29	22
100-109	--	--	7	--	--	--	4	--	36	--	--	3
110-119	--	--	--	--	--	--	--	--	43	3	12	3
120-129	--	--	--	--	--	--	--	--	24	18	18	15
130-139	--	--	--	--	--	--	--	--	30	7	13	5
140-149	--	--	--	--	--	--	--	--	8	3	10	16
150-159	--	--	--	--	--	--	--	--	4	--	7	--
160-169	--	--	--	--	--	--	--	--	--	--	--	6
170-179	--	--	--	--	--	--	--	--	--	3	--	4
180-189	--	--	--	--	--	--	--	--	--	--	3	--
190-199	--	--	--	--	--	--	--	--	4	--	--	--
200-209	--	--	--	--	--	--	--	--	--	--	--	--
210-219	--	--	--	--	--	--	--	--	--	--	--	--
220-229	--	--	--	--	--	--	--	--	--	--	--	--
230-239	--	--	--	--	--	--	--	--	--	--	--	--
240-249	--	--	--	--	--	--	--	--	--	--	3	--
250-259	--	--	--	--	--	--	--	3	--	3	--	--
260-269	--	--	--	--	--	--	--	--	8	--	--	--
270-279	--	--	--	--	--	--	30	--	3	--	--	--
280-289	--	--	--	--	--	--	--	4	--	3	--	--
290-299	--	--	--	--	--	--	--	--	--	--	--	--
300-309	--	--	--	--	--	--	--	4	8	--	--	--
310-319	--	--	--	--	--	--	--	--	--	--	--	--
320-329	--	--	--	--	--	--	3	--	--	4	--	--
330-339	--	--	--	--	--	--	--	--	4	--	--	--
340-349	--	--	--	--	--	--	--	4	--	--	--	--
ESTIMATED TOTAL	1,388	90	341	14	7	--	47	18	247	193	521	397

Table 4-1. Entrainment Estimates of Shellfish and Ichthyoplankton from the Intake Forebay at the Point Beach Nuclear Plant, April - September 2006.

		Actuals Collected			Entrainment Estimates	
Taxa	Life Stage	No.	Density No./1,000m^3	%	No.	%
Shellfish						
Gammarus		62,998	6,503.4	100.0	4,057,474,137	100.0
Hyalella azteca		1	0.1	0.0	62,838	0.0
Total Shellfish		62,999	6,503.5	100.0	4,057,536,975	100.0
Ichthyoplankton						
UNID CLUPEIDAE	LARVAE	1	0.1	0.6	64,740	0.6
ALEWIFE	EGG	1	0.1	0.6	64,682	0.6
	POST YOLK-SAC	1	0.1	0.6	62,830	0.6
	JUVENILE	16	1.7	9.6	1,029,058	9.6
ALEWIFE type	EGG	33	3.4	19.8	2,132,617	19.9
UNID *ALOSA*	JUVENILE	2	0.2	1.2	129,262	1.2
UNID COREGONINAE	YOLK-SAC	2	0.2	1.2	125,676	1.2
RAINBOW SMELT	POST YOLK-SAC	2	0.2	1.2	129,507	1.2
	JUVENILE	83	8.6	49.7	5,341,080	49.7
	LARVAE	3	0.3	1.8	193,219	1.8
COMMON CARP	YOLK-SAC	1	0.1	0.6	64,740	0.6
UNID CYPRINID	YOLK-SAC	1	0.1	0.6	64,413	0.6
	LARVAE	1	0.1	0.6	64,413	0.6
UNID CATOSTOMID	EGG	1	0.1	0.6	63,786	0.6
BURBOT	YOLK-SAC	3	0.3	1.8	178,558	1.7
	JUVENILE	1	0.1	0.6	64,579	0.6
UNID STICKLEBACK	YOLK-SAC	2	0.2	1.2	127,571	1.2
	LARVAE	1	0.1	0.6	64,717	0.6
UNID *LEPOMIS*	POST YOLK-SAC	1	0.1	0.6	63,786	0.6
SLIMY SCULPIN	POST YOLK-SAC	2	0.2	1.2	128,775	1.2
UNID SCULPIN	POST YOLK-SAC	1	0.1	0.6	64,755	0.6
	LARVAE	1	0.1	0.6	64,682	0.6
UNIDENTIFIED	EGG	6	0.6	3.6	387,103	3.6
	LARVAE	1	0.1	0.6	64,413	0.6
Total Ichthyoplankton		167	17.2	100.0	10,738,963	100.0

Table 4-2. Statistical Comparison of Mean Densities among Locations for Concurrent Sampling Events, April - September 2006.

Taxa or Grouping[a,b]	Onshore Entrainment	Offshore Depth Contours 6-8 FT	18 FT	30 FT	Significant Difference[c]	F Value	P Value
Gammarus	6,300.7 A	197.8 B	68.3 C	73.7 C[d]	Yes	632.71	<0.01
Total Ichthyoplankton	21.1 C	181.4 A	53.6 AB	48.5 B	Yes	14.58	<0.01
Total Fish Larvae	16.1 B	49.0 A	50.2 A	47.7 A	Yes	22.80	<0.01
Clupeidae Larvae[e]	0.8 D	23.4 A	18.4 B	7.4 C	Yes	32.57	<0.01
Rainbow smelt Larvae	13.1 B	4.7 B	11.6 AB	22.8 A	Yes	7.93	<0.01
Yellow perch Larvae	0 C	1.8 B	5.7 A	7.8 AB	Yes	15.11	<0.01
Total Fish Eggs	5.0 B	132.3 A	3.3 C	0.8 C	Yes	11.95	<0.01
Alewife (+ type) Eggs	3.8 B	130.9 A	1.8 BC	0.2 C	Yes	12.31	<0.01

(a) All data log transformed for statistical analyses because they are not normally distributed.
(b) Densities are #/1000 m^3.
(c) Results from four-factor (transect*depth*trip*diel period) parametric Analysis of Variance tests (alpha=0.05); Type III Sum of Squares.
(d) Results of Tukey's Studentized Range (HSD) Test; values with the same letters are not significantly different (alpha=0.05).
(e) Unid. clupeidae, alewife, and unid. *Alosa* larvae.

Table 4-3. Comparisons of Entrainment Densities of Shellfish and Ichthyoplankton Among the Three Ambient Sampling Locations Near PBNP for Concurrent Sampling Events, April - September 2006.

Taxa	Life Stage	Entrainment		6-8 FT		Ratio of 6-8 FT	18-FT		Ratio of 18 FT	30-FT		Ratio of 30 FT
		Density	%	Density	%	to Entrainment	Density	%	to Entrainment	Density	%	to Entrainment
Shellfish												
UNID AMPHIPODA		0.0	–	0.4	0.2	–	–	–	–	–	–	–
Gammarus		6,289.1	100.0	185.5	99.8	33.9	71.4	99.9	0.0	74.8	99.9	0.01
Hyalella azteca		0.2	0.0	–	–	–	–	–	–	–	–	–
Mysis relicta		–	–	–	–	–	0.1	0.1	–	0.1	–	–
Total Shellfish		6,289.3	100.0	185.9	100.0	0.0	71.4	100.0	0.0	74.9	100.0	0.01
Ichthyoplankton												
UNID CLUPEIDAE	YOLK-SAC	–	–	12.8	6.7	–	6.1	11.6	–	2.3	4.9	–
	POST YOLK-SAC	–	–	0.6	0.3	–	1.2	2.3	–	1.6	3.4	–
	LARVAE	0.2	0.8	–	–	–	0.3	0.6	1.9	–	–	–
ALEWIFE	EGG	–	–	0.6	0.3	–	–	–	–	0.3	0.6	–
	YOLK-SAC	–	–	–	–	–	0.0	0.1	–	0.1	0.3	–
	POST YOLK-SAC	–	–	–	–	–	0.1	0.2	–	0.1	0.2	–
	JUVENILE	0.7	3.1	0.1	0.1	0.2	–	–	–	–	–	–
ALEWIFE type	EGG	3.8	18.1	141.2	73.7	37.1	2.0	3.7	0.5	–	–	–
UNID *ALOSA*	YOLK-SAC	–	–	8.0	4.2	–	8.7	16.5	–	2.6	5.6	–
	POST YOLK-SAC	–	–	1.2	0.6	–	0.4	0.8	–	–	–	–
	JUVENILE	–	–	0.9	0.4	–	0.0	0.1	–	–	–	–
UNID COREGONINAE	YOLK-SAC	0.3	1.6	7.4	3.9	22.3	7.2	13.5	21.6	0.4	0.8	1.2
	POST YOLK-SAC	–	–	–	–	–	0.5	1.0	–	–	–	–
RAINBOW SMELT	YOLK-SAC	–	–	1.6	0.8	–	2.2	4.1	–	2.8	6.0	–
	POST YOLK-SAC	0.2	0.8	2.0	1.0	11.8	8.8	16.6	53.0	18.7	39.4	112.9
	JUVENILE	12.4	59.0	0.7	0.4	0.1	0.2	0.3	0.0	0.1	0.2	0.0
	LARVAE	0.5	2.4	–	–	–	–	–	–	0.0	0.1	0.1
COMMON CARP	YOLK-SAC	0.2	0.8	8.9	4.6	53.3	0.5	1.0	3.1	0.3	0.6	1.7
PIMEPHALES type	YOLK-SAC	–	–	0.2	0.1	–	0.2	0.4	–	0.0	0.1	–
UNID CYPRINID	YOLK-SAC	0.2	0.8	0.1	0.1	0.7	0.0	0.1	0.2	–	–	–
	LARVAE	0.2	0.8	–	–	–	–	–	–	–	–	–
UNID CATOSTOMINAE	YOLK-SAC	–	–	–	–	–	0.0	0.1	–	–	–	–
UNID CATOSTOMID	EGG	0.2	0.8	–	–	–	1.6	3.0	9.4	0.2	0.4	1.2
BURBOT	YOLK-SAC	0.2	0.8	0.1	0.1	0.7	2.5	4.7	14.9	4.4	9.3	26.5
	POST YOLK-SAC	–	–	–	–	–	–	–	–	0.2	0.4	–
UNID STICKLEBACK	YOLK-SAC	0.3	1.6	–	–	–	1.9	3.6	5.7	1.1	2.4	3.4
	POST YOLK-SAC	–	–	0.4	0.2	–	1.5	2.8	–	2.4	5.0	–
	LARVAE	0.2	0.8	–	–	–	–	–	–	–	–	–
UNID *LEPOMIS*	POST YOLK-SAC	0.2	0.8	–	–	–	–	–	–	–	–	–
YELLOW PERCH	YOLK-SAC	–	–	1.8	1.0	–	5.8	11.0	–	8.0	16.9	–
UNID PERCID	LARVAE	–	–	–	–	–	0.1	0.2	–	–	–	–
SLIMY SCULPIN	POST YOLK-SAC	0.2	0.8	0.1	0.1	0.7	0.6	1.1	3.6	0.6	1.3	3.6
DEEPWATER SCULPIN	POST YOLK-SAC	–	–	–	–	–	–	–	–	0.0	0.1	–
UNID SCULPIN	POST YOLK-SAC	0.2	0.8	–	–	–	–	–	–	0.4	0.8	2.2
UNIDENTIFIED	EGG	1.0	4.7	1.5	0.8	1.5	0.0	0.1	0.0	0.3	0.6	0.3
	YOLK-SAC	–	–	0.1	0.1	–	–	–	–	–	–	–
	LARVAE	0.2	0.8	1.2	0.6	7.4	0.4	0.8	2.4	0.4	0.9	2.7
Total Ichthyoplankton		21.0	100.0	191.6	100.0	9.1	52.9	100.0	2.5	47.5	100.0	2.3

Note: 0.0 denotes values less than 0.05. Density=No./1,000m ^{3}.

Table 4-4. Actual Ichthyoplankton Entrainment Estimate at Point Beach Nuclear Plant Compared to Entrainment Baseline Caculation for a Hypothetical Onshore Intake, April - September 2006.

		Actual Estimate		6-8 FT to Offshore	Baseline Calculation	
Taxa	Life Stage	No.	%	Ratio[1]	No.	%
UNID CLUPEIDAE	LARVAE	64,740	0.6	--	--	--
ALEWIFE	EGG	64,682	0.6	--	--	--
	POST YOLK-SAC	62,830	0.6	--	--	--
	JUVENILE	1,029,058	9.6	0.2	205,812	0.2
ALEWIFE type	EGG	2,132,617	19.9	37.1	79,120,099	88.9
UNID *ALOSA*	JUVENILE	129,262	1.2	--	--	--
UNID COREGONINAE	YOLK-SAC	125,676	1.2	22.3	2,802,567	3.2
RAINBOW SMELT	POST YOLK-SAC	129,507	1.2	11.8	1,528,188	1.7
	JUVENILE	5,341,080	49.7	0.1	534,108	0.6
	LARVAE	193,219	1.8	--	--	--
COMMON CARP	YOLK-SAC	64,740	0.6	53.3	3,450,668	3.9
UNID CYPRINID	YOLK-SAC	64,413	0.6	0.7	45,089	0.1
	LARVAE	64,413	0.6	--	--	--
UNID CATOSTOMID	EGG	63,786	0.6	--	--	--
BURBOT	YOLK-SAC	178,558	1.7	0.7	124,991	0.1
	JUVENILE	64,579	0.6	--	--	--
UNID STICKLEBACK	YOLK-SAC	127,571	1.2	--	--	--
	LARVAE	64,717	0.6	--	--	--
UNID *LEPOMIS*	POST YOLK-SAC	63,786	0.6	--	--	--
SLIMY SCULPIN	POST YOLK-SAC	128,775	1.2	0.7	90,143	0.1
UNID SCULPIN	POST YOLK-SAC	64,755	0.6	--	--	--
	LARVAE	64,682	0.6	--	--	--
UNIDENTIFIED	EGG	387,103	3.6	1.5	580,654	0.7
	LARVAE	64,413	0.6	7.4	476,653	0.5
Total Ichthyoplankton		10,738,963	100.0		88,958,971	100.0

Table 4-3 for source of ratios.

Table 4-5. Estimated Numbers and Biomass of Crayfish and Fish Impinged at Point Beach Nuclear Plant, 4 December 2005 – 2 December 2006.

Common Name	Estimated Number		Estimated Weight	
	No.	%	KG	%
GREAT LAKES CRAYFISH	707	100.00	--	--
Total Crayfish	707	100.00	--	--
LAKE STURGEON	3	0.00	0.711	0.00
ALEWIFE	8,624,384	99.21	30,249.059	94.27
ALEWIFE type	6,335	0.07	18.877	0.06
UNID *ALOSA*	15	0.00	0.015	0.00
GIZZARD SHAD	3,105	0.04	65.081	0.20
LAKE WHITEFISH	21	0.00	0.519	0.00
BLOATER	381	0.00	1.735	0.01
COHO SALMON	14	0.00	0.097	0.00
CHINOOK SALMON	27	0.00	9.698	0.03
ROUND WHITEFISH	225	0.00	107.471	0.33
BROWN TROUT	116	0.00	71.119	0.22
LAKE TROUT	31	0.00	52.713	0.16
RAINBOW SMELT	38,709	0.45	221.079	0.69
CENTRAL MUDMINNOW	7	0.00	0.035	0.00
COMMON CARP	47	0.00	0.818	0.00
GOLDEN SHINER	3	0.00	0.013	0.00
EMERALD SHINER	3	0.00	0.017	0.00
COMMON SHINER	10	0.00	0.343	0.00
SPOTTAIL SHINER	4,864	0.06	31.866	0.10
FATHEAD MINNOW	14	0.00	0.054	0.00
LONGNOSE DACE	220	0.00	2.192	0.01
LONGNOSE SUCKER	190	0.00	93.527	0.29
WHITE SUCKER	756	0.01	759.675	2.37
BLACK BULLHEAD	172	0.00	28.172	0.09
CHANNEL CATFISH	182	0.00	37.984	0.12
TROUT-PERCH	10	0.00	0.121	0.00
BURBOT	303	0.00	125.838	0.39
BROOK STICKLEBACK	26	0.00	0.048	0.00
THREESPINE STICKLEBACK	2,823	0.03	3.904	0.01
NINESPINE STICKLEBACK	2,713	0.03	6.240	0.02
WHITE PERCH	22	0.00	2.177	0.01
GREEN SUNFISH	3	0.00	0.010	0.00
PUMPKINSEED	31	0.00	0.434	0.00
BLUEGILL	25	0.00	0.270	0.00
UNID *LEPOMIS*	3	0.00	0.007	0.00
SMALLMOUTH BASS	74	0.00	23.801	0.07
BLACK CRAPPIE	3	0.00	0.039	0.00
YELLOW PERCH	3,262	0.04	41.716	0.13
FRESHWATER DRUM	96	0.00	105.490	0.33
ROUND GOBY	39	0.00	2.061	0.01
MOTTLED SCULPIN	2,763	0.03	16.161	0.05
SLIMY SCULPIN	758	0.01	4.602	0.01
UNID *COTTUS*	8	0.00	0.024	0.00
DEEPWATER SCULPIN	19	0.00	0.175	0.00
Estimated Total Fish	8,692,813	100.00	32,085.985	100.00
Estimated Total Crayfish and Fish	8,693,520		--	

Notes: 0.00 denotes values less than 0.005.

Table 4-6. Comparison of Impingement Rates for Alewife, Rainbow Smelt, and Yellow Perch Impinged at Seven Lake Michigan Power Plants, 1975.

				Alewife		Rainbow Smelt		Yellow Perch	
Plant	Intake Type	Design Flow (MGD)	1975 Total Water Use (gal x10^{6})	1975 Estimate	No. per MG	1975 Estimate	No. per MG	1975 Estimate	No. per MG
DC Cook	Offshore	1,022	343,424	173,000	0.50375	4,110	0.01197	12,800	0.03727
Kewaunee	Offshore	595	176,995	179,000	1.01133	19,100	0.10791	240	0.00136
Point Beach	Offshore	1,107	319,648	1,190,000	3.72284	176,000	0.55061	255	0.00080
Bailly	Offshore	485	124,161	121,000	0.97454	754	0.00607	666	0.00536
Offshore Mean		802	241,057	415,750	1.55312	49,991	0.16914	3,490	0.01120
Port Washington	Onshore	789	150,578	2,410,000	16.00499	77,900	0.51734	262	0.00174
Oak Creek	Onshore	1,773	433,242	1,700,000	3.92390	409,000	0.94404	1,430	0.00330
Waukegan	Onshore	1,035	245,680	766,000	3.11788	9,810	0.03993	321	0.00131
Onshore Mean	–	1,199	276,500	1,625,333	7.68226	165,570	0.50044	671	0.00212
Onshore/Offshore Ratio	–	–			4.9		3.0		0.2

Source: Table 4 in Spigarelli et al. 1981.

Table 4-7. Comparison of Study Estimates and Impingmement Calculaton Baseline for Point Beach Nuclear Plant, 4 December 2005 through 2 December 2006.

Common Name	Estimated Number		Calculation Baseline	
	No.	%	No.	%
GREAT LAKES CRAYFISH	707	100.00	707	100.00
Total Crayfish	707	100.00	707	100.00
LAKE STURGEON	3	0.00	3	0.00
ALEWIFE	8,624,384	99.21	42,259,481	99.66
ALEWIFE type	6,335	0.07	6,335	0.01
UNID *ALOSA*	15	0.00	15	0.00
GIZZARD SHAD	3,105	0.04	3,105	0.01
LAKE WHITEFISH	21	0.00	21	0.00
BLOATER	381	0.00	381	0.00
COHO SALMON	14	0.00	14	0.00
CHINOOK SALMON	27	0.00	27	0.00
ROUND WHITEFISH	225	0.00	225	0.00
BROWN TROUT	116	0.00	116	0.00
LAKE TROUT	31	0.00	31	0.00
RAINBOW SMELT	38,709	0.45	116,126	0.27
CENTRAL MUDMINNOW	7	0.00	7	0.00
COMMON CARP	47	0.00	47	0.00
GOLDEN SHINER	3	0.00	3	0.00
EMERALD SHINER	3	0.00	3	0.00
COMMON SHINER	10	0.00	10	0.00
SPOTTAIL SHINER	4,864	0.06	4,864	0.01
FATHEAD MINNOW	14	0.00	14	0.00
LONGNOSE DACE	220	0.00	220	0.00
LONGNOSE SUCKER	190	0.00	190	0.00
WHITE SUCKER	756	0.01	756	0.00
BLACK BULLHEAD	172	0.00	172	0.00
CHANNEL CATFISH	182	0.00	182	0.00
TROUT-PERCH	10	0.00	10	0.00
BURBOT	303	0.00	303	0.00
BROOK STICKLEBACK	26	0.00	26	0.00
THREESPINE STICKLEBACK	2,823	0.03	2,823	0.01
NINESPINE STICKLEBACK	2,713	0.03	2,713	0.01
WHITE PERCH	22	0.00	22	0.00
GREEN SUNFISH	3	0.00	3	0.00
PUMPKINSEED	31	0.00	31	0.00
BLUEGILL	25	0.00	25	0.00
UNID *LEPOMIS*	3	0.00	3	0.00
SMALLMOUTH BASS	74	0.00	74	0.00
BLACK CRAPPIE	3	0.00	3	0.00
YELLOW PERCH	3,262	0.04	652	0.00
FRESHWATER DRUM	96	0.00	96	0.00
ROUND GOBY	39	0.00	39	0.00
MOTTLED SCULPIN	2,763	0.03	2,763	0.01
SLIMY SCULPIN	758	0.01	758	0.00
UNID *COTTUS*	8	0.00	8	0.00
DEEPWATER SCULPIN	19	0.00	19	0.00
Estimated Total Fish	8,692,813	100.00	42,402,718	100.00
Estimated Total Crayfish and Fish	8,693,520		42,403,425	

Notes: 0.00 denotes values less than 0.005.

APPENDIX A

APPENDIX A1 - RAW ENTRAINMENT DATA LISTING

SAMPLING PERIOD: 19-20APR06 DATE: 19APR06 START TIME: 11:02 END TIME: 12:42
DIEL PERIOD: 12:00-18:00 VOLUME SAMPLED (gals x 10^6): 0.026597 VOLUME SAMPLED (m^3): 100.670
INTAKE TEMPERATURES (F): MINIMUM= 46.0 MEAN= 49.0 MAXIMUM= 53.2 STUDY GRAB TEMPERATURE (F): 48.0
DISCHARGE TEMPERATURES (F): MINIMUM= 64.7 MEAN= 69.5 MAXIMUM= 83.7
WEEKLY EXTRAPOLATION PERIOD: 16-22APR06 STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6): 6782.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	19
Hyalella azteca	.	1

SAMPLING PERIOD: 19-20APR06 DATE: 19APR06 START TIME: 17:02 END TIME: 18:45
DIEL PERIOD: 18:00-00:00 VOLUME SAMPLED (gals x 10^6): 0.028293 VOLUME SAMPLED (m^3): 107.089
INTAKE TEMPERATURES (F): MINIMUM= 46.0 MEAN= 49.0 MAXIMUM= 53.2 STUDY GRAB TEMPERATURE (F): 50.0
DISCHARGE TEMPERATURES (F): MINIMUM= 64.7 MEAN= 69.5 MAXIMUM= 83.7
WEEKLY EXTRAPOLATION PERIOD: 16-22APR06 STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6): 6782.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	43

SAMPLING PERIOD: 19-20APR06 DATE: 19APR06 START TIME: 23:05 END TIME: 0:44
DIEL PERIOD: 00:00-06:00 VOLUME SAMPLED (gals x 10^6): 0.026525 VOLUME SAMPLED (m^3): 100.397
INTAKE TEMPERATURES (F): MINIMUM= 46.0 MEAN= 49.0 MAXIMUM= 53.2 STUDY GRAB TEMPERATURE (F): 51.8
DISCHARGE TEMPERATURES (F): MINIMUM= 64.7 MEAN= 69.5 MAXIMUM= 83.7
WEEKLY EXTRAPOLATION PERIOD: 16-22APR06 STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6): 6782.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	72
UNID COREGONINAE	YOLK-SAC	1

SAMPLING PERIOD: 19-20APR06 DATE: 20APR06 START TIME: 5:03 END TIME: 6:42
DIEL PERIOD: 06:00-12:00 VOLUME SAMPLED (gals x 10^6): 0.026520 VOLUME SAMPLED (m^3): 100.378
INTAKE TEMPERATURES (F): MINIMUM= 46.0 MEAN= 49.0 MAXIMUM= 53.2 STUDY GRAB TEMPERATURE (F): 49.8
DISCHARGE TEMPERATURES (F): MINIMUM= 64.7 MEAN= 69.5 MAXIMUM= 83.7
WEEKLY EXTRAPOLATION PERIOD: 16-22APR06 STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6): 6782.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	42
UNID COREGONINAE	YOLK-SAC	1

SAMPLING PERIOD: 26-27APR06 DATE: 26APR06 START TIME: 11:11 END TIME: 12:55
DIEL PERIOD: 12:00-18:00 VOLUME SAMPLED (gals x 10^6): 0.026625 VOLUME SAMPLED (m^3): 100.776
INTAKE TEMPERATURES (F): MINIMUM= 46.7 MEAN= 48.8 MAXIMUM= 50.4 STUDY GRAB TEMPERATURE (F): 50.4
DISCHARGE TEMPERATURES (F): MINIMUM= 65.3 MEAN= 67.4 MAXIMUM= 68.8
WEEKLY EXTRAPOLATION PERIOD: 23-29APR06 STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6): 6854.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	49

SAMPLING PERIOD: 26-27APR06 DATE: 26APR06 START TIME: 17:10 END TIME: 18:53
DIEL PERIOD: 18:00-00:00 VOLUME SAMPLED (gals x 10^6): 0.026676 VOLUME SAMPLED (m^3): 100.969
INTAKE TEMPERATURES (F): MINIMUM= 46.7 MEAN= 48.8 MAXIMUM= 50.4 STUDY GRAB TEMPERATURE (F): 50.5
DISCHARGE TEMPERATURES (F): MINIMUM= 65.3 MEAN= 67.4 MAXIMUM= 68.8
WEEKLY EXTRAPOLATION PERIOD: 23-29APR06 STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6): 6854.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	23

SAMPLING PERIOD: 26-27APR06 DATE: 26APR06 START TIME: 23:37 END TIME: 1:21
DIEL PERIOD: 00:00-06:00 VOLUME SAMPLED (gals x 10^6): 0.026518 VOLUME SAMPLED (m^3): 100.371
INTAKE TEMPERATURES (F): MINIMUM= 46.7 MEAN= 48.8 MAXIMUM= 50.4 STUDY GRAB TEMPERATURE (F): 49.3
DISCHARGE TEMPERATURES (F): MINIMUM= 65.3 MEAN= 67.4 MAXIMUM= 68.8
WEEKLY EXTRAPOLATION PERIOD: 23-29APR06 STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6): 6854.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	38
BURBOT	YOLK-SAC	1

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SAMPLING PERIOD: 26-27APR06        DATE: 27APR06        START TIME:  5:37        END TIME:  7:22
DIEL PERIOD: 06:00-12:00           VOLUME SAMPLED (gals x 10^6):  0.026488       VOLUME SAMPLED (m^3):  100.257
INTAKE TEMPERATURES (F):    MINIMUM= 46.7  MEAN= 48.8  MAXIMUM= 50.4             STUDY GRAB TEMPERATURE (F):  49.3
DISCHARGE TEMPERATURES (F): MINIMUM= 65.3  MEAN= 67.4  MAXIMUM= 68.8
WEEKLY EXTRAPOLATION PERIOD: 23-29APR06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------      --------------  ------
            Gammarus                           .       36
-------------------------------------------------------------------------------------------------------------------
SAMPLING PERIOD: 03-04MAY06        DATE: 03MAY06        START TIME: 11:19        END TIME: 12:55
DIEL PERIOD: 12:00-18:00           VOLUME SAMPLED (gals x 10^6):  0.026547       VOLUME SAMPLED (m^3):  100.480
INTAKE TEMPERATURES (F):    MINIMUM= 44.0  MEAN= 45.9  MAXIMUM= 47.6             STUDY GRAB TEMPERATURE (F):  45.9
DISCHARGE TEMPERATURES (F): MINIMUM= 64.0  MEAN= 70.1  MAXIMUM= 80.0
WEEKLY EXTRAPOLATION PERIOD: 30APR-06MAY06   STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6180.5

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------      --------------  ------
            Gammarus                           .       27
-------------------------------------------------------------------------------------------------------------------
SAMPLING PERIOD: 03-04MAY06        DATE: 03MAY06        START TIME: 18:00        END TIME: 19:42
DIEL PERIOD: 18:00-00:00           VOLUME SAMPLED (gals x 10^6):  0.026531       VOLUME SAMPLED (m^3):  100.420
INTAKE TEMPERATURES (F):    MINIMUM= 44.0  MEAN= 45.9  MAXIMUM= 47.6             STUDY GRAB TEMPERATURE (F):  47.5
DISCHARGE TEMPERATURES (F): MINIMUM= 64.0  MEAN= 70.1  MAXIMUM= 80.0
WEEKLY EXTRAPOLATION PERIOD: 30APR-06MAY06   STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6180.5

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------      --------------  ------
            Gammarus                           .       25
-------------------------------------------------------------------------------------------------------------------
SAMPLING PERIOD: 03-04MAY06        DATE: 04MAY06        START TIME:  0:12        END TIME:  1:56
DIEL PERIOD: 00:00-06:00           VOLUME SAMPLED (gals x 10^6):  0.026741       VOLUME SAMPLED (m^3):  101.215
INTAKE TEMPERATURES (F):    MINIMUM= 44.0  MEAN= 45.9  MAXIMUM= 47.6             STUDY GRAB TEMPERATURE (F):  48.9
DISCHARGE TEMPERATURES (F): MINIMUM= 64.0  MEAN= 70.1  MAXIMUM= 80.0
WEEKLY EXTRAPOLATION PERIOD: 30APR-06MAY06   STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6180.5

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------      --------------  ------
            Gammarus                           .       49
            BURBOT                   YOLK-SAC         2
-------------------------------------------------------------------------------------------------------------------
SAMPLING PERIOD: 03-04MAY06        DATE: 04MAY06        START TIME:  6:01        END TIME:  7:40
DIEL PERIOD: 06:00-12:00           VOLUME SAMPLED (gals x 10^6):  0.028534       VOLUME SAMPLED (m^3):  108.001
INTAKE TEMPERATURES (F):    MINIMUM= 44.0  MEAN= 45.9  MAXIMUM= 47.6             STUDY GRAB TEMPERATURE (F):  48.2
DISCHARGE TEMPERATURES (F): MINIMUM= 64.0  MEAN= 70.1  MAXIMUM= 80.0
WEEKLY EXTRAPOLATION PERIOD: 30APR-06MAY06   STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6180.5

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------      --------------  ------
            Gammarus                           .       39
-------------------------------------------------------------------------------------------------------------------
SAMPLING PERIOD: 10-11MAY06        DATE: 10MAY06        START TIME: 12:00        END TIME: 13:45
DIEL PERIOD: 12:00-18:00           VOLUME SAMPLED (gals x 10^6):  0.026566       VOLUME SAMPLED (m^3):  100.552
INTAKE TEMPERATURES (F):    MINIMUM= 42.9  MEAN= 43.9  MAXIMUM= 47.4             STUDY GRAB TEMPERATURE (F):  45.3
DISCHARGE TEMPERATURES (F): MINIMUM= 61.5  MEAN= 62.8  MAXIMUM= 65.5
WEEKLY EXTRAPOLATION PERIOD: 07-13MAY06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------      --------------  ------
            Gammarus                           .       46
-------------------------------------------------------------------------------------------------------------------
SAMPLING PERIOD: 10-11MAY06        DATE: 10MAY06        START TIME: 18:00        END TIME: 19:44
DIEL PERIOD: 18:00-00:00           VOLUME SAMPLED (gals x 10^6):  0.026505       VOLUME SAMPLED (m^3):  100.321
INTAKE TEMPERATURES (F):    MINIMUM= 42.9  MEAN= 43.9  MAXIMUM= 47.4             STUDY GRAB TEMPERATURE (F):  46.2
DISCHARGE TEMPERATURES (F): MINIMUM= 61.5  MEAN= 62.8  MAXIMUM= 65.5
WEEKLY EXTRAPOLATION PERIOD: 07-13MAY06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------      --------------  ------
            Gammarus                           .       48
-------------------------------------------------------------------------------------------------------------------
SAMPLING PERIOD: 10-11MAY06        DATE: 10MAY06        START TIME: 23:00        END TIME:  0:45
DIEL PERIOD: 00:00-06:00           VOLUME SAMPLED (gals x 10^6):  0.026427       VOLUME SAMPLED (m^3):  100.026
INTAKE TEMPERATURES (F):    MINIMUM= 42.9  MEAN= 43.9  MAXIMUM= 47.4             STUDY GRAB TEMPERATURE (F):  45.7
DISCHARGE TEMPERATURES (F): MINIMUM= 61.5  MEAN= 62.8  MAXIMUM= 65.5
WEEKLY EXTRAPOLATION PERIOD: 07-13MAY06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------      --------------  ------
            Gammarus                           .       24
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SAMPLING PERIOD: 10-11MAY06        DATE: 11MAY06        START TIME:  0:55        END TIME:  2:35
DIEL PERIOD: 06:00-12:00           VOLUME SAMPLED (gals x 10^6):  0.026421       VOLUME SAMPLED (m^3):  100.003
INTAKE TEMPERATURES (F):     MINIMUM= 42.9  MEAN= 43.9  MAXIMUM= 47.4            STUDY GRAB TEMPERATURE (F):  47.3
DISCHARGE TEMPERATURES (F): MINIMUM= 61.5  MEAN= 62.8  MAXIMUM= 65.5
WEEKLY EXTRAPOLATION PERIOD: 07-13MAY06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------      --------------  ------
            Gammarus                              .     28
-------------------------------------------------------------------------------------------------------------
SAMPLING PERIOD: 17-18MAY06        DATE: 17MAY06        START TIME: 12:00        END TIME: 13:47
DIEL PERIOD: 12:00-18:00           VOLUME SAMPLED (gals x 10^6):  0.027394       VOLUME SAMPLED (m^3):  103.686
INTAKE TEMPERATURES (F):     MINIMUM= 46.9  MEAN= 48.1  MAXIMUM= 50.3            STUDY GRAB TEMPERATURE (F):  51.4
DISCHARGE TEMPERATURES (F): MINIMUM= 65.6  MEAN= 66.7  MAXIMUM= 68.8
WEEKLY EXTRAPOLATION PERIOD: 14-20MAY06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------      --------------  ------
            Gammarus                              .    211
-------------------------------------------------------------------------------------------------------------
SAMPLING PERIOD: 17-18MAY06        DATE: 17MAY06        START TIME: 18:16        END TIME: 20:17
DIEL PERIOD: 18:00-00:00           VOLUME SAMPLED (gals x 10^6):  0.028108       VOLUME SAMPLED (m^3):  106.389
INTAKE TEMPERATURES (F):     MINIMUM= 46.9  MEAN= 48.1  MAXIMUM= 50.3            STUDY GRAB TEMPERATURE (F):  48.9
DISCHARGE TEMPERATURES (F): MINIMUM= 65.6  MEAN= 66.7  MAXIMUM= 68.8
WEEKLY EXTRAPOLATION PERIOD: 14-20MAY06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------      --------------  ------
            Gammarus                              .    228
-------------------------------------------------------------------------------------------------------------
SAMPLING PERIOD: 17-18MAY06        DATE: 18MAY06        START TIME:  0:02        END TIME:  1:55
DIEL PERIOD: 00:00-06:00           VOLUME SAMPLED (gals x 10^6):  0.026674       VOLUME SAMPLED (m^3):  100.961
INTAKE TEMPERATURES (F):     MINIMUM= 46.9  MEAN= 48.1  MAXIMUM= 50.3            STUDY GRAB TEMPERATURE (F):  49.1
DISCHARGE TEMPERATURES (F): MINIMUM= 65.6  MEAN= 66.7  MAXIMUM= 68.8
WEEKLY EXTRAPOLATION PERIOD: 14-20MAY06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------      --------------  ------
            Gammarus                              .    310
-------------------------------------------------------------------------------------------------------------
SAMPLING PERIOD: 17-18MAY06        DATE: 18MAY06        START TIME:  6:04        END TIME:  7:59
DIEL PERIOD: 06:00-12:00           VOLUME SAMPLED (gals x 10^6):  0.026509       VOLUME SAMPLED (m^3):  100.337
INTAKE TEMPERATURES (F):     MINIMUM= 46.9  MEAN= 48.1  MAXIMUM= 50.3            STUDY GRAB TEMPERATURE (F):  50.0
DISCHARGE TEMPERATURES (F): MINIMUM= 65.6  MEAN= 66.7  MAXIMUM= 68.8
WEEKLY EXTRAPOLATION PERIOD: 14-20MAY06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------      --------------  ------
            Gammarus                              .    247
-------------------------------------------------------------------------------------------------------------
SAMPLING PERIOD: 24-25MAY06        DATE: 24MAY06        START TIME: 12:13        END TIME: 13:50
DIEL PERIOD: 12:00-18:00           VOLUME SAMPLED (gals x 10^6):  0.026580       VOLUME SAMPLED (m^3):  100.605
INTAKE TEMPERATURES (F):     MINIMUM= 45.5  MEAN= 47.1  MAXIMUM= 50.3            STUDY GRAB TEMPERATURE (F):  48.2
DISCHARGE TEMPERATURES (F): MINIMUM= 64.5  MEAN= 66.2  MAXIMUM= 70.2
WEEKLY EXTRAPOLATION PERIOD: 21-27MAY06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------      --------------  ------
            Gammarus                              .    244
-------------------------------------------------------------------------------------------------------------
SAMPLING PERIOD: 24-25MAY06        DATE: 24MAY06        START TIME: 18:12        END TIME: 19:50
DIEL PERIOD: 18:00-00:00           VOLUME SAMPLED (gals x 10^6):  0.026504       VOLUME SAMPLED (m^3):  100.318
INTAKE TEMPERATURES (F):     MINIMUM= 45.5  MEAN= 47.1  MAXIMUM= 50.3            STUDY GRAB TEMPERATURE (F):  49.5
DISCHARGE TEMPERATURES (F): MINIMUM= 64.5  MEAN= 66.2  MAXIMUM= 70.2
WEEKLY EXTRAPOLATION PERIOD: 21-27MAY06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------      --------------  ------
            Gammarus                              .    106
-------------------------------------------------------------------------------------------------------------
SAMPLING PERIOD: 24-25MAY06        DATE: 25MAY06        START TIME:  0:00        END TIME:  1:39
DIEL PERIOD: 00:00-06:00           VOLUME SAMPLED (gals x 10^6):  0.026438       VOLUME SAMPLED (m^3):  100.068
INTAKE TEMPERATURES (F):     MINIMUM= 45.5  MEAN= 47.1  MAXIMUM= 50.3            STUDY GRAB TEMPERATURE (F):  51.4
DISCHARGE TEMPERATURES (F): MINIMUM= 64.5  MEAN= 66.2  MAXIMUM= 70.2
WEEKLY EXTRAPOLATION PERIOD: 21-27MAY06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------      --------------  ------
            Gammarus                              .    144
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SAMPLING PERIOD: 24-25MAY06        DATE: 25MAY06        START TIME:  5:59       END TIME:  7:39
DIEL PERIOD: 06:00-12:00           VOLUME SAMPLED (gals x 10^6):  0.026425      VOLUME SAMPLED (m^3):  100.019
INTAKE TEMPERATURES (F):    MINIMUM= 45.5  MEAN= 47.1  MAXIMUM= 50.3            STUDY GRAB TEMPERATURE (F):  48.0
DISCHARGE TEMPERATURES (F): MINIMUM= 64.5  MEAN= 66.2  MAXIMUM= 70.2
WEEKLY EXTRAPOLATION PERIOD: 21-27MAY06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------      -------------   ------
            Gammarus                           .       37
-------------------------------------------------------------------------------------------------------------
SAMPLING PERIOD: 31MAY-01JUN06     DATE: 31MAY06        START TIME: 12:00       END TIME: 13:41
DIEL PERIOD: 12:00-18:00           VOLUME SAMPLED (gals x 10^6):  0.027013      VOLUME SAMPLED (m^3):  102.244
INTAKE TEMPERATURES (F):    MINIMUM= 46.6  MEAN= 50.2  MAXIMUM= 52.6            STUDY GRAB TEMPERATURE (F):  52.0
DISCHARGE TEMPERATURES (F): MINIMUM= 65.4  MEAN= 68.4  MAXIMUM= 70.7
WEEKLY EXTRAPOLATION PERIOD: 28MAY-03JUN06   STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------      -------------   ------
            Gammarus                           .       59
-------------------------------------------------------------------------------------------------------------
SAMPLING PERIOD: 31MAY-01JUN06     DATE: 31MAY06        START TIME: 18:00       END TIME: 19:42
DIEL PERIOD: 18:00-00:00           VOLUME SAMPLED (gals x 10^6):  0.027630      VOLUME SAMPLED (m^3):  104.580
INTAKE TEMPERATURES (F):    MINIMUM= 46.6  MEAN= 50.2  MAXIMUM= 52.6            STUDY GRAB TEMPERATURE (F):  52.7
DISCHARGE TEMPERATURES (F): MINIMUM= 65.4  MEAN= 68.4  MAXIMUM= 70.7
WEEKLY EXTRAPOLATION PERIOD: 28MAY-03JUN06   STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------      -------------   ------
            Gammarus                           .      299
-------------------------------------------------------------------------------------------------------------
SAMPLING PERIOD: 31MAY-01JUN06     DATE: 01JUN06        START TIME:  0:00       END TIME:  1:37
DIEL PERIOD: 00:00-06:00           VOLUME SAMPLED (gals x 10^6):  0.026772      VOLUME SAMPLED (m^3):  101.332
INTAKE TEMPERATURES (F):    MINIMUM= 46.6  MEAN= 50.2  MAXIMUM= 52.6            STUDY GRAB TEMPERATURE (F):  53.2
DISCHARGE TEMPERATURES (F): MINIMUM= 65.4  MEAN= 68.4  MAXIMUM= 70.7
WEEKLY EXTRAPOLATION PERIOD: 28MAY-03JUN06   STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------      -------------   ------
            Gammarus                           .       71
-------------------------------------------------------------------------------------------------------------
SAMPLING PERIOD: 31MAY-01JUN06     DATE: 01JUN06        START TIME:  6:00       END TIME:  7:37
DIEL PERIOD: 06:00-12:00           VOLUME SAMPLED (gals x 10^6):  0.026540      VOLUME SAMPLED (m^3):  100.454
INTAKE TEMPERATURES (F):    MINIMUM= 46.6  MEAN= 50.2  MAXIMUM= 52.6            STUDY GRAB TEMPERATURE (F):  53.2
DISCHARGE TEMPERATURES (F): MINIMUM= 65.4  MEAN= 68.4  MAXIMUM= 70.7
WEEKLY EXTRAPOLATION PERIOD: 28MAY-03JUN06   STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------      -------------   ------
            Gammarus                           .      142
-------------------------------------------------------------------------------------------------------------
SAMPLING PERIOD: 07-08JUN06        DATE: 07JUN06        START TIME: 12:02       END TIME: 13:41
DIEL PERIOD: 12:00-18:00           VOLUME SAMPLED (gals x 10^6):  0.026766      VOLUME SAMPLED (m^3):  101.309
INTAKE TEMPERATURES (F):    MINIMUM= 47.8  MEAN= 50.7  MAXIMUM= 51.9            STUDY GRAB TEMPERATURE (F):  53.1
DISCHARGE TEMPERATURES (F): MINIMUM= 65.5  MEAN= 69.0  MAXIMUM= 70.4
WEEKLY EXTRAPOLATION PERIOD: 04-10JUN06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------      -------------   ------
            Gammarus                           .      147
            UNIDENTIFIED             EGG                 3
-------------------------------------------------------------------------------------------------------------
SAMPLING PERIOD: 07-08JUN06        DATE: 07JUN06        START TIME: 18:00       END TIME: 19:37
DIEL PERIOD: 18:00-00:00           VOLUME SAMPLED (gals x 10^6):  0.026511      VOLUME SAMPLED (m^3):  100.344
INTAKE TEMPERATURES (F):    MINIMUM= 47.8  MEAN= 50.7  MAXIMUM= 51.9            STUDY GRAB TEMPERATURE (F):  51.8
DISCHARGE TEMPERATURES (F): MINIMUM= 65.5  MEAN= 69.0  MAXIMUM= 70.4
WEEKLY EXTRAPOLATION PERIOD: 04-10JUN06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------      -------------   ------
            Gammarus                           .      102
-------------------------------------------------------------------------------------------------------------
SAMPLING PERIOD: 07-08JUN06        DATE: 07JUN06        START TIME: 23:50       END TIME:  1:26
DIEL PERIOD: 00:00-06:00           VOLUME SAMPLED (gals x 10^6):  0.026429      VOLUME SAMPLED (m^3):  100.034
INTAKE TEMPERATURES (F):    MINIMUM= 47.8  MEAN= 50.7  MAXIMUM= 51.9            STUDY GRAB TEMPERATURE (F):  52.3
DISCHARGE TEMPERATURES (F): MINIMUM= 65.5  MEAN= 69.0  MAXIMUM= 70.4
WEEKLY EXTRAPOLATION PERIOD: 04-10JUN06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------      -------------   ------
            Gammarus                           .      102
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SAMPLING PERIOD: 07-08JUN06        DATE: 08JUN06        START TIME:  5:55        END TIME:  6:33
DIEL PERIOD: 06:00-12:00           VOLUME SAMPLED (gals x 10^6):  0.026459       VOLUME SAMPLED (m^3):  100.147
INTAKE TEMPERATURES (F):     MINIMUM= 47.8  MEAN= 50.7  MAXIMUM= 51.9            STUDY GRAB TEMPERATURE (F):  52.3
DISCHARGE TEMPERATURES (F): MINIMUM= 65.5  MEAN= 69.0  MAXIMUM= 70.4
WEEKLY EXTRAPOLATION PERIOD: 04-10JUN06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------------  --------------  ------
            Gammarus                              .     101
            UNIDENTIFIED             EGG                 1
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SAMPLING PERIOD: 14-15JUN06        DATE: 14JUN06        START TIME: 12:09        END TIME: 13:46
DIEL PERIOD: 12:00-18:00           VOLUME SAMPLED (gals x 10^6):  0.026767       VOLUME SAMPLED (m^3):  101.313
INTAKE TEMPERATURES (F):     MINIMUM= 57.1  MEAN= 59.7  MAXIMUM= 60.8            STUDY GRAB TEMPERATURE (F):  59.0
DISCHARGE TEMPERATURES (F): MINIMUM= 75.9  MEAN= 78.2  MAXIMUM= 79.3
WEEKLY EXTRAPOLATION PERIOD: 11-17JUN06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------------  --------------  ------
            Gammarus                              .     297
            UNID CYPRINID            LARVAE              1
            UNIDENTIFIED             LARVAE              1
-----------------------------------------------------------------------------------------------------------------
SAMPLING PERIOD: 14-15JUN06        DATE: 14JUN06        START TIME: 18:01        END TIME: 19:37
DIEL PERIOD: 18:00-00:00           VOLUME SAMPLED (gals x 10^6):  0.026623       VOLUME SAMPLED (m^3):  100.768
INTAKE TEMPERATURES (F):     MINIMUM= 57.1  MEAN= 59.7  MAXIMUM= 60.8            STUDY GRAB TEMPERATURE (F):  60.3
DISCHARGE TEMPERATURES (F): MINIMUM= 75.9  MEAN= 78.2  MAXIMUM= 79.3
WEEKLY EXTRAPOLATION PERIOD: 11-17JUN06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------------  --------------  ------
            Gammarus                              .     485
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SAMPLING PERIOD: 14-15JUN06        DATE: 15JUN06        START TIME:  0:00        END TIME:  1:36
DIEL PERIOD: 00:00-06:00           VOLUME SAMPLED (gals x 10^6):  0.027015       VOLUME SAMPLED (m^3):  102.252
INTAKE TEMPERATURES (F):     MINIMUM= 57.1  MEAN= 59.7  MAXIMUM= 60.8            STUDY GRAB TEMPERATURE (F):  60.8
DISCHARGE TEMPERATURES (F): MINIMUM= 75.9  MEAN= 78.2  MAXIMUM= 79.3
WEEKLY EXTRAPOLATION PERIOD: 11-17JUN06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------------  --------------  ------
            Gammarus                              .     550
            UNID CYPRINID            YOLK-SAC            1
-----------------------------------------------------------------------------------------------------------------
SAMPLING PERIOD: 14-15JUN06        DATE: 15JUN06        START TIME:  6:00        END TIME:  7:37
DIEL PERIOD: 06:00-12:00           VOLUME SAMPLED (gals x 10^6):  0.026009       VOLUME SAMPLED (m^3):   98.444
INTAKE TEMPERATURES (F):     MINIMUM= 57.1  MEAN= 59.7  MAXIMUM= 60.8            STUDY GRAB TEMPERATURE (F):  61.2
DISCHARGE TEMPERATURES (F): MINIMUM= 75.9  MEAN= 78.2  MAXIMUM= 79.3
WEEKLY EXTRAPOLATION PERIOD: 11-17JUN06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------------  --------------  ------
            Gammarus                              .     177
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SAMPLING PERIOD: 21-22JUN06        DATE: 21JUN06        START TIME: 12:00        END TIME: 13:31
DIEL PERIOD: 12:00-18:00           VOLUME SAMPLED (gals x 10^6):  0.026532       VOLUME SAMPLED (m^3):  100.424
INTAKE TEMPERATURES (F):     MINIMUM= 45.9  MEAN= 47.2  MAXIMUM= 48.5            STUDY GRAB TEMPERATURE (F):  48.0
DISCHARGE TEMPERATURES (F): MINIMUM= 64.3  MEAN= 66.0  MAXIMUM= 68.1
WEEKLY EXTRAPOLATION PERIOD: 18-24JUN06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------------  --------------  ------
            Gammarus                              .     106
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SAMPLING PERIOD: 21-22JUN06        DATE: 21JUN06        START TIME: 18:00        END TIME: 19:35
DIEL PERIOD: 18:00-00:00           VOLUME SAMPLED (gals x 10^6):  0.026527       VOLUME SAMPLED (m^3):  100.405
INTAKE TEMPERATURES (F):     MINIMUM= 45.9  MEAN= 47.2  MAXIMUM= 48.5            STUDY GRAB TEMPERATURE (F):  47.5
DISCHARGE TEMPERATURES (F): MINIMUM= 64.3  MEAN= 66.0  MAXIMUM= 68.1
WEEKLY EXTRAPOLATION PERIOD: 18-24JUN06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------------  --------------  ------
            Gammarus                              .     105
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SAMPLING PERIOD: 21-22JUN06        DATE: 22JUN06        START TIME:  0:00        END TIME:  1:36
DIEL PERIOD: 00:00-06:00           VOLUME SAMPLED (gals x 10^6):  0.026428       VOLUME SAMPLED (m^3):  100.030
INTAKE TEMPERATURES (F):     MINIMUM= 45.9  MEAN= 47.2  MAXIMUM= 48.5            STUDY GRAB TEMPERATURE (F):  48.7
DISCHARGE TEMPERATURES (F): MINIMUM= 64.3  MEAN= 66.0  MAXIMUM= 68.1
WEEKLY EXTRAPOLATION PERIOD: 18-24JUN06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4
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TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	86
UNID STICKLEBACK	LARVAE	1

SAMPLING PERIOD: 21-22JUN06 DATE: 22JUN06 START TIME: 6:00 END TIME: 7:35
DIEL PERIOD: 06:00-12:00 VOLUME SAMPLED (gals x 10^6): 0.026427 VOLUME SAMPLED (m^3): 100.026
INTAKE TEMPERATURES (F): MINIMUM= 45.9 MEAN= 47.2 MAXIMUM= 48.5 STUDY GRAB TEMPERATURE (F): 48.4
DISCHARGE TEMPERATURES (F): MINIMUM= 64.3 MEAN= 66.0 MAXIMUM= 68.1
WEEKLY EXTRAPOLATION PERIOD: 18-24JUN06 STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6): 6854.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	90
RAINBOW SMELT	LARVAE	2

SAMPLING PERIOD: 28-29JUN06 DATE: 28JUN06 START TIME: 13:28 END TIME: 15:06
DIEL PERIOD: 12:00-18:00 VOLUME SAMPLED (gals x 10^6): 0.026596 VOLUME SAMPLED (m^3): 100.666
INTAKE TEMPERATURES (F): MINIMUM= 57.3 MEAN= 59.0 MAXIMUM= 60.9 STUDY GRAB TEMPERATURE (F): 58.8
DISCHARGE TEMPERATURES (F): MINIMUM= 76.0 MEAN= 77.8 MAXIMUM= 79.9
WEEKLY EXTRAPOLATION PERIOD: 25JUN-01JUL06 STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6): 6854.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	195
RAINBOW SMELT	LARVAE	1

SAMPLING PERIOD: 28-29JUN06 DATE: 28JUN06 START TIME: 18:00 END TIME: 19:38
DIEL PERIOD: 18:00-00:00 VOLUME SAMPLED (gals x 10^6): 0.026478 VOLUME SAMPLED (m^3): 100.219
INTAKE TEMPERATURES (F): MINIMUM= 57.3 MEAN= 59.0 MAXIMUM= 60.9 STUDY GRAB TEMPERATURE (F): 60.6
DISCHARGE TEMPERATURES (F): MINIMUM= 76.0 MEAN= 77.8 MAXIMUM= 79.9
WEEKLY EXTRAPOLATION PERIOD: 25JUN-01JUL06 STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6): 6854.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	254
UNID LEPOMIS	POST YOLK-SAC	1

SAMPLING PERIOD: 28-29JUN06 DATE: 29JUN06 START TIME: 0:00 END TIME: 1:40
DIEL PERIOD: 00:00-06:00 VOLUME SAMPLED (gals x 10^6): 0.027875 VOLUME SAMPLED (m^3): 105.507
INTAKE TEMPERATURES (F): MINIMUM= 57.3 MEAN= 59.0 MAXIMUM= 60.9 STUDY GRAB TEMPERATURE (F): 59.9
DISCHARGE TEMPERATURES (F): MINIMUM= 76.0 MEAN= 77.8 MAXIMUM= 79.9
WEEKLY EXTRAPOLATION PERIOD: 25JUN-01JUL06 STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6): 6854.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	353
UNID STICKLEBACK	YOLK-SAC	2

SAMPLING PERIOD: 28-29JUN06 DATE: 29JUN06 START TIME: 6:21 END TIME: 7:56
DIEL PERIOD: 06:00-12:00 VOLUME SAMPLED (gals x 10^6): 0.026511 VOLUME SAMPLED (m^3): 100.344
INTAKE TEMPERATURES (F): MINIMUM= 57.3 MEAN= 59.0 MAXIMUM= 60.9 STUDY GRAB TEMPERATURE (F): 59.7
DISCHARGE TEMPERATURES (F): MINIMUM= 76.0 MEAN= 77.8 MAXIMUM= 79.9
WEEKLY EXTRAPOLATION PERIOD: 25JUN-01JUL06 STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6): 6854.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	339
UNID CATOSTOMID	EGG	1

SAMPLING PERIOD: 10-11JUL06 DATE: 10JUL06 START TIME: 12:10 END TIME: 13:50
DIEL PERIOD: 12:00-18:00 VOLUME SAMPLED (gals x 10^6): 0.026673 VOLUME SAMPLED (m^3): 100.957
INTAKE TEMPERATURES (F): MINIMUM= 51.4 MEAN= 52.6 MAXIMUM= 56.1 STUDY GRAB TEMPERATURE (F): 53.6
DISCHARGE TEMPERATURES (F): MINIMUM= 70.1 MEAN= 71.3 MAXIMUM= 74.6
WEEKLY EXTRAPOLATION PERIOD: 02-08JUL06 STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6): 6854.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	182

SAMPLING PERIOD: 10-11JUL06 DATE: 10JUL06 START TIME: 18:00 END TIME: 19:48
DIEL PERIOD: 18:00-00:00 VOLUME SAMPLED (gals x 10^6): 0.026504 VOLUME SAMPLED (m^3): 100.318
INTAKE TEMPERATURES (F): MINIMUM= 51.4 MEAN= 52.6 MAXIMUM= 56.1 STUDY GRAB TEMPERATURE (F): 53.4
DISCHARGE TEMPERATURES (F): MINIMUM= 70.1 MEAN= 71.3 MAXIMUM= 74.6
WEEKLY EXTRAPOLATION PERIOD: 02-08JUL06 STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6): 6854.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	112
ALEWIFE type	EGG	3

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SAMPLING PERIOD: 10-11JUL06        DATE: 11JUL06        START TIME:  0:00       END TIME:  1:37
DIEL PERIOD: 00:00-06:00           VOLUME SAMPLED (gals x 10^6):  0.026465      VOLUME SAMPLED (m^3):  100.170
INTAKE TEMPERATURES (F):    MINIMUM= 51.4  MEAN= 52.6  MAXIMUM= 56.1            STUDY GRAB TEMPERATURE (F):  52.3
DISCHARGE TEMPERATURES (F): MINIMUM= 70.1  MEAN= 71.3  MAXIMUM= 74.6
WEEKLY EXTRAPOLATION PERIOD: 02-08JUL06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------------  --------------  ------
            Gammarus                              .     126
            ALEWIFE type             EGG                  7
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SAMPLING PERIOD: 10-11JUL06        DATE: 11JUL06        START TIME:  6:00       END TIME:  7:38
DIEL PERIOD: 06:00-12:00           VOLUME SAMPLED (gals x 10^6):  0.026425      VOLUME SAMPLED (m^3):  100.019
INTAKE TEMPERATURES (F):    MINIMUM= 51.4  MEAN= 52.6  MAXIMUM= 56.1            STUDY GRAB TEMPERATURE (F):  53.8
DISCHARGE TEMPERATURES (F): MINIMUM= 70.1  MEAN= 71.3  MAXIMUM= 74.6
WEEKLY EXTRAPOLATION PERIOD: 02-08JUL06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------------  --------------  ------
            Gammarus                              .     130
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SAMPLING PERIOD: 12-13JUL06        DATE: 12JUL06        START TIME: 12:00       END TIME: 13:40
DIEL PERIOD: 12:00-18:00           VOLUME SAMPLED (gals x 10^6):  0.026504      VOLUME SAMPLED (m^3):  100.318
INTAKE TEMPERATURES (F):    MINIMUM= 57.2  MEAN= 59.7  MAXIMUM= 61.9            STUDY GRAB TEMPERATURE (F):  59.2
DISCHARGE TEMPERATURES (F): MINIMUM= 75.8  MEAN= 78.7  MAXIMUM= 81.2
WEEKLY EXTRAPOLATION PERIOD: 09-15JUL06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------------  --------------  ------
            Gammarus                              .     159
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SAMPLING PERIOD: 12-13JUL06        DATE: 12JUL06        START TIME: 18:00       END TIME: 19:40
DIEL PERIOD: 18:00-00:00           VOLUME SAMPLED (gals x 10^6):  0.026514      VOLUME SAMPLED (m^3):  100.355
INTAKE TEMPERATURES (F):    MINIMUM= 57.2  MEAN= 59.7  MAXIMUM= 61.9            STUDY GRAB TEMPERATURE (F):  60.8
DISCHARGE TEMPERATURES (F): MINIMUM= 75.8  MEAN= 78.7  MAXIMUM= 81.2
WEEKLY EXTRAPOLATION PERIOD: 09-15JUL06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------------  --------------  ------
            Gammarus                              .     166
            ALEWIFE type             EGG                  2
-------------------------------------------------------------------------------------------------------------
SAMPLING PERIOD: 12-13JUL06        DATE: 13JUL06        START TIME:  0:00       END TIME:  1:39
DIEL PERIOD: 00:00-06:00           VOLUME SAMPLED (gals x 10^6):  0.026426      VOLUME SAMPLED (m^3):  100.022
INTAKE TEMPERATURES (F):    MINIMUM= 57.2  MEAN= 59.7  MAXIMUM= 61.9            STUDY GRAB TEMPERATURE (F):  62.4
DISCHARGE TEMPERATURES (F): MINIMUM= 75.8  MEAN= 78.7  MAXIMUM= 81.2
WEEKLY EXTRAPOLATION PERIOD: 09-15JUL06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------------  --------------  ------
            Gammarus                              .     353
            UNID CLUPEIDAE           LARVAE               1
            ALEWIFE type             EGG                  9
            COMMON CARP              YOLK-SAC             1
-------------------------------------------------------------------------------------------------------------
SAMPLING PERIOD: 12-13JUL06        DATE: 13JUL06        START TIME:  6:00       END TIME:  7:41
DIEL PERIOD: 06:00-12:00           VOLUME SAMPLED (gals x 10^6):  0.026431      VOLUME SAMPLED (m^3):  100.041
INTAKE TEMPERATURES (F):    MINIMUM= 57.2  MEAN= 59.7  MAXIMUM= 61.9            STUDY GRAB TEMPERATURE (F):  61.5
DISCHARGE TEMPERATURES (F): MINIMUM= 75.8  MEAN= 78.7  MAXIMUM= 81.2
WEEKLY EXTRAPOLATION PERIOD: 09-15JUL06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------------  --------------  ------
            Gammarus                              .     148
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SAMPLING PERIOD: 19-20JUL06        DATE: 19JUL06        START TIME: 11:57       END TIME: 13:36
DIEL PERIOD: 12:00-18:00           VOLUME SAMPLED (gals x 10^6):  0.027067      VOLUME SAMPLED (m^3):  102.449
INTAKE TEMPERATURES (F):    MINIMUM= 49.6  MEAN= 53.0  MAXIMUM= 57.9            STUDY GRAB TEMPERATURE (F):  58.5
DISCHARGE TEMPERATURES (F): MINIMUM= 68.3  MEAN= 72.3  MAXIMUM= 79.4
WEEKLY EXTRAPOLATION PERIOD: 16-22JUL06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------------  --------------  ------
            Gammarus                              .     210
            SLIMY SCULPIN            POST YOLK-SAC        1
-------------------------------------------------------------------------------------------------------------
SAMPLING PERIOD: 19-20JUL06        DATE: 19JUL06        START TIME: 18:00       END TIME: 17:36
DIEL PERIOD: 18:00-00:00           VOLUME SAMPLED (gals x 10^6):  0.026501      VOLUME SAMPLED (m^3):  100.306
INTAKE TEMPERATURES (F):    MINIMUM= 49.6  MEAN= 53.0  MAXIMUM= 57.9            STUDY GRAB TEMPERATURE (F):  55.2
DISCHARGE TEMPERATURES (F): MINIMUM= 68.3  MEAN= 72.3  MAXIMUM= 79.4
WEEKLY EXTRAPOLATION PERIOD: 16-22JUL06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4
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TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	149
ALEWIFE type	EGG	4
UNIDENTIFIED	EGG	1

SAMPLING PERIOD: 19-20JUL06 DATE: 20JUL06 START TIME: 0:00 END TIME: 1:35
DIEL PERIOD: 00:00-06:00 VOLUME SAMPLED (gals x 10^6): 0.026848 VOLUME SAMPLED (m^3): 101.620
INTAKE TEMPERATURES (F): MINIMUM= 49.6 MEAN= 53.0 MAXIMUM= 57.9 STUDY GRAB TEMPERATURE (F): 51.3
DISCHARGE TEMPERATURES (F): MINIMUM= 68.3 MEAN= 72.3 MAXIMUM= 79.4
WEEKLY EXTRAPOLATION PERIOD: 16-22JUL06 STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6): 6854.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	227
ALEWIFE type	EGG	1

SAMPLING PERIOD: 19-20JUL06 DATE: 20JUL06 START TIME: 6:03 END TIME: 7:36
DIEL PERIOD: 06:00-12:00 VOLUME SAMPLED (gals x 10^6): 0.026529 VOLUME SAMPLED (m^3): 100.412
INTAKE TEMPERATURES (F): MINIMUM= 49.6 MEAN= 53.0 MAXIMUM= 57.9 STUDY GRAB TEMPERATURE (F): 52.2
DISCHARGE TEMPERATURES (F): MINIMUM= 68.3 MEAN= 72.3 MAXIMUM= 79.4
WEEKLY EXTRAPOLATION PERIOD: 16-22JUL06 STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6): 6854.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	76
RAINBOW SMELT	JUVENILE	1

SAMPLING PERIOD: 26-27JUL06 DATE: 26JUL06 START TIME: 12:05 END TIME: 13:46
DIEL PERIOD: 12:00-18:00 VOLUME SAMPLED (gals x 10^6): 0.026437 VOLUME SAMPLED (m^3): 100.064
INTAKE TEMPERATURES (F): MINIMUM= 57.3 MEAN= 58.9 MAXIMUM= 62.2 STUDY GRAB TEMPERATURE (F): .
DISCHARGE TEMPERATURES (F): MINIMUM= 76.3 MEAN= 78.2 MAXIMUM= 81.2
WEEKLY EXTRAPOLATION PERIOD: 23-29JUL06 STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6): 6854.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	152
RAINBOW SMELT	JUVENILE	4

SAMPLING PERIOD: 26-27JUL06 DATE: 26JUL06 START TIME: 18:02 END TIME: 19:42
DIEL PERIOD: 18:00-00:00 VOLUME SAMPLED (gals x 10^6): 0.026448 VOLUME SAMPLED (m^3): 100.106
INTAKE TEMPERATURES (F): MINIMUM= 57.3 MEAN= 58.9 MAXIMUM= 62.2 STUDY GRAB TEMPERATURE (F): .
DISCHARGE TEMPERATURES (F): MINIMUM= 76.3 MEAN= 78.2 MAXIMUM= 81.2
WEEKLY EXTRAPOLATION PERIOD: 23-29JUL06 STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6): 6854.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	109
ALEWIFE type	EGG	7
RAINBOW SMELT	JUVENILE	40

SAMPLING PERIOD: 26-27JUL06 DATE: 27JUL06 START TIME: 0:00 END TIME: 1:41
DIEL PERIOD: 00:00-06:00 VOLUME SAMPLED (gals x 10^6): 0.026429 VOLUME SAMPLED (m^3): 100.034
INTAKE TEMPERATURES (F): MINIMUM= 57.3 MEAN= 58.9 MAXIMUM= 62.2 STUDY GRAB TEMPERATURE (F): 58.6
DISCHARGE TEMPERATURES (F): MINIMUM= 76.3 MEAN= 78.2 MAXIMUM= 81.2
WEEKLY EXTRAPOLATION PERIOD: 23-29JUL06 STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6): 6854.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	267
RAINBOW SMELT	JUVENILE	1

SAMPLING PERIOD: 26-27JUL06 DATE: 27JUL06 START TIME: 6:00 END TIME: 7:40
DIEL PERIOD: 06:00-12:00 VOLUME SAMPLED (gals x 10^6): 0.026423 VOLUME SAMPLED (m^3): 100.011
INTAKE TEMPERATURES (F): MINIMUM= 57.3 MEAN= 58.9 MAXIMUM= 62.2 STUDY GRAB TEMPERATURE (F): .
DISCHARGE TEMPERATURES (F): MINIMUM= 76.3 MEAN= 78.2 MAXIMUM= 81.2
WEEKLY EXTRAPOLATION PERIOD: 23-29JUL06 STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6): 6854.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	95
RAINBOW SMELT	JUVENILE	15
RAINBOW SMELT	POST YOLK-SAC	1

SAMPLING PERIOD: 02-03AUG06 DATE: 02AUG06 START TIME: 12:00 END TIME: 13:41
DIEL PERIOD: 12:00-18:00 VOLUME SAMPLED (gals x 10^6): 0.026508 VOLUME SAMPLED (m^3): 100.333
INTAKE TEMPERATURES (F): MINIMUM= 51.1 MEAN= 59.3 MAXIMUM= 64.9 STUDY GRAB TEMPERATURE (F): 55.4
DISCHARGE TEMPERATURES (F): MINIMUM= 71.4 MEAN= 79.1 MAXIMUM= 85.1
WEEKLY EXTRAPOLATION PERIOD: 30JUL-05AUG06 STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6): 6854.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	56
RAINBOW SMELT	JUVENILE	2

SAMPLING PERIOD: 02-03AUG06 DATE: 02AUG06 START TIME: 18:02 END TIME: 19:41
DIEL PERIOD: 18:00-00:00 VOLUME SAMPLED (gals x 10^6): 0.026449 VOLUME SAMPLED (m^3): 100.109
INTAKE TEMPERATURES (F): MINIMUM= 51.1 MEAN= 59.3 MAXIMUM= 64.9 STUDY GRAB TEMPERATURE (F): 61.9
DISCHARGE TEMPERATURES (F): MINIMUM= 71.4 MEAN= 79.1 MAXIMUM= 85.1
WEEKLY EXTRAPOLATION PERIOD: 30JUL-05AUG06 STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6): 6854.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	311
SLIMY SCULPIN	POST YOLK-SAC	1

SAMPLING PERIOD: 02-03AUG06 DATE: 03AUG06 START TIME: 0:00 END TIME: 1:43
DIEL PERIOD: 00:00-06:00 VOLUME SAMPLED (gals x 10^6): 0.026502 VOLUME SAMPLED (m^3): 100.310
INTAKE TEMPERATURES (F): MINIMUM= 51.1 MEAN= 59.3 MAXIMUM= 64.9 STUDY GRAB TEMPERATURE (F): 62.2
DISCHARGE TEMPERATURES (F): MINIMUM= 71.4 MEAN= 79.1 MAXIMUM= 85.1
WEEKLY EXTRAPOLATION PERIOD: 30JUL-05AUG06 STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6): 6854.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	437

SAMPLING PERIOD: 02-03AUG06 DATE: 03AUG06 START TIME: 6:00 END TIME: 7:39
DIEL PERIOD: 06:00-12:00 VOLUME SAMPLED (gals x 10^6): 0.026511 VOLUME SAMPLED (m^3): 100.344
INTAKE TEMPERATURES (F): MINIMUM= 51.1 MEAN= 59.3 MAXIMUM= 64.9 STUDY GRAB TEMPERATURE (F): 62.8
DISCHARGE TEMPERATURES (F): MINIMUM= 71.4 MEAN= 79.1 MAXIMUM= 85.1
WEEKLY EXTRAPOLATION PERIOD: 30JUL-05AUG06 STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6): 6854.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	568
ALEWIFE	EGG	1
RAINBOW SMELT	POST YOLK-SAC	1
RAINBOW SMELT	JUVENILE	3
UNID SCULPIN	LARVAE	1

SAMPLING PERIOD: 09-10AUG06 DATE: 09AUG06 START TIME: 12:00 END TIME: 13:38
DIEL PERIOD: 12:00-18:00 VOLUME SAMPLED (gals x 10^6): 0.026504 VOLUME SAMPLED (m^3): 100.318
INTAKE TEMPERATURES (F): MINIMUM= 68.6 MEAN= 69.9 MAXIMUM= 71.4 STUDY GRAB TEMPERATURE (F): 72.1
DISCHARGE TEMPERATURES (F): MINIMUM= 88.8 MEAN= 90.6 MAXIMUM= 93.3
WEEKLY EXTRAPOLATION PERIOD: 06-12AUG06 STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6): 6854.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	1383

SAMPLING PERIOD: 09-10AUG06 DATE: 09AUG06 START TIME: 18:00 END TIME: 19:39
DIEL PERIOD: 18:00-00:00 VOLUME SAMPLED (gals x 10^6): 0.026500 VOLUME SAMPLED (m^3): 100.303
INTAKE TEMPERATURES (F): MINIMUM= 68.6 MEAN= 69.9 MAXIMUM= 71.4 STUDY GRAB TEMPERATURE (F): 71.6
DISCHARGE TEMPERATURES (F): MINIMUM= 88.8 MEAN= 90.6 MAXIMUM= 93.3
WEEKLY EXTRAPOLATION PERIOD: 06-12AUG06 STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6): 6854.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	3723

SAMPLING PERIOD: 09-10AUG06 DATE: 10AUG06 START TIME: 0:00 END TIME: 1:37
DIEL PERIOD: 00:00-06:00 VOLUME SAMPLED (gals x 10^6): 0.026425 VOLUME SAMPLED (m^3): 100.019
INTAKE TEMPERATURES (F): MINIMUM= 68.6 MEAN= 69.9 MAXIMUM= 71.4 STUDY GRAB TEMPERATURE (F): 71.1
DISCHARGE TEMPERATURES (F): MINIMUM= 88.8 MEAN= 90.6 MAXIMUM= 93.3
WEEKLY EXTRAPOLATION PERIOD: 06-12AUG06 STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6): 6854.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	2404
UNID SCULPIN	POST YOLK-SAC	1
UNIDENTIFIED	EGG	1

SAMPLING PERIOD: 09-10AUG06 DATE: 10AUG06 START TIME: 6:00 END TIME: 7:37
DIEL PERIOD: 06:00-12:00 VOLUME SAMPLED (gals x 10^6): 0.026422 VOLUME SAMPLED (m^3): 100.007
INTAKE TEMPERATURES (F): MINIMUM= 68.6 MEAN= 69.9 MAXIMUM= 71.4 STUDY GRAB TEMPERATURE (F): 71.2
DISCHARGE TEMPERATURES (F): MINIMUM= 88.8 MEAN= 90.6 MAXIMUM= 93.3
WEEKLY EXTRAPOLATION PERIOD: 06-12AUG06 STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6): 6854.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	2216

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SAMPLING PERIOD: 16-17AUG06        DATE: 16AUG06        START TIME: 12:00        END TIME: 13:38
DIEL PERIOD: 12:00-18:00           VOLUME SAMPLED (gals x 10^6):  0.026504       VOLUME SAMPLED (m^3):  100.318
INTAKE TEMPERATURES (F):     MINIMUM= 62.9  MEAN= 66.0  MAXIMUM= 70.3            STUDY GRAB TEMPERATURE (F):  71.1
DISCHARGE TEMPERATURES (F): MINIMUM= 82.3  MEAN= 86.4  MAXIMUM= 91.6
WEEKLY EXTRAPOLATION PERIOD: 13-19AUG06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
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            Gammarus                              .     1008
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SAMPLING PERIOD: 16-17AUG06        DATE: 16AUG06        START TIME: 16:00        END TIME: 17:42
DIEL PERIOD: 18:00-00:00           VOLUME SAMPLED (gals x 10^6):  0.028341       VOLUME SAMPLED (m^3):  107.271
INTAKE TEMPERATURES (F):     MINIMUM= 62.9  MEAN= 66.0  MAXIMUM= 70.3            STUDY GRAB TEMPERATURE (F):  68.0
DISCHARGE TEMPERATURES (F): MINIMUM= 82.3  MEAN= 86.4  MAXIMUM= 91.6
WEEKLY EXTRAPOLATION PERIOD: 13-19AUG06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------------  --------------  ------
            Gammarus                              .       20
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SAMPLING PERIOD: 16-17AUG06        DATE: 17AUG06        START TIME:  0:04        END TIME:  1:44
DIEL PERIOD: 00:00-06:00           VOLUME SAMPLED (gals x 10^6):  0.027798       VOLUME SAMPLED (m^3):  105.215
INTAKE TEMPERATURES (F):     MINIMUM= 62.9  MEAN= 66.0  MAXIMUM= 70.3            STUDY GRAB TEMPERATURE (F):  66.7
DISCHARGE TEMPERATURES (F): MINIMUM= 82.3  MEAN= 86.4  MAXIMUM= 91.6
WEEKLY EXTRAPOLATION PERIOD: 13-19AUG06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------------  --------------  ------
            Gammarus                              .     1101
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SAMPLING PERIOD: 16-17AUG06        DATE: 17AUG06        START TIME:  6:03        END TIME:  7:38
DIEL PERIOD: 06:00-12:00           VOLUME SAMPLED (gals x 10^6):  0.026451       VOLUME SAMPLED (m^3):  100.117
INTAKE TEMPERATURES (F):     MINIMUM= 62.9  MEAN= 66.0  MAXIMUM= 70.3            STUDY GRAB TEMPERATURE (F):  68.5
DISCHARGE TEMPERATURES (F): MINIMUM= 82.3  MEAN= 86.4  MAXIMUM= 91.6
WEEKLY EXTRAPOLATION PERIOD: 13-19AUG06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------------  --------------  ------
            Gammarus                              .      835
            ALEWIFE                  POST YOLK-SAC        1
-----------------------------------------------------------------------------------------------------------------
SAMPLING PERIOD: 23-24AUG06        DATE: 23AUG06        START TIME: 12:00        END TIME: 13:36
DIEL PERIOD: 12:00-18:00           VOLUME SAMPLED (gals x 10^6):  0.026701       VOLUME SAMPLED (m^3):  101.063
INTAKE TEMPERATURES (F):     MINIMUM= 68.6  MEAN= 69.6  MAXIMUM= 72.3            STUDY GRAB TEMPERATURE (F):  71.1
DISCHARGE TEMPERATURES (F): MINIMUM= 88.3  MEAN= 90.0  MAXIMUM= 92.5
WEEKLY EXTRAPOLATION PERIOD: 20-26AUG06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------------  --------------  ------
            Gammarus                              .     1732
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SAMPLING PERIOD: 23-24AUG06        DATE: 23AUG06        START TIME: 18:00        END TIME: 19:36
DIEL PERIOD: 18:00-00:00           VOLUME SAMPLED (gals x 10^6):  0.026517       VOLUME SAMPLED (m^3):  100.367
INTAKE TEMPERATURES (F):     MINIMUM= 68.6  MEAN= 69.6  MAXIMUM= 72.3            STUDY GRAB TEMPERATURE (F):  71.4
DISCHARGE TEMPERATURES (F): MINIMUM= 88.3  MEAN= 90.0  MAXIMUM= 92.5
WEEKLY EXTRAPOLATION PERIOD: 20-26AUG06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------------  --------------  ------
            Gammarus                              .     1099
            RAINBOW SMELT            JUVENILE             1
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SAMPLING PERIOD: 23-24AUG06        DATE: 24AUG06        START TIME:  0:00        END TIME:  1:36
DIEL PERIOD: 00:00-06:00           VOLUME SAMPLED (gals x 10^6):  0.026552       VOLUME SAMPLED (m^3):  100.499
INTAKE TEMPERATURES (F):     MINIMUM= 68.6  MEAN= 69.6  MAXIMUM= 72.3            STUDY GRAB TEMPERATURE (F):  72.0
DISCHARGE TEMPERATURES (F): MINIMUM= 88.3  MEAN= 90.0  MAXIMUM= 92.5
WEEKLY EXTRAPOLATION PERIOD: 20-26AUG06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------------  --------------  ------
            Gammarus                              .     3808
            ALEWIFE                  JUVENILE             1
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SAMPLING PERIOD: 23-24AUG06        DATE: 24AUG06        START TIME:  6:29        END TIME:  8:03
DIEL PERIOD: 06:00-12:00           VOLUME SAMPLED (gals x 10^6):  0.026535       VOLUME SAMPLED (m^3):  100.435
INTAKE TEMPERATURES (F):     MINIMUM= 68.6  MEAN= 69.6  MAXIMUM= 72.3            STUDY GRAB TEMPERATURE (F):  72.0
DISCHARGE TEMPERATURES (F): MINIMUM= 88.3  MEAN= 90.0  MAXIMUM= 92.5
WEEKLY EXTRAPOLATION PERIOD: 20-26AUG06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4
                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------------  --------------  ------
            Gammarus                              .      445
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SAMPLING PERIOD: 30-31AUG06        DATE: 30AUG06        START TIME: 12:00        END TIME:      .
DIEL PERIOD: 12:00-18:00           VOLUME SAMPLED (gals x 10^6):  0.026500       VOLUME SAMPLED (m^3):  100.303
INTAKE TEMPERATURES (F):     MINIMUM= 69.2  MEAN= 70.3  MAXIMUM= 74.3            STUDY GRAB TEMPERATURE (F):     .
DISCHARGE TEMPERATURES (F): MINIMUM= 88.8  MEAN= 90.3  MAXIMUM= 93.9
WEEKLY EXTRAPOLATION PERIOD: 27AUG-02SEP06   STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                      LIFE            PLUS
            TAXA                      STAGE           COUNT
            -------------------------  --------------  ------
            Gammarus                                .    3129
            ALEWIFE                   JUVENILE          11
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SAMPLING PERIOD: 30-31AUG06        DATE: 30AUG06        START TIME: 18:00        END TIME:      .
DIEL PERIOD: 18:00-00:00           VOLUME SAMPLED (gals x 10^6):  0.026500       VOLUME SAMPLED (m^3):  100.303
INTAKE TEMPERATURES (F):     MINIMUM= 69.2  MEAN= 70.3  MAXIMUM= 74.3            STUDY GRAB TEMPERATURE (F):     .
DISCHARGE TEMPERATURES (F): MINIMUM= 88.8  MEAN= 90.3  MAXIMUM= 93.9
WEEKLY EXTRAPOLATION PERIOD: 27AUG-02SEP06   STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                      LIFE            PLUS
            TAXA                      STAGE           COUNT
            -------------------------  --------------  ------
            Gammarus                                .    4304
            RAINBOW SMELT             JUVENILE           1
-------------------------------------------------------------------------------------------------------------
SAMPLING PERIOD: 30-31AUG06        DATE: 31AUG06        START TIME:  0:00        END TIME:      .
DIEL PERIOD: 00:00-06:00           VOLUME SAMPLED (gals x 10^6):  0.026500       VOLUME SAMPLED (m^3):  100.303
INTAKE TEMPERATURES (F):     MINIMUM= 69.2  MEAN= 70.3  MAXIMUM= 74.3            STUDY GRAB TEMPERATURE (F):     .
DISCHARGE TEMPERATURES (F): MINIMUM= 88.8  MEAN= 90.3  MAXIMUM= 93.9
WEEKLY EXTRAPOLATION PERIOD: 27AUG-02SEP06   STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                      LIFE            PLUS
            TAXA                      STAGE           COUNT
            -------------------------  --------------  ------
            Gammarus                                .    5296
            ALEWIFE                   JUVENILE           1
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SAMPLING PERIOD: 30-31AUG06        DATE: 31AUG06        START TIME:  6:00        END TIME:      .
DIEL PERIOD: 06:00-12:00           VOLUME SAMPLED (gals x 10^6):  0.026500       VOLUME SAMPLED (m^3):  100.303
INTAKE TEMPERATURES (F):     MINIMUM= 69.2  MEAN= 70.3  MAXIMUM= 74.3            STUDY GRAB TEMPERATURE (F):     .
DISCHARGE TEMPERATURES (F): MINIMUM= 88.8  MEAN= 90.3  MAXIMUM= 93.9
WEEKLY EXTRAPOLATION PERIOD: 27AUG-02SEP06   STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                      LIFE            PLUS
            TAXA                      STAGE           COUNT
            -------------------------  --------------  ------
            Gammarus                                .    2464
            UNID ALOSA                JUVENILE           1
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SAMPLING PERIOD: 06-07SEP06        DATE: 06SEP06        START TIME: 12:00        END TIME:  1:40
DIEL PERIOD: 12:00-18:00           VOLUME SAMPLED (gals x 10^6):  0.026500       VOLUME SAMPLED (m^3):  100.303
INTAKE TEMPERATURES (F):     MINIMUM= 69.5  MEAN= 70.2  MAXIMUM= 72.0            STUDY GRAB TEMPERATURE (F):  73.6
DISCHARGE TEMPERATURES (F): MINIMUM= 89.0  MEAN= 90.1  MAXIMUM= 91.5
WEEKLY EXTRAPOLATION PERIOD: 03-09SEP06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                      LIFE            PLUS
            TAXA                      STAGE           COUNT
            -------------------------  --------------  ------
            Gammarus                                .    2952
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SAMPLING PERIOD: 06-07SEP06        DATE: 06SEP06        START TIME: 18:00        END TIME: 19:38
DIEL PERIOD: 18:00-00:00           VOLUME SAMPLED (gals x 10^6):  0.026504       VOLUME SAMPLED (m^3):  100.318
INTAKE TEMPERATURES (F):     MINIMUM= 69.5  MEAN= 70.2  MAXIMUM= 72.0            STUDY GRAB TEMPERATURE (F):  71.6
DISCHARGE TEMPERATURES (F): MINIMUM= 89.0  MEAN= 90.1  MAXIMUM= 91.5
WEEKLY EXTRAPOLATION PERIOD: 03-09SEP06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                      LIFE            PLUS
            TAXA                      STAGE           COUNT
            -------------------------  --------------  ------
            Gammarus                                .    5355
            ALEWIFE                   JUVENILE           1
-------------------------------------------------------------------------------------------------------------
SAMPLING PERIOD: 06-07SEP06        DATE: 07SEP06        START TIME:  0:00        END TIME:  1:36
DIEL PERIOD: 00:00-06:00           VOLUME SAMPLED (gals x 10^6):  0.026518       VOLUME SAMPLED (m^3):  100.371
INTAKE TEMPERATURES (F):     MINIMUM= 69.5  MEAN= 70.2  MAXIMUM= 72.0            STUDY GRAB TEMPERATURE (F):  72.1
DISCHARGE TEMPERATURES (F): MINIMUM= 89.0  MEAN= 90.1  MAXIMUM= 91.5
WEEKLY EXTRAPOLATION PERIOD: 03-09SEP06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                      LIFE            PLUS
            TAXA                      STAGE           COUNT
            -------------------------  --------------  ------
            Gammarus                                .    2840
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SAMPLING PERIOD: 06-07SEP06        DATE: 07SEP06        START TIME:  6:00        END TIME:  7:36
DIEL PERIOD: 06:00-12:00           VOLUME SAMPLED (gals x 10^6):  0.026506       VOLUME SAMPLED (m^3):  100.325
INTAKE TEMPERATURES (F):     MINIMUM= 69.5  MEAN= 70.2  MAXIMUM= 72.0            STUDY GRAB TEMPERATURE (F):  72.3
DISCHARGE TEMPERATURES (F): MINIMUM= 89.0  MEAN= 90.1  MAXIMUM= 91.5
WEEKLY EXTRAPOLATION PERIOD: 03-09SEP06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4
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TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	1200

SAMPLING PERIOD: 13-14SEP06 DATE: 13SEP06 START TIME: 12:00 END TIME: 13:41
DIEL PERIOD: 12:00-18:00 VOLUME SAMPLED (gals x 10^6): 0.026508 VOLUME SAMPLED (m^3): 100.333
INTAKE TEMPERATURES (F): MINIMUM= 63.9 MEAN= 64.4 MAXIMUM= 65.2 STUDY GRAB TEMPERATURE (F): .
DISCHARGE TEMPERATURES (F): MINIMUM= 83.3 MEAN= 83.9 MAXIMUM= 85.5
WEEKLY EXTRAPOLATION PERIOD: 10-16SEP06 STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6): 6854.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	130

SAMPLING PERIOD: 13-14SEP06 DATE: 13SEP06 START TIME: 18:00 END TIME: 19:41
DIEL PERIOD: 18:00-00:00 VOLUME SAMPLED (gals x 10^6): 0.026502 VOLUME SAMPLED (m^3): 100.310
INTAKE TEMPERATURES (F): MINIMUM= 63.9 MEAN= 64.4 MAXIMUM= 65.2 STUDY GRAB TEMPERATURE (F): .
DISCHARGE TEMPERATURES (F): MINIMUM= 83.3 MEAN= 83.9 MAXIMUM= 85.5
WEEKLY EXTRAPOLATION PERIOD: 10-16SEP06 STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6): 6854.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	323

SAMPLING PERIOD: 13-14SEP06 DATE: 14SEP06 START TIME: 0:00 END TIME: 1:41
DIEL PERIOD: 00:00-06:00 VOLUME SAMPLED (gals x 10^6): 0.026513 VOLUME SAMPLED (m^3): 100.352
INTAKE TEMPERATURES (F): MINIMUM= 63.9 MEAN= 64.4 MAXIMUM= 65.2 STUDY GRAB TEMPERATURE (F): .
DISCHARGE TEMPERATURES (F): MINIMUM= 83.3 MEAN= 83.9 MAXIMUM= 85.5
WEEKLY EXTRAPOLATION PERIOD: 10-16SEP06 STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6): 6854.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	505
UNID ALOSA	JUVENILE	1
RAINBOW SMELT	JUVENILE	1

SAMPLING PERIOD: 13-14SEP06 DATE: 14SEP06 START TIME: 6:00 END TIME: 7:41
DIEL PERIOD: 06:00-12:00 VOLUME SAMPLED (gals x 10^6): 0.026586 VOLUME SAMPLED (m^3): 100.628
INTAKE TEMPERATURES (F): MINIMUM= 63.9 MEAN= 64.4 MAXIMUM= 65.2 STUDY GRAB TEMPERATURE (F): .
DISCHARGE TEMPERATURES (F): MINIMUM= 83.3 MEAN= 83.9 MAXIMUM= 85.5
WEEKLY EXTRAPOLATION PERIOD: 10-16SEP06 STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6): 6854.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	207

SAMPLING PERIOD: 18-19SEP06 DATE: 18SEP06 START TIME: 12:00 END TIME: 13:41
DIEL PERIOD: 12:00-18:00 VOLUME SAMPLED (gals x 10^6): 0.026508 VOLUME SAMPLED (m^3): 100.333
INTAKE TEMPERATURES (F): MINIMUM= 45.8 MEAN= 49.4 MAXIMUM= 59.6 STUDY GRAB TEMPERATURE (F): 57.9
DISCHARGE TEMPERATURES (F): MINIMUM= 64.7 MEAN= 68.9 MAXIMUM= 80.8
WEEKLY EXTRAPOLATION PERIOD: 17-23SEP06 STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6): 6577.2

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	512

SAMPLING PERIOD: 18-19SEP06 DATE: 18SEP06 START TIME: 18:00 END TIME: 19:43
DIEL PERIOD: 18:00-00:00 VOLUME SAMPLED (gals x 10^6): 0.026501 VOLUME SAMPLED (m^3): 100.306
INTAKE TEMPERATURES (F): MINIMUM= 45.8 MEAN= 49.4 MAXIMUM= 59.6 STUDY GRAB TEMPERATURE (F): 51.4
DISCHARGE TEMPERATURES (F): MINIMUM= 64.7 MEAN= 68.9 MAXIMUM= 80.8
WEEKLY EXTRAPOLATION PERIOD: 17-23SEP06 STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6): 6577.2

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	419
ALEWIFE	JUVENILE	1
RAINBOW SMELT	JUVENILE	9

SAMPLING PERIOD: 18-19SEP06 DATE: 19SEP06 START TIME: 0:00 END TIME: 1:50
DIEL PERIOD: 00:00-06:00 VOLUME SAMPLED (gals x 10^6): 0.026603 VOLUME SAMPLED (m^3): 100.692
INTAKE TEMPERATURES (F): MINIMUM= 45.8 MEAN= 49.4 MAXIMUM= 59.6 STUDY GRAB TEMPERATURE (F): 49.3
DISCHARGE TEMPERATURES (F): MINIMUM= 64.7 MEAN= 68.9 MAXIMUM= 80.8
WEEKLY EXTRAPOLATION PERIOD: 17-23SEP06 STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6): 6577.2

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	452
RAINBOW SMELT	JUVENILE	3

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SAMPLING PERIOD: 18-19SEP06        DATE: 19SEP06        START TIME:  6:00       END TIME:  7:42
DIEL PERIOD: 06:00-12:00           VOLUME SAMPLED (gals x 10^6):  0.026504      VOLUME SAMPLED (m^3):  100.318
INTAKE TEMPERATURES (F):    MINIMUM= 45.8  MEAN= 49.4  MAXIMUM= 59.6            STUDY GRAB TEMPERATURE (F):  48.4
DISCHARGE TEMPERATURES (F): MINIMUM= 64.7  MEAN= 68.9  MAXIMUM= 80.8
WEEKLY EXTRAPOLATION PERIOD: 17-23SEP06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6577.2

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------------  --------------  ------
            Gammarus                              .     330
            ALEWIFE                  JUVENILE           1
            RAINBOW SMELT            JUVENILE           1
-------------------------------------------------------------------------------------------------------------
SAMPLING PERIOD: 27-28SEP06        DATE: 27SEP06        START TIME: 12:00       END TIME: 13:46
DIEL PERIOD: 12:00-18:00           VOLUME SAMPLED (gals x 10^6):  0.026502      VOLUME SAMPLED (m^3):  100.310
INTAKE TEMPERATURES (F):    MINIMUM= 48.9  MEAN= 49.4  MAXIMUM= 49.9            STUDY GRAB TEMPERATURE (F):  51.3
DISCHARGE TEMPERATURES (F): MINIMUM= 67.8  MEAN= 68.4  MAXIMUM= 69.0
WEEKLY EXTRAPOLATION PERIOD: 24-30SEP06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------------  --------------  ------
            Gammarus                              .     734
-------------------------------------------------------------------------------------------------------------
SAMPLING PERIOD: 27-28SEP06        DATE: 27SEP06        START TIME: 18:00       END TIME: 19:49
DIEL PERIOD: 18:00-00:00           VOLUME SAMPLED (gals x 10^6):  0.026506      VOLUME SAMPLED (m^3):  100.325
INTAKE TEMPERATURES (F):    MINIMUM= 48.9  MEAN= 49.4  MAXIMUM= 49.9            STUDY GRAB TEMPERATURE (F):  51.8
DISCHARGE TEMPERATURES (F): MINIMUM= 67.8  MEAN= 68.4  MAXIMUM= 69.0
WEEKLY EXTRAPOLATION PERIOD: 24-30SEP06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------------  --------------  ------
            Gammarus                              .     797
            RAINBOW SMELT            JUVENILE           1
-------------------------------------------------------------------------------------------------------------
SAMPLING PERIOD: 27-28SEP06        DATE: 28SEP06        START TIME:  0:00       END TIME:  1:43
DIEL PERIOD: 00:00-06:00           VOLUME SAMPLED (gals x 10^6):  0.026524      VOLUME SAMPLED (m^3):  100.393
INTAKE TEMPERATURES (F):    MINIMUM= 48.9  MEAN= 49.4  MAXIMUM= 49.9            STUDY GRAB TEMPERATURE (F):  50.9
DISCHARGE TEMPERATURES (F): MINIMUM= 67.8  MEAN= 68.4  MAXIMUM= 69.0
WEEKLY EXTRAPOLATION PERIOD: 24-30SEP06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------------  --------------  ------
            Gammarus                              .     637
            BURBOT                   JUVENILE           1
-------------------------------------------------------------------------------------------------------------
SAMPLING PERIOD: 27-28SEP06        DATE: 28SEP06        START TIME:  6:00       END TIME:  7:41
DIEL PERIOD: 06:00-12:00           VOLUME SAMPLED (gals x 10^6):  0.026607      VOLUME SAMPLED (m^3):  100.707
INTAKE TEMPERATURES (F):    MINIMUM= 48.9  MEAN= 49.4  MAXIMUM= 49.9            STUDY GRAB TEMPERATURE (F):  50.2
DISCHARGE TEMPERATURES (F): MINIMUM= 67.8  MEAN= 68.4  MAXIMUM= 69.0
WEEKLY EXTRAPOLATION PERIOD: 24-30SEP06      STUDY PLANT VOLUME FOR EXTRAPOLATION PERIOD (gals x 10^6):   6854.4

                                     LIFE            PLUS
            TAXA                     STAGE           COUNT
            -------------------------  --------------  ------
            Gammarus                              .     410
```

APPENDIX A2 - RAW AMBIENT MONITORING DATA LISTING

SAMPLING PERIOD: 19-20APR06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 19APR06 DIEL PERIOD: DAY START TIME: 10:48 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 154.987
STUDY GRAB TEMPERATURE (F): 51.0 STUDY GRAB DISSOLVED OXYGEN (mg/l): 14.2

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	1
UNID COREGONINAE	YOLK-SAC	3
RAINBOW SMELT	YOLK-SAC	1

SAMPLING PERIOD: 19-20APR06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 19APR06 DIEL PERIOD: DAY START TIME: 10:48 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 142.520
STUDY GRAB TEMPERATURE (F): 51.0 STUDY GRAB DISSOLVED OXYGEN (mg/l): 14.2

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	1
RAINBOW SMELT	POST YOLK-SAC	1

SAMPLING PERIOD: 19-20APR06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 19APR06 DIEL PERIOD: DAY START TIME: 11:10 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 195.490
STUDY GRAB TEMPERATURE (F): 50.4 STUDY GRAB DISSOLVED OXYGEN (mg/l): 15.2

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 19-20APR06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 19APR06 DIEL PERIOD: DAY START TIME: 11:10 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 175.893
STUDY GRAB TEMPERATURE (F): 50.4 STUDY GRAB DISSOLVED OXYGEN (mg/l): 15.2

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 19-20APR06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 19APR06 DIEL PERIOD: DAY START TIME: 11:29 TOW DURATION (min.): 2.00 VOLUME SAMPLED (m^3): 107.860
STUDY GRAB TEMPERATURE (F): 46.5 STUDY GRAB DISSOLVED OXYGEN (mg/l): 16.5

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 19-20APR06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 19APR06 DIEL PERIOD: DAY START TIME: 11:29 TOW DURATION (min.): 2.00 VOLUME SAMPLED (m^3): 109.253
STUDY GRAB TEMPERATURE (F): 46.5 STUDY GRAB DISSOLVED OXYGEN (mg/l): 16.5

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 19-20APR06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 19APR06 DIEL PERIOD: DAY START TIME: 11:50 TOW DURATION (min.): 2.50 VOLUME SAMPLED (m^3): 131.466
STUDY GRAB TEMPERATURE (F): 45.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 15.0

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 19-20APR06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 19APR06 DIEL PERIOD: DAY START TIME: 11:50 TOW DURATION (min.): 2.50 VOLUME SAMPLED (m^3): 121.847
STUDY GRAB TEMPERATURE (F): 45.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 15.0

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 19-20APR06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 19APR06 DIEL PERIOD: DAY START TIME: 12:10 TOW DURATION (min.): 2.50 VOLUME SAMPLED (m^3): 136.740
STUDY GRAB TEMPERATURE (F): 50.7 STUDY GRAB DISSOLVED OXYGEN (mg/l): 14.5

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 19-20APR06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 19APR06 DIEL PERIOD: DAY START TIME: 12:10 TOW DURATION (min.): 2.50 VOLUME SAMPLED (m^3): 130.348
STUDY GRAB TEMPERATURE (F): 50.7 STUDY GRAB DISSOLVED OXYGEN (mg/l): 14.5

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 19-20APR06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 19APR06 DIEL PERIOD: DAY START TIME: 12:27 TOW DURATION (min.): 2.50 VOLUME SAMPLED (m^3): 149.566
STUDY GRAB TEMPERATURE (F): 43.9 STUDY GRAB DISSOLVED OXYGEN (mg/l): 17.4

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 19-20APR06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 19APR06 DIEL PERIOD: DAY START TIME: 12:27 TOW DURATION (min.): 2.50 VOLUME SAMPLED (m^3): 145.790
STUDY GRAB TEMPERATURE (F): 43.9 STUDY GRAB DISSOLVED OXYGEN (mg/l): 17.4

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 19-20APR06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 19APR06 DIEL PERIOD: DAY START TIME: 12:48 TOW DURATION (min.): 2.50 VOLUME SAMPLED (m^3): 134.103
STUDY GRAB TEMPERATURE (F): 43.9 STUDY GRAB DISSOLVED OXYGEN (mg/l): 18.7

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 19-20APR06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 19APR06 DIEL PERIOD: DAY START TIME: 12:48 TOW DURATION (min.): 2.50 VOLUME SAMPLED (m^3): 134.651
STUDY GRAB TEMPERATURE (F): 43.9 STUDY GRAB DISSOLVED OXYGEN (mg/l): 18.7

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 19-20APR06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 19APR06 DIEL PERIOD: NIGHT START TIME: 22:37 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 150.916
STUDY GRAB TEMPERATURE (F): 53.7 STUDY GRAB DISSOLVED OXYGEN (mg/l): 10.9

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	33
UNID COREGONINAE	YOLK-SAC	25

SAMPLING PERIOD: 19-20APR06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 19APR06 DIEL PERIOD: NIGHT START TIME: 22:37 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 135.179
STUDY GRAB TEMPERATURE (F): 53.7 STUDY GRAB DISSOLVED OXYGEN (mg/l): 10.9

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	22
UNID COREGONINAE	YOLK-SAC	31
UNID COREGONINAE	YOLK-SAC	1

SAMPLING PERIOD: 19-20APR06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 19APR06 DIEL PERIOD: NIGHT START TIME: 23:58 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 163.700
STUDY GRAB TEMPERATURE (F): 51.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.9

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	23
UNID COREGONINAE	POST YOLK-SAC	2
UNID COREGONINAE	YOLK-SAC	28

SAMPLING PERIOD: 19-20APR06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 19APR06 DIEL PERIOD: NIGHT START TIME: 23:58 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 166.611
STUDY GRAB TEMPERATURE (F): 51.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.9

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	26
UNID COREGONINAE	POST YOLK-SAC	1
UNID COREGONINAE	YOLK-SAC	21
UNID COREGONINAE	POST YOLK-SAC	1
RAINBOW SMELT	YOLK-SAC	1

SAMPLING PERIOD: 19-20APR06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 20APR06 DIEL PERIOD: NIGHT START TIME: 0:41 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 147.330
STUDY GRAB TEMPERATURE (F): 51.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.0

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	27
UNID COREGONINAE	YOLK-SAC	37

SAMPLING PERIOD: 19-20APR06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 20APR06 DIEL PERIOD: NIGHT START TIME: 0:41 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 160.451
STUDY GRAB TEMPERATURE (F): 51.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.0

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	32
UNID COREGONINAE	YOLK-SAC	24
UNID COREGONINAE	POST YOLK-SAC	6

SAMPLING PERIOD: 19-20APR06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 20APR06 DIEL PERIOD: NIGHT START TIME: 0:58 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 155.873
STUDY GRAB TEMPERATURE (F): 49.9 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.7

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	18
UNID COREGONINAE	YOLK-SAC	30

SAMPLING PERIOD: 19-20APR06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 20APR06 DIEL PERIOD: NIGHT START TIME: 0:58 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 165.809
STUDY GRAB TEMPERATURE (F): 49.9 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.7

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	31
UNID COREGONINAE	YOLK-SAC	38
UNID COREGONINAE	POST YOLK-SAC	3

SAMPLING PERIOD: 19-20APR06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 20APR06 DIEL PERIOD: NIGHT START TIME: 1:28 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 171.357
STUDY GRAB TEMPERATURE (F): 49.7 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.3

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	12
UNID COREGONINAE	YOLK-SAC	2
BURBOT	YOLK-SAC	1

SAMPLING PERIOD: 19-20APR06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 20APR06 DIEL PERIOD: NIGHT START TIME: 1:28 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 178.108
STUDY GRAB TEMPERATURE (F): 49.7 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.3

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	21
UNID COREGONINAE	YOLK-SAC	1

SAMPLING PERIOD: 19-20APR06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 20APR06 DIEL PERIOD: NIGHT START TIME: 1:43 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 161.991
STUDY GRAB TEMPERATURE (F): 47.1 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.9

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	12
UNID COREGONINAE	YOLK-SAC	2

SAMPLING PERIOD: 19-20APR06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 20APR06 DIEL PERIOD: NIGHT START TIME: 1:43 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 161.822
STUDY GRAB TEMPERATURE (F): 47.1 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.9

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	14
UNID COREGONINAE	YOLK-SAC	2
RAINBOW SMELT	YOLK-SAC	1

SAMPLING PERIOD: 19-20APR06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 20APR06 DIEL PERIOD: NIGHT START TIME: 2:02 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 167.834
STUDY GRAB TEMPERATURE (F): 46.0 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.7

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	7
UNID COREGONINAE	YOLK-SAC	1

SAMPLING PERIOD: 19-20APR06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 20APR06 DIEL PERIOD: NIGHT START TIME: 2:02 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 238.440
STUDY GRAB TEMPERATURE (F): 46.0 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.7

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	10
UNID COREGONINAE	YOLK-SAC	2

SAMPLING PERIOD: 26-27APR06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 26APR06 DIEL PERIOD: DAY START TIME: 11:43 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 135.664
STUDY GRAB TEMPERATURE (F): 47.2 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.7

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 26-27APR06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 26APR06 DIEL PERIOD: DAY START TIME: 11:43 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 135.917
STUDY GRAB TEMPERATURE (F): 47.2 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.7

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 26-27APR06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 26APR06 DIEL PERIOD: DAY START TIME: 12:06 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 158.342
STUDY GRAB TEMPERATURE (F): 46.9 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.8

TAXA	LIFE STAGE	PLUS COUNT
UNID CATOSTOMINAE	YOLK-SAC	1

SAMPLING PERIOD: 26-27APR06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 26APR06 DIEL PERIOD: DAY START TIME: 12:06 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 138.111
STUDY GRAB TEMPERATURE (F): 46.9 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.8

TAXA	LIFE STAGE	PLUS COUNT
BURBOT	YOLK-SAC	1

SAMPLING PERIOD: 26-27APR06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 26APR06 DIEL PERIOD: DAY START TIME: 12:25 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 141.761
STUDY GRAB TEMPERATURE (F): 46.9 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.5

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 26-27APR06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 26APR06 DIEL PERIOD: DAY START TIME: 12:25 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 130.664
STUDY GRAB TEMPERATURE (F): 46.9 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.5

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 26-27APR06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 26APR06 DIEL PERIOD: DAY START TIME: 12:44 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 143.976
STUDY GRAB TEMPERATURE (F): 46.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.5

TAXA	LIFE STAGE	PLUS COUNT
BURBOT	YOLK-SAC	1

SAMPLING PERIOD: 26-27APR06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 26APR06 DIEL PERIOD: DAY START TIME: 12:44 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 132.247
STUDY GRAB TEMPERATURE (F): 46.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.5

TAXA	LIFE STAGE	PLUS COUNT
BURBOT	YOLK-SAC	2

SAMPLING PERIOD: 26-27APR06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 26APR06 DIEL PERIOD: DAY START TIME: 13:07 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 124.990
STUDY GRAB TEMPERATURE (F): 47.0 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.8

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 26-27APR06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 26APR06 DIEL PERIOD: DAY START TIME: 13:07 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 120.644
STUDY GRAB TEMPERATURE (F): 47.0 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.8

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 26-27APR06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 26APR06 DIEL PERIOD: DAY START TIME: 13:39 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 136.888
STUDY GRAB TEMPERATURE (F): 47.0 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.7

TAXA	LIFE STAGE	PLUS COUNT
BURBOT	YOLK-SAC	1

SAMPLING PERIOD: 26-27APR06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 26APR06 DIEL PERIOD: DAY START TIME: 13:39 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 148.026
STUDY GRAB TEMPERATURE (F): 47.0 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.7

TAXA	LIFE STAGE	PLUS COUNT
BURBOT	YOLK-SAC	1

SAMPLING PERIOD: 26-27APR06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 26APR06 DIEL PERIOD: DAY START TIME: 13:56 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 138.934
STUDY GRAB TEMPERATURE (F): 46.2 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.4

TAXA	LIFE STAGE	PLUS COUNT
BURBOT	YOLK-SAC	2

SAMPLING PERIOD: 26-27APR06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 26APR06 DIEL PERIOD: DAY START TIME: 13:56 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 141.107
STUDY GRAB TEMPERATURE (F): 46.2 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.4

TAXA	LIFE STAGE	PLUS COUNT
BURBOT	YOLK-SAC	3

SAMPLING PERIOD: 26-27APR06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 27APR06 DIEL PERIOD: NIGHT START TIME: 3:03 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 177.011
STUDY GRAB TEMPERATURE (F): 48.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.7

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	42
BURBOT	YOLK-SAC	1

SAMPLING PERIOD: 26-27APR06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 27APR06 DIEL PERIOD: NIGHT START TIME: 3:03 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 166.358
STUDY GRAB TEMPERATURE (F): 48.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.7

TAXA	LIFE STAGE	PLUS COUNT
UNID AMPHIPODA	.	3

SAMPLING PERIOD: 26-27APR06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 27APR06 DIEL PERIOD: NIGHT START TIME: 2:45 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 169.923
STUDY GRAB TEMPERATURE (F): 47.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	12
RAINBOW SMELT	POST YOLK-SAC	1
BURBOT	YOLK-SAC	5

SAMPLING PERIOD: 26-27APR06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 27APR06 DIEL PERIOD: NIGHT START TIME: 2:45 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 185.997
STUDY GRAB TEMPERATURE (F): 47.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	6
BURBOT	YOLK-SAC	2

SAMPLING PERIOD: 26-27APR06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 27APR06 DIEL PERIOD: NIGHT START TIME: 2:28 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 170.661
STUDY GRAB TEMPERATURE (F): 47.7 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.7

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	18
BURBOT	YOLK-SAC	6

SAMPLING PERIOD: 26-27APR06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 27APR06 DIEL PERIOD: NIGHT START TIME: 2:28 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 173.404
STUDY GRAB TEMPERATURE (F): 47.7 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.7

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	20
Mysis relicta	.	1
BURBOT	YOLK-SAC	5

SAMPLING PERIOD: 26-27APR06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 27APR06 DIEL PERIOD: NIGHT START TIME: 2:15 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 176.040
STUDY GRAB TEMPERATURE (F): 47.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.5

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	15
Mysis relicta	.	1
UNID COREGONINAE	YOLK-SAC	1
BURBOT	YOLK-SAC	6

SAMPLING PERIOD: 26-27APR06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 27APR06 DIEL PERIOD: NIGHT START TIME: 2:15 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 175.977
STUDY GRAB TEMPERATURE (F): 47.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.5

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	17
BURBOT	YOLK-SAC	8

SAMPLING PERIOD: 26-27APR06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 27APR06 DIEL PERIOD: NIGHT START TIME: 1:44 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 159.818
STUDY GRAB TEMPERATURE (F): 46.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.6

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	9
BURBOT	YOLK-SAC	4

SAMPLING PERIOD: 26-27APR06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 27APR06 DIEL PERIOD: NIGHT START TIME: 1:44 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 166.970
STUDY GRAB TEMPERATURE (F): 46.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.6

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	9
Mysis relicta	.	1
BURBOT	YOLK-SAC	12

SAMPLING PERIOD: 26-27APR06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 27APR06 DIEL PERIOD: NIGHT START TIME: 1:24 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 180.829
STUDY GRAB TEMPERATURE (F): 46.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	7
RAINBOW SMELT	POST YOLK-SAC	1
BURBOT	YOLK-SAC	20

SAMPLING PERIOD: 26-27APR06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 27APR06 DIEL PERIOD: NIGHT START TIME: 1:24 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 202.979
STUDY GRAB TEMPERATURE (F): 46.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	11
BURBOT	YOLK-SAC	16

SAMPLING PERIOD: 26-27APR06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 27APR06 DIEL PERIOD: NIGHT START TIME: 0:58 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 167.223
STUDY GRAB TEMPERATURE (F): 46.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.5

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	7
BURBOT	YOLK-SAC	17

SAMPLING PERIOD: 26-27APR06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 27APR06 DIEL PERIOD: NIGHT START TIME: 0:58 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 161.527
STUDY GRAB TEMPERATURE (F): 46.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.5

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	5
BURBOT	YOLK-SAC	9

SAMPLING PERIOD: 10MAY06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 10MAY06 DIEL PERIOD: DAY START TIME: 12:02 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 130.960
STUDY GRAB TEMPERATURE (F): 44.9 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.2

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 10MAY06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 10MAY06 DIEL PERIOD: DAY START TIME: 12:02 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 128.386
STUDY GRAB TEMPERATURE (F): 44.9 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.2

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 10MAY06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 10MAY06 DIEL PERIOD: DAY START TIME: 12:24 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 143.301
STUDY GRAB TEMPERATURE (F): 43.4 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.3

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 10MAY06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 10MAY06 DIEL PERIOD: DAY START TIME: 12:24 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 140.073
STUDY GRAB TEMPERATURE (F): 43.4 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.3

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 10MAY06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 10MAY06 DIEL PERIOD: DAY START TIME: 12:45 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 133.175
STUDY GRAB TEMPERATURE (F): 43.0 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.3

TAXA	LIFE STAGE	PLUS COUNT
BURBOT	YOLK-SAC	7

SAMPLING PERIOD: 10MAY06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 10MAY06 DIEL PERIOD: DAY START TIME: 12:45 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 131.550
STUDY GRAB TEMPERATURE (F): 43.0 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.3

TAXA	LIFE STAGE	PLUS COUNT
BURBOT	YOLK-SAC	5

SAMPLING PERIOD: 10MAY06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 10MAY06 DIEL PERIOD: DAY START TIME: 13:45 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 122.986
STUDY GRAB TEMPERATURE (F): 43.2 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.5

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	2
BURBOT	YOLK-SAC	4

SAMPLING PERIOD: 10MAY06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 10MAY06 DIEL PERIOD: DAY START TIME: 13:45 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 124.631
STUDY GRAB TEMPERATURE (F): 43.2 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.5

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	1
BURBOT	YOLK-SAC	5

SAMPLING PERIOD: 10MAY06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 10MAY06 DIEL PERIOD: DAY START TIME: 14:10 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 144.313
STUDY GRAB TEMPERATURE (F): 42.2 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.6

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 10MAY06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 10MAY06 DIEL PERIOD: DAY START TIME: 14:10 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 138.406
STUDY GRAB TEMPERATURE (F): 42.2 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.6

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 10MAY06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 10MAY06 DIEL PERIOD: DAY START TIME: 14:29 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 128.028
STUDY GRAB TEMPERATURE (F): 42.0 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.5

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 10MAY06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 10MAY06 DIEL PERIOD: DAY START TIME: 14:29 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 123.492
STUDY GRAB TEMPERATURE (F): 42.0 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.5

TAXA	LIFE STAGE	PLUS COUNT
BURBOT	YOLK-SAC	2

SAMPLING PERIOD: 10MAY06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 10MAY06 DIEL PERIOD: DAY START TIME: 15:00 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 140.917
STUDY GRAB TEMPERATURE (F): 41.9 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.5

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	1
BURBOT	YOLK-SAC	6

SAMPLING PERIOD: 10MAY06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 10MAY06 DIEL PERIOD: DAY START TIME: 15:00 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 137.225
STUDY GRAB TEMPERATURE (F): 41.9 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.5

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	2
BURBOT	YOLK-SAC	4

SAMPLING PERIOD: 17MAY06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 17MAY06 DIEL PERIOD: NIGHT START TIME: 2:10 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 154.355
STUDY GRAB TEMPERATURE (F): 48.5 STUDY GRAB DISSOLVED OXYGEN (mg/l): 10.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	82
RAINBOW SMELT	JUVENILE	1

SAMPLING PERIOD: 17MAY06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 17MAY06 DIEL PERIOD: NIGHT START TIME: 2:20 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 180.091
STUDY GRAB TEMPERATURE (F): 48.5 STUDY GRAB DISSOLVED OXYGEN (mg/l): 10.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	114

SAMPLING PERIOD: 17MAY06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 17MAY06 DIEL PERIOD: NIGHT START TIME: 1:15 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 191.820
STUDY GRAB TEMPERATURE (F): 47.9 STUDY GRAB DISSOLVED OXYGEN (mg/l): 10.7

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	74

SAMPLING PERIOD: 17MAY06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 17MAY06 DIEL PERIOD: NIGHT START TIME: 1:15 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 192.052
STUDY GRAB TEMPERATURE (F): 47.9 STUDY GRAB DISSOLVED OXYGEN (mg/l): 10.7

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	78
RAINBOW SMELT	POST YOLK-SAC	2

SAMPLING PERIOD: 17MAY06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 17MAY06 DIEL PERIOD: NIGHT START TIME: 1:35 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 270.927
STUDY GRAB TEMPERATURE (F): 47.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 10.6

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	80
RAINBOW SMELT	POST YOLK-SAC	1

SAMPLING PERIOD: 17MAY06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 17MAY06 DIEL PERIOD: NIGHT START TIME: 1:35 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 193.128
STUDY GRAB TEMPERATURE (F): 47.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 10.6

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	13

SAMPLING PERIOD: 17MAY06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 17MAY06 DIEL PERIOD: NIGHT START TIME: 1:50 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 161.506
STUDY GRAB TEMPERATURE (F): 47.7 STUDY GRAB DISSOLVED OXYGEN (mg/l): 10.7

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	47

SAMPLING PERIOD: 17MAY06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 17MAY06 DIEL PERIOD: NIGHT START TIME: 1:50 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 151.950
STUDY GRAB TEMPERATURE (F): 47.7 STUDY GRAB DISSOLVED OXYGEN (mg/l): 10.7

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	48
BURBOT	YOLK-SAC	1

SAMPLING PERIOD: 17MAY06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 17MAY06 DIEL PERIOD: NIGHT START TIME: 0:10 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 156.211
STUDY GRAB TEMPERATURE (F): 51.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 10.5

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	11
RAINBOW SMELT	POST YOLK-SAC	2

SAMPLING PERIOD: 17MAY06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 17MAY06 DIEL PERIOD: NIGHT START TIME: 0:10 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 159.818
STUDY GRAB TEMPERATURE (F): 51.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 10.5

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	4

SAMPLING PERIOD: 17MAY06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 17MAY06 DIEL PERIOD: NIGHT START TIME: 0:40 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 173.699
STUDY GRAB TEMPERATURE (F): 47.4 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.0

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	3
RAINBOW SMELT	POST YOLK-SAC	2

SAMPLING PERIOD: 17MAY06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 17MAY06 DIEL PERIOD: NIGHT START TIME: 0:40 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 174.458
STUDY GRAB TEMPERATURE (F): 47.4 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.0

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	3
RAINBOW SMELT	JUVENILE	1

SAMPLING PERIOD: 17MAY06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 17MAY06 DIEL PERIOD: NIGHT START TIME: 1:00 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 132.479
STUDY GRAB TEMPERATURE (F): 46.1 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.3

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	1
RAINBOW SMELT	YOLK-SAC	1

SAMPLING PERIOD: 17MAY06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 17MAY06 DIEL PERIOD: NIGHT START TIME: 1:00 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 148.089
STUDY GRAB TEMPERATURE (F): 46.1 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.3

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	4
RAINBOW SMELT	YOLK-SAC	1

SAMPLING PERIOD: 24-25MAY06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 24MAY06 DIEL PERIOD: DAY START TIME: 13:38 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 152.203
STUDY GRAB TEMPERATURE (F): 47.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.1

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 24-25MAY06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 24MAY06 DIEL PERIOD: DAY START TIME: 13:38 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 126.825
STUDY GRAB TEMPERATURE (F): 47.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.1

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	1
RAINBOW SMELT	YOLK-SAC	1

SAMPLING PERIOD: 24-25MAY06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 24MAY06 DIEL PERIOD: DAY START TIME: 13:50 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 142.204
STUDY GRAB TEMPERATURE (F): 48.4 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.0

TAXA	LIFE STAGE	PLUS COUNT
RAINBOW SMELT	YOLK-SAC	1

SAMPLING PERIOD: 24-25MAY06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 24MAY06 DIEL PERIOD: DAY START TIME: 13:50 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 146.444
STUDY GRAB TEMPERATURE (F): 48.4 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.0

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 24-25MAY06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 24MAY06 DIEL PERIOD: DAY START TIME: 14:14 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 140.516
STUDY GRAB TEMPERATURE (F): 48.4 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.1

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 24-25MAY06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 24MAY06 DIEL PERIOD: DAY START TIME: 14:14 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 140.031
STUDY GRAB TEMPERATURE (F): 48.4 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.1

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	1

SAMPLING PERIOD: 24-25MAY06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 24MAY06 DIEL PERIOD: DAY START TIME: 14:29 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 153.553
STUDY GRAB TEMPERATURE (F): 48.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.0

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	1

SAMPLING PERIOD: 24-25MAY06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 24MAY06 DIEL PERIOD: DAY START TIME: 14:29 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 173.804
STUDY GRAB TEMPERATURE (F): 48.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.0

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	3

SAMPLING PERIOD: 24-25MAY06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 24MAY06 DIEL PERIOD: DAY START TIME: 14:55 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 142.119
STUDY GRAB TEMPERATURE (F): 44.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.8

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 24-25MAY06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 24MAY06 DIEL PERIOD: DAY START TIME: 14:55 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 127.985
STUDY GRAB TEMPERATURE (F): 44.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.8

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	1

SAMPLING PERIOD: 24-25MAY06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 24MAY06 DIEL PERIOD: DAY START TIME: 15:12 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 147.773
STUDY GRAB TEMPERATURE (F): 44.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.6

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 24-25MAY06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 24MAY06 DIEL PERIOD: DAY START TIME: 15:12 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 145.684
STUDY GRAB TEMPERATURE (F): 44.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.6

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 24-25MAY06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 24MAY06 DIEL PERIOD: DAY START TIME: 15:27 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 148.448
STUDY GRAB TEMPERATURE (F): 44.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.4

TAXA	LIFE STAGE	PLUS COUNT
BURBOT	YOLK-SAC	1

SAMPLING PERIOD: 24-25MAY06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 24MAY06 DIEL PERIOD: DAY START TIME: 15:27 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 147.372
STUDY GRAB TEMPERATURE (F): 44.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	1

SAMPLING PERIOD: 24-25MAY06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 25MAY06 DIEL PERIOD: NIGHT START TIME: 0:05 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 123.091
STUDY GRAB TEMPERATURE (F): 54.0 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.1

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	61

SAMPLING PERIOD: 24-25MAY06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 25MAY06 DIEL PERIOD: NIGHT START TIME: 0:05 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 126.234
STUDY GRAB TEMPERATURE (F): 54.0 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.1

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	62
RAINBOW SMELT	JUVENILE	1

SAMPLING PERIOD: 24-25MAY06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 25MAY06 DIEL PERIOD: NIGHT START TIME: 0:44 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 128.998
STUDY GRAB TEMPERATURE (F): 50.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.6

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	20
RAINBOW SMELT	JUVENILE	1

SAMPLING PERIOD: 24-25MAY06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 25MAY06 DIEL PERIOD: NIGHT START TIME: 0:44 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 132.415
STUDY GRAB TEMPERATURE (F): 50.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.6

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	22

SAMPLING PERIOD: 24-25MAY06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 25MAY06 DIEL PERIOD: NIGHT START TIME: 1:07 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 146.486
STUDY GRAB TEMPERATURE (F): 50.2 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.0

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	19

SAMPLING PERIOD: 24-25MAY06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 25MAY06 DIEL PERIOD: NIGHT START TIME: 1:07 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 133.006
STUDY GRAB TEMPERATURE (F): 50.2 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.0

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	24

SAMPLING PERIOD: 24-25MAY06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 25MAY06 DIEL PERIOD: NIGHT START TIME: 1:49 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 118.577
STUDY GRAB TEMPERATURE (F): 47.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.7

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	3
RAINBOW SMELT	POST YOLK-SAC	1

SAMPLING PERIOD: 24-25MAY06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 25MAY06 DIEL PERIOD: NIGHT START TIME: 1:49 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 119.906
STUDY GRAB TEMPERATURE (F): 47.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.7

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	7

SAMPLING PERIOD: 24-25MAY06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 25MAY06 DIEL PERIOD: NIGHT START TIME: 2:28 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 136.086
STUDY GRAB TEMPERATURE (F): 45.4 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.1

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	4

SAMPLING PERIOD: 24-25MAY06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 25MAY06 DIEL PERIOD: NIGHT START TIME: 2:28 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 136.782
STUDY GRAB TEMPERATURE (F): 45.4 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.1

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	1
Mysis relicta	.	1

SAMPLING PERIOD: 24-25MAY06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 25MAY06 DIEL PERIOD: NIGHT START TIME: 2:49 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 136.402
STUDY GRAB TEMPERATURE (F): 44.9 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.0

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 24-25MAY06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 25MAY06 DIEL PERIOD: NIGHT START TIME: 2:49 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 126.530
STUDY GRAB TEMPERATURE (F): 44.9 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.0

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	1
BURBOT	YOLK-SAC	1

SAMPLING PERIOD: 24-25MAY06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 25MAY06 DIEL PERIOD: NIGHT START TIME: 3:16 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 142.288
STUDY GRAB TEMPERATURE (F): 45.0 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.1

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	2

SAMPLING PERIOD: 24-25MAY06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 25MAY06 DIEL PERIOD: NIGHT START TIME: 3:16 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 129.589
STUDY GRAB TEMPERATURE (F): 45.0 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.1

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 07-08JUN06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 07JUN06 DIEL PERIOD: DAY START TIME: 12:27 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 145.537
STUDY GRAB TEMPERATURE (F): 50.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.4

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 07-08JUN06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 07JUN06 DIEL PERIOD: DAY START TIME: 12:27 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 122.733
STUDY GRAB TEMPERATURE (F): 50.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.4

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 07-08JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 07JUN06 DIEL PERIOD: DAY START TIME: 12:52 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 145.431
STUDY GRAB TEMPERATURE (F): 49.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.8

TAXA	LIFE STAGE	PLUS COUNT
YELLOW PERCH	YOLK-SAC	1

SAMPLING PERIOD: 07-08JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 07JUN06 DIEL PERIOD: DAY START TIME: 12:52 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 144.102
STUDY GRAB TEMPERATURE (F): 49.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.8

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 07-08JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 07JUN06 DIEL PERIOD: DAY START TIME: 13:17 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 135.453
STUDY GRAB TEMPERATURE (F): 49.2 STUDY GRAB DISSOLVED OXYGEN (mg/l): 14.0

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 07-08JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 07JUN06 DIEL PERIOD: DAY START TIME: 13:17 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 139.461
STUDY GRAB TEMPERATURE (F): 49.2 STUDY GRAB DISSOLVED OXYGEN (mg/l): 14.0

TAXA	LIFE STAGE	PLUS COUNT
YELLOW PERCH	YOLK-SAC	4

SAMPLING PERIOD: 07-08JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 07JUN06 DIEL PERIOD: DAY START TIME: 13:38 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 154.966
STUDY GRAB TEMPERATURE (F): 49.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.9

TAXA	LIFE STAGE	PLUS COUNT
YELLOW PERCH	YOLK-SAC	1

SAMPLING PERIOD: 07-08JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 07JUN06 DIEL PERIOD: DAY START TIME: 13:38 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 151.211
STUDY GRAB TEMPERATURE (F): 49.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.9

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 07-08JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 07JUN06 DIEL PERIOD: DAY START TIME: 14:00 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 118.767
STUDY GRAB TEMPERATURE (F): 47.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.9

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 07-08JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 07JUN06 DIEL PERIOD: DAY START TIME: 14:00 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 110.392
STUDY GRAB TEMPERATURE (F): 47.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.9

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 07-08JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 07JUN06 DIEL PERIOD: DAY START TIME: 14:19 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 140.537
STUDY GRAB TEMPERATURE (F): 47.0 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.8

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 07-08JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 07JUN06 DIEL PERIOD: DAY START TIME: 14:19 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 127.542
STUDY GRAB TEMPERATURE (F): 47.0 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.8

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 07-08JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 07JUN06 DIEL PERIOD: DAY START TIME: 14:38 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 136.993
STUDY GRAB TEMPERATURE (F): 45.2 STUDY GRAB DISSOLVED OXYGEN (mg/l): 14.3

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	2

SAMPLING PERIOD: 07-08JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 07JUN06 DIEL PERIOD: DAY START TIME: 14:38 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 128.681
STUDY GRAB TEMPERATURE (F): 45.2 STUDY GRAB DISSOLVED OXYGEN (mg/l): 14.3

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	2

SAMPLING PERIOD: 07-08JUN06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 08JUN06 DIEL PERIOD: NIGHT START TIME: 0:52 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 151.886
STUDY GRAB TEMPERATURE (F): 52.2 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.4

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 07-08JUN06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 08JUN06 DIEL PERIOD: NIGHT START TIME: 0:52 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 152.372
STUDY GRAB TEMPERATURE (F): 52.2 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	3
YELLOW PERCH	YOLK-SAC	1

SAMPLING PERIOD: 07-08JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 08JUN06 DIEL PERIOD: NIGHT START TIME: 0:42 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 156.422
STUDY GRAB TEMPERATURE (F): 55.0 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.1

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	13
YELLOW PERCH	YOLK-SAC	4

SAMPLING PERIOD: 07-08JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 08JUN06 DIEL PERIOD: NIGHT START TIME: 0:42 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 164.333
STUDY GRAB TEMPERATURE (F): 55.0 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.1

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	6
YELLOW PERCH	YOLK-SAC	5

SAMPLING PERIOD: 07-08JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 08JUN06 DIEL PERIOD: NIGHT START TIME: 0:30 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 147.288
STUDY GRAB TEMPERATURE (F): 50.9 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.8

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	6
RAINBOW SMELT	POST YOLK-SAC	1
YELLOW PERCH	YOLK-SAC	9

SAMPLING PERIOD: 07-08JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 08JUN06 DIEL PERIOD: NIGHT START TIME: 0:30 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 134.124
STUDY GRAB TEMPERATURE (F): 50.9 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.8

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	8
PIMEPHALES type	YOLK-SAC	1
YELLOW PERCH	YOLK-SAC	3

SAMPLING PERIOD: 07-08JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 08JUN06 DIEL PERIOD: NIGHT START TIME: 0:10 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 155.030
STUDY GRAB TEMPERATURE (F): 50.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.8

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	24
PIMEPHALES type	YOLK-SAC	2
YELLOW PERCH	YOLK-SAC	1

SAMPLING PERIOD: 07-08JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 08JUN06 DIEL PERIOD: NIGHT START TIME: 0:10 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 165.451
STUDY GRAB TEMPERATURE (F): 50.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.8

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	16
PIMEPHALES type	YOLK-SAC	1
YELLOW PERCH	YOLK-SAC	3

SAMPLING PERIOD: 07-08JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 08JUN06 DIEL PERIOD: NIGHT START TIME: 0:05 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 185.997
STUDY GRAB TEMPERATURE (F): 51.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 14.0

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 07-08JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 08JUN06 DIEL PERIOD: NIGHT START TIME: 0:05 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 172.961
STUDY GRAB TEMPERATURE (F): 51.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 14.0

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 07-08JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 07JUN06 DIEL PERIOD: NIGHT START TIME: 23:30 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 134.166
STUDY GRAB TEMPERATURE (F): 48.2 STUDY GRAB DISSOLVED OXYGEN (mg/l): 14.6

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 07-08JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 07JUN06 DIEL PERIOD: NIGHT START TIME: 23:30 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 137.077
STUDY GRAB TEMPERATURE (F): 48.2 STUDY GRAB DISSOLVED OXYGEN (mg/l): 14.6

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 07-08JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 07JUN06 DIEL PERIOD: NIGHT START TIME: 22:45 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 187.474
STUDY GRAB TEMPERATURE (F): 45.1 STUDY GRAB DISSOLVED OXYGEN (mg/l): 14.7

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 07-08JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 07JUN06 DIEL PERIOD: NIGHT START TIME: 22:45 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 168.594
STUDY GRAB TEMPERATURE (F): 45.1 STUDY GRAB DISSOLVED OXYGEN (mg/l): 14.7

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	2

SAMPLING PERIOD: 14-15JUN06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 14JUN06 DIEL PERIOD: DAY START TIME: 13:18 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 144.208
STUDY GRAB TEMPERATURE (F): 60.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.2

TAXA	LIFE STAGE	PLUS COUNT
Gammarus		1
YELLOW PERCH	YOLK-SAC	7

SAMPLING PERIOD: 14-15JUN06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 14JUN06 DIEL PERIOD: DAY START TIME: 13:18 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 148.764
STUDY GRAB TEMPERATURE (F): 60.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.2

TAXA	LIFE STAGE	PLUS COUNT
YELLOW PERCH	YOLK-SAC	3

SAMPLING PERIOD: 14-15JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 14JUN06 DIEL PERIOD: DAY START TIME: 13:02 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 141.908
STUDY GRAB TEMPERATURE (F): 61.4 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.2

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH		0

SAMPLING PERIOD: 14-15JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 14JUN06 DIEL PERIOD: DAY START TIME: 13:02 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 149.671
STUDY GRAB TEMPERATURE (F): 61.4 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.2

TAXA	LIFE STAGE	PLUS COUNT
YELLOW PERCH	YOLK-SAC	6

SAMPLING PERIOD: 14-15JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 14JUN06 DIEL PERIOD: DAY START TIME: 12:44 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 135.052
STUDY GRAB TEMPERATURE (F): 59.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.6

TAXA	LIFE STAGE	PLUS COUNT
RAINBOW SMELT	POST YOLK-SAC	1
YELLOW PERCH	YOLK-SAC	3

SAMPLING PERIOD: 14-15JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 14JUN06 DIEL PERIOD: DAY START TIME: 12:44 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 130.010
STUDY GRAB TEMPERATURE (F): 59.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.6

TAXA	LIFE STAGE	PLUS COUNT
YELLOW PERCH	YOLK-SAC	4
UNID PERCID	LARVAE	1

SAMPLING PERIOD: 14-15JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 14JUN06 DIEL PERIOD: DAY START TIME: 12:30 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 134.166
STUDY GRAB TEMPERATURE (F): 56.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.2

TAXA	LIFE STAGE	PLUS COUNT
RAINBOW SMELT	POST YOLK-SAC	4
YELLOW PERCH	YOLK-SAC	7

SAMPLING PERIOD: 14-15JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 14JUN06 DIEL PERIOD: DAY START TIME: 12:30 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 143.933
STUDY GRAB TEMPERATURE (F): 56.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.2

TAXA	LIFE STAGE	PLUS COUNT
RAINBOW SMELT	POST YOLK-SAC	3
YELLOW PERCH	YOLK-SAC	12

SAMPLING PERIOD: 14-15JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 14JUN06 DIEL PERIOD: DAY START TIME: 12:08 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 134.019
STUDY GRAB TEMPERATURE (F): 62.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.5

TAXA	LIFE STAGE	PLUS COUNT
RAINBOW SMELT	POST YOLK-SAC	1
YELLOW PERCH	YOLK-SAC	8

SAMPLING PERIOD: 14-15JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 14JUN06 DIEL PERIOD: DAY START TIME: 12:08 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 141.423
STUDY GRAB TEMPERATURE (F): 62.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.5

TAXA	LIFE STAGE	PLUS COUNT
RAINBOW SMELT	POST YOLK-SAC	8
YELLOW PERCH	YOLK-SAC	2

SAMPLING PERIOD: 14-15JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 14JUN06 DIEL PERIOD: DAY START TIME: 11:50 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 118.387
STUDY GRAB TEMPERATURE (F): 57.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.9

TAXA	LIFE STAGE	PLUS COUNT
RAINBOW SMELT	POST YOLK-SAC	7

SAMPLING PERIOD: 14-15JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 14JUN06 DIEL PERIOD: DAY START TIME: 11:50 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 143.216
STUDY GRAB TEMPERATURE (F): 57.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.9

TAXA	LIFE STAGE	PLUS COUNT
RAINBOW SMELT	YOLK-SAC	11
RAINBOW SMELT	POST YOLK-SAC	3
YELLOW PERCH	YOLK-SAC	10

SAMPLING PERIOD: 14-15JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 14JUN06 DIEL PERIOD: DAY START TIME: 11:35 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 128.597
STUDY GRAB TEMPERATURE (F): 55.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.0

TAXA	LIFE STAGE	PLUS COUNT
RAINBOW SMELT	POST YOLK-SAC	25
YELLOW PERCH	YOLK-SAC	3

SAMPLING PERIOD: 14-15JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 14JUN06 DIEL PERIOD: DAY START TIME: 11:35 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 146.992
STUDY GRAB TEMPERATURE (F): 55.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.0

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	4
RAINBOW SMELT	YOLK-SAC	38
RAINBOW SMELT	POST YOLK-SAC	1
YELLOW PERCH	YOLK-SAC	3
UNIDENTIFIED	LARVAE	6

SAMPLING PERIOD: 14-15JUN06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 15JUN06 DIEL PERIOD: NIGHT START TIME: 2:08 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 136.213
STUDY GRAB TEMPERATURE (F): 61.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.5

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	17
RAINBOW SMELT	POST YOLK-SAC	3
COMMON CARP	YOLK-SAC	1
YELLOW PERCH	YOLK-SAC	2
UNIDENTIFIED	EGG	10

SAMPLING PERIOD: 14-15JUN06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 15JUN06 DIEL PERIOD: NIGHT START TIME: 2:08 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 143.617
STUDY GRAB TEMPERATURE (F): 61.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.5

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	12
RAINBOW SMELT	YOLK-SAC	2
COMMON CARP	YOLK-SAC	2
YELLOW PERCH	YOLK-SAC	1
UNIDENTIFIED	EGG	2

SAMPLING PERIOD: 14-15JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 15JUN06 DIEL PERIOD: NIGHT START TIME: 1:46 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 142.330
STUDY GRAB TEMPERATURE (F): 61.4 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.6

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	60
RAINBOW SMELT	POST YOLK-SAC	21
PIMEPHALES type	YOLK-SAC	1
UNID STICKLEBACK	YOLK-SAC	1
YELLOW PERCH	YOLK-SAC	17

SAMPLING PERIOD: 14-15JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 15JUN06 DIEL PERIOD: NIGHT START TIME: 1:46 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 150.515
STUDY GRAB TEMPERATURE (F): 61.4 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.6

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	40
RAINBOW SMELT	YOLK-SAC	20
YELLOW PERCH	YOLK-SAC	20
UNIDENTIFIED	LARVAE	1

SAMPLING PERIOD: 14-15JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 15JUN06 DIEL PERIOD: NIGHT START TIME: 1:18 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 139.799
STUDY GRAB TEMPERATURE (F): 60.0 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.3

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	56
RAINBOW SMELT	POST YOLK-SAC	16
UNID STICKLEBACK	YOLK-SAC	3
YELLOW PERCH	YOLK-SAC	5

SAMPLING PERIOD: 14-15JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 15JUN06 DIEL PERIOD: NIGHT START TIME: 1:18 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 149.144
STUDY GRAB TEMPERATURE (F): 60.0 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.3

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	68
RAINBOW SMELT	YOLK-SAC	20
UNID STICKLEBACK	YOLK-SAC	1
YELLOW PERCH	YOLK-SAC	3
UNID PERCID	LARVAE	1

SAMPLING PERIOD: 14-15JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 15JUN06 DIEL PERIOD: NIGHT START TIME: 1:00 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 149.186
STUDY GRAB TEMPERATURE (F): 59.2 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	50
RAINBOW SMELT	POST YOLK-SAC	21
UNID STICKLEBACK	YOLK-SAC	3
YELLOW PERCH	YOLK-SAC	9

SAMPLING PERIOD: 14-15JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 15JUN06 DIEL PERIOD: NIGHT START TIME: 1:00 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 155.325
STUDY GRAB TEMPERATURE (F): 59.2 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	63
UNID STICKLEBACK	YOLK-SAC	5
UNID STICKLEBACK	POST YOLK-SAC	13
UNID STICKLEBACK	YOLK-SAC	2
YELLOW PERCH	YOLK-SAC	7

SAMPLING PERIOD: 14-15JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 15JUN06 DIEL PERIOD: NIGHT START TIME: 0:33 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 139.482
STUDY GRAB TEMPERATURE (F): 58.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.2

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	163
RAINBOW SMELT	POST YOLK-SAC	4
COMMON CARP	YOLK-SAC	1
UNID STICKLEBACK	POST YOLK-SAC	1
YELLOW PERCH	YOLK-SAC	73
UNID SCULPIN	POST YOLK-SAC	2

SAMPLING PERIOD: 14-15JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 15JUN06 DIEL PERIOD: NIGHT START TIME: 0:33 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 150.958
STUDY GRAB TEMPERATURE (F): 58.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.2

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	162
YELLOW PERCH	YOLK-SAC	72
UNIDENTIFIED	LARVAE	5

SAMPLING PERIOD: 14-15JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 15JUN06 DIEL PERIOD: NIGHT START TIME: 0:10 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 150.114
STUDY GRAB TEMPERATURE (F): 58.2 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.3

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	98
RAINBOW SMELT	POST YOLK-SAC	2
YELLOW PERCH	YOLK-SAC	9
UNID SCULPIN	POST YOLK-SAC	4

SAMPLING PERIOD: 14-15JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 15JUN06 DIEL PERIOD: NIGHT START TIME: 0:10 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 154.523
STUDY GRAB TEMPERATURE (F): 58.2 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.3

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	109
RAINBOW SMELT	YOLK-SAC	1
YELLOW PERCH	YOLK-SAC	5
SLIMY SCULPIN	POST YOLK-SAC	1

SAMPLING PERIOD: 14-15JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 14JUN06 DIEL PERIOD: NIGHT START TIME: 23:47 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 126.888
STUDY GRAB TEMPERATURE (F): 55.5 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.9

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	122
RAINBOW SMELT	POST YOLK-SAC	3
YELLOW PERCH	YOLK-SAC	2
UNID SCULPIN	POST YOLK-SAC	2

SAMPLING PERIOD: 14-15JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 14JUN06 DIEL PERIOD: NIGHT START TIME: 23:47 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 143.258
STUDY GRAB TEMPERATURE (F): 55.5 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.9

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	98
RAINBOW SMELT	POST YOLK-SAC	4
COMMON CARP	YOLK-SAC	1
PIMEPHALES type	YOLK-SAC	1
YELLOW PERCH	YOLK-SAC	2
SLIMY SCULPIN	POST YOLK-SAC	1

SAMPLING PERIOD: 21-22JUN06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 21JUN06 DIEL PERIOD: DAY START TIME: 14:07 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 136.360
STUDY GRAB TEMPERATURE (F): 57.4 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.8

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 21-22JUN06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 21JUN06 DIEL PERIOD: DAY START TIME: 14:07 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 130.791
STUDY GRAB TEMPERATURE (F): 57.4 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.8

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 21-22JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 21JUN06 DIEL PERIOD: DAY START TIME: 13:47 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 136.930
STUDY GRAB TEMPERATURE (F): 59.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.9

TAXA	LIFE STAGE	PLUS COUNT
YELLOW PERCH	YOLK-SAC	1
UNIDENTIFIED	EGG	1

SAMPLING PERIOD: 21-22JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 21JUN06 DIEL PERIOD: DAY START TIME: 13:47 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 132.858
STUDY GRAB TEMPERATURE (F): 59.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.9

TAXA	LIFE STAGE	PLUS COUNT
YELLOW PERCH	YOLK-SAC	1

SAMPLING PERIOD: 21-22JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 21JUN06 DIEL PERIOD: DAY START TIME: 13:28 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 137.710
STUDY GRAB TEMPERATURE (F): 47.4 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.9

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 21-22JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 21JUN06 DIEL PERIOD: DAY START TIME: 13:28 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 134.546
STUDY GRAB TEMPERATURE (F): 47.4 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.9

TAXA	LIFE STAGE	PLUS COUNT
RAINBOW SMELT	YOLK-SAC	1
RAINBOW SMELT	POST YOLK-SAC	1
YELLOW PERCH	YOLK-SAC	1

SAMPLING PERIOD: 21-22JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 21JUN06 DIEL PERIOD: DAY START TIME: 13:05 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 136.909
STUDY GRAB TEMPERATURE (F): 46.4 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.3

TAXA	LIFE STAGE	PLUS COUNT
RAINBOW SMELT	POST YOLK-SAC	1

SAMPLING PERIOD: 21-22JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 21JUN06 DIEL PERIOD: DAY START TIME: 13:05 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 136.550
STUDY GRAB TEMPERATURE (F): 46.4 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.3

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 21-22JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 21JUN06 DIEL PERIOD: DAY START TIME: 12:45 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 134.567
STUDY GRAB TEMPERATURE (F): 50.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.3

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	1

SAMPLING PERIOD: 21-22JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 21JUN06 DIEL PERIOD: DAY START TIME: 12:45 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 125.053
STUDY GRAB TEMPERATURE (F): 50.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.3

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 21-22JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 21JUN06 DIEL PERIOD: DAY START TIME: 12:25 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 144.398
STUDY GRAB TEMPERATURE (F): 47.7 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.6

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 21-22JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 21JUN06 DIEL PERIOD: DAY START TIME: 12:25 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 139.081
STUDY GRAB TEMPERATURE (F): 47.7 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.6

TAXA	LIFE STAGE	PLUS COUNT
YELLOW PERCH	YOLK-SAC	1

SAMPLING PERIOD: 21-22JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 21JUN06 DIEL PERIOD: DAY START TIME: 12:03 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 135.411
STUDY GRAB TEMPERATURE (F): 44.5 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.5

TAXA	LIFE STAGE	PLUS COUNT
RAINBOW SMELT	POST YOLK-SAC	3

SAMPLING PERIOD: 21-22JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 21JUN06 DIEL PERIOD: DAY START TIME: 12:03 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 133.723
STUDY GRAB TEMPERATURE (F): 44.5 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.5

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	1
RAINBOW SMELT	POST YOLK-SAC	2

SAMPLING PERIOD: 21-22JUN06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 22JUN06 DIEL PERIOD: NIGHT START TIME: 1:05 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 123.682
STUDY GRAB TEMPERATURE (F): 46.2 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	1
RAINBOW SMELT	POST YOLK-SAC	6

SAMPLING PERIOD: 21-22JUN06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 22JUN06 DIEL PERIOD: NIGHT START TIME: 1:05 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 115.012
STUDY GRAB TEMPERATURE (F): 46.2 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.4

TAXA	LIFE STAGE	PLUS COUNT
RAINBOW SMELT	YOLK-SAC	6
RAINBOW SMELT	POST YOLK-SAC	1
YELLOW PERCH	YOLK-SAC	1

SAMPLING PERIOD: 21-22JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 22JUN06 DIEL PERIOD: NIGHT START TIME: 0:48 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 135.116
STUDY GRAB TEMPERATURE (F): 47.1 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	4
RAINBOW SMELT	POST YOLK-SAC	32
YELLOW PERCH	YOLK-SAC	1

SAMPLING PERIOD: 21-22JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 22JUN06 DIEL PERIOD: NIGHT START TIME: 0:48 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 98.452
STUDY GRAB TEMPERATURE (F): 47.1 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	3
RAINBOW SMELT	POST YOLK-SAC	1
UNID STICKLEBACK	POST YOLK-SAC	3

SAMPLING PERIOD: 21-22JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 22JUN06 DIEL PERIOD: NIGHT START TIME: 0:28 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 148.574
STUDY GRAB TEMPERATURE (F): 46.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.3

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 21-22JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 22JUN06 DIEL PERIOD: NIGHT START TIME: 0:28 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 132.141
STUDY GRAB TEMPERATURE (F): 46.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.3

TAXA	LIFE STAGE	PLUS COUNT
RAINBOW SMELT	POST YOLK-SAC	19
RAINBOW SMELT	YOLK-SAC	3
YELLOW PERCH	YOLK-SAC	1

SAMPLING PERIOD: 21-22JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 22JUN06 DIEL PERIOD: NIGHT START TIME: 0:15 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 133.512
STUDY GRAB TEMPERATURE (F): 46.1 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.3

TAXA	LIFE STAGE	PLUS COUNT
RAINBOW SMELT	POST YOLK-SAC	5
UNID STICKLEBACK	YOLK-SAC	1

SAMPLING PERIOD: 21-22JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 22JUN06 DIEL PERIOD: NIGHT START TIME: 0:15 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 121.383
STUDY GRAB TEMPERATURE (F): 46.1 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.3

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	2
RAINBOW SMELT	POST YOLK-SAC	5
RAINBOW SMELT	YOLK-SAC	3
UNID STICKLEBACK	POST YOLK-SAC	1
YELLOW PERCH	YOLK-SAC	1

SAMPLING PERIOD: 21-22JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 21JUN06 DIEL PERIOD: NIGHT START TIME: 23:45 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 146.402
STUDY GRAB TEMPERATURE (F): 47.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.1

TAXA	LIFE STAGE	PLUS COUNT
RAINBOW SMELT	POST YOLK-SAC	65
DEEPWATER SCULPIN	POST YOLK-SAC	1

SAMPLING PERIOD: 21-22JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 21JUN06 DIEL PERIOD: NIGHT START TIME: 23:45 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 136.508
STUDY GRAB TEMPERATURE (F): 47.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.1

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 21-22JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 21JUN06 DIEL PERIOD: NIGHT START TIME: 23:32 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 136.234
STUDY GRAB TEMPERATURE (F): 47.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.0

TAXA	LIFE STAGE	PLUS COUNT
RAINBOW SMELT	POST YOLK-SAC	5
YELLOW PERCH	YOLK-SAC	1
UNID SCULPIN	POST YOLK-SAC	1

SAMPLING PERIOD: 21-22JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 21JUN06 DIEL PERIOD: NIGHT START TIME: 23:32 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 132.858
STUDY GRAB TEMPERATURE (F): 47.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.0

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	2
RAINBOW SMELT	YOLK-SAC	3
RAINBOW SMELT	POST YOLK-SAC	36
SLIMY SCULPIN	POST YOLK-SAC	1

SAMPLING PERIOD: 21-22JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 21JUN06 DIEL PERIOD: NIGHT START TIME: 23:15 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 123.724
STUDY GRAB TEMPERATURE (F): 46.1 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.2

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	2
RAINBOW SMELT	POST YOLK-SAC	42

SAMPLING PERIOD: 21-22JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 21JUN06 DIEL PERIOD: NIGHT START TIME: 23:15 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 126.888
STUDY GRAB TEMPERATURE (F): 46.1 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.2

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	3
RAINBOW SMELT	POST YOLK-SAC	15
RAINBOW SMELT	YOLK-SAC	8
UNIDENTIFIED	EGG	1

SAMPLING PERIOD: 28-29JUN06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 28JUN06 DIEL PERIOD: DAY START TIME: 13:03 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 119.800
STUDY GRAB TEMPERATURE (F): 62.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.0

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 28-29JUN06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 28JUN06 DIEL PERIOD: DAY START TIME: 13:03 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 116.214
STUDY GRAB TEMPERATURE (F): 62.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.0

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 28-29JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 28JUN06 DIEL PERIOD: DAY START TIME: 13:32 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 117.691
STUDY GRAB TEMPERATURE (F): 62.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.7

TAXA	LIFE STAGE	PLUS COUNT
RAINBOW SMELT	POST YOLK-SAC	1

SAMPLING PERIOD: 28-29JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 28JUN06 DIEL PERIOD: DAY START TIME: 13:32 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 120.138
STUDY GRAB TEMPERATURE (F): 62.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.7

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 28-29JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 28JUN06 DIEL PERIOD: DAY START TIME: 13:55 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 120.412
STUDY GRAB TEMPERATURE (F): 57.9 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.1

TAXA	LIFE STAGE	PLUS COUNT
RAINBOW SMELT	POST YOLK-SAC	4
YELLOW PERCH	YOLK-SAC	7

SAMPLING PERIOD: 28-29JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 28JUN06 DIEL PERIOD: DAY START TIME: 13:55 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 112.164
STUDY GRAB TEMPERATURE (F): 57.9 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.1

TAXA	LIFE STAGE	PLUS COUNT
RAINBOW SMELT	YOLK-SAC	1
RAINBOW SMELT	POST YOLK-SAC	1
YELLOW PERCH	YOLK-SAC	1

SAMPLING PERIOD: 28-29JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 28JUN06 DIEL PERIOD: DAY START TIME: 14:12 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 111.257
STUDY GRAB TEMPERATURE (F): 56.0 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.6

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	75
UNID STICKLEBACK	POST YOLK-SAC	3
YELLOW PERCH	YOLK-SAC	2
SLIMY SCULPIN	POST YOLK-SAC	1

SAMPLING PERIOD: 28-29JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 28JUN06 DIEL PERIOD: DAY START TIME: 14:12 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 110.350
STUDY GRAB TEMPERATURE (F): 56.0 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.6

TAXA	LIFE STAGE	PLUS COUNT
RAINBOW SMELT	POST YOLK-SAC	2
RAINBOW SMELT	YOLK-SAC	2
YELLOW PERCH	YOLK-SAC	1

SAMPLING PERIOD: 28-29JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 28JUN06 DIEL PERIOD: DAY START TIME: 14:43 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 108.451
STUDY GRAB TEMPERATURE (F): 58.7 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.8

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 28-29JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 28JUN06 DIEL PERIOD: DAY START TIME: 14:43 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 115.223
STUDY GRAB TEMPERATURE (F): 58.7 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.8

TAXA	LIFE STAGE	PLUS COUNT
UNID CATOSTOMID	EGG	2

SAMPLING PERIOD: 28-29JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 28JUN06 DIEL PERIOD: DAY START TIME: 15:03 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 111.046
STUDY GRAB TEMPERATURE (F): 58.2 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.7

TAXA	LIFE STAGE	PLUS COUNT
RAINBOW SMELT	POST YOLK-SAC	1

SAMPLING PERIOD: 28-29JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 28JUN06 DIEL PERIOD: DAY START TIME: 15:03 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 110.582
STUDY GRAB TEMPERATURE (F): 58.2 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.7

TAXA	LIFE STAGE	PLUS COUNT
RAINBOW SMELT	POST YOLK-SAC	4
BURBOT	POST YOLK-SAC	1

SAMPLING PERIOD: 28-29JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 28JUN06 DIEL PERIOD: DAY START TIME: 15:20 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 121.762
STUDY GRAB TEMPERATURE (F): 56.7 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.2

TAXA	LIFE STAGE	PLUS COUNT
RAINBOW SMELT	POST YOLK-SAC	2

SAMPLING PERIOD: 28-29JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 28JUN06 DIEL PERIOD: DAY START TIME: 15:20 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 113.577
STUDY GRAB TEMPERATURE (F): 56.7 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.2

TAXA	LIFE STAGE	PLUS COUNT
RAINBOW SMELT	POST YOLK-SAC	4

SAMPLING PERIOD: 28-29JUN06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 29JUN06 DIEL PERIOD: NIGHT START TIME: 3:03 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 124.441
STUDY GRAB TEMPERATURE (F): 59.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.2

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	4
UNID CLUPEIDAE	YOLK-SAC	2
COMMON CARP	YOLK-SAC	4
PIMEPHALES type	YOLK-SAC	1
UNID STICKLEBACK	POST YOLK-SAC	2
SLIMY SCULPIN	POST YOLK-SAC	1

SAMPLING PERIOD: 28-29JUN06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 29JUN06 DIEL PERIOD: NIGHT START TIME: 3:03 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 120.433
STUDY GRAB TEMPERATURE (F): 59.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.2

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	5
ALEWIFE type	EGG	1
COMMON CARP	YOLK-SAC	10

SAMPLING PERIOD: 28-29JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 29JUN06 DIEL PERIOD: NIGHT START TIME: 2:41 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 124.716
STUDY GRAB TEMPERATURE (F): 59.4 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.0

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	10
RAINBOW SMELT	POST YOLK-SAC	4
COMMON CARP	YOLK-SAC	2
UNID STICKLEBACK	YOLK-SAC	5
SLIMY SCULPIN	POST YOLK-SAC	1

SAMPLING PERIOD: 28-29JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 29JUN06 DIEL PERIOD: NIGHT START TIME: 2:41 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 112.058
STUDY GRAB TEMPERATURE (F): 59.4 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.0

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	. .	15
RAINBOW SMELT	POST YOLK-SAC	7
COMMON CARP	YOLK-SAC	1
UNID STICKLEBACK	POST YOLK-SAC	4

SAMPLING PERIOD: 28-29JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 29JUN06 DIEL PERIOD: NIGHT START TIME: 2:20 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 123.049
STUDY GRAB TEMPERATURE (F): 59.5 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.7

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	6
RAINBOW SMELT	POST YOLK-SAC	1
COMMON CARP	YOLK-SAC	1
UNID STICKLEBACK	YOLK-SAC	8

SAMPLING PERIOD: 28-29JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 29JUN06 DIEL PERIOD: NIGHT START TIME: 2:20 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 121.446
STUDY GRAB TEMPERATURE (F): 59.5 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.7

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	14
RAINBOW SMELT	POST YOLK-SAC	1
RAINBOW SMELT	YOLK-SAC	1
COMMON CARP	YOLK-SAC	1
UNID STICKLEBACK	YOLK-SAC	12
SLIMY SCULPIN	POST YOLK-SAC	1

SAMPLING PERIOD: 28-29JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 29JUN06 DIEL PERIOD: NIGHT START TIME: 1:39 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 121.108
STUDY GRAB TEMPERATURE (F): 56.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.2

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	12
COMMON CARP	YOLK-SAC	1
UNID STICKLEBACK	YOLK-SAC	6
SLIMY SCULPIN	POST YOLK-SAC	2

SAMPLING PERIOD: 28-29JUN06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 29JUN06 DIEL PERIOD: NIGHT START TIME: 1:39 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 119.737
STUDY GRAB TEMPERATURE (F): 56.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.2

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	15
RAINBOW SMELT	POST YOLK-SAC	1
RAINBOW SMELT	YOLK-SAC	1
COMMON CARP	YOLK-SAC	5
UNID STICKLEBACK	POST YOLK-SAC	4
SLIMY SCULPIN	POST YOLK-SAC	4

SAMPLING PERIOD: 28-29JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 29JUN06 DIEL PERIOD: NIGHT START TIME: 1:15 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 118.049
STUDY GRAB TEMPERATURE (F): 61.2 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.5

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	27
RAINBOW SMELT	POST YOLK-SAC	6
COMMON CARP	YOLK-SAC	1
BURBOT	YOLK-SAC	1
UNID STICKLEBACK	YOLK-SAC	1
YELLOW PERCH	YOLK-SAC	1
SLIMY SCULPIN	POST YOLK-SAC	1

SAMPLING PERIOD: 28-29JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 29JUN06 DIEL PERIOD: NIGHT START TIME: 1:15 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 131.529
STUDY GRAB TEMPERATURE (F): 61.2 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.5

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	29
RAINBOW SMELT	POST YOLK-SAC	2
RAINBOW SMELT	YOLK-SAC	1
COMMON CARP	YOLK-SAC	2
UNID STICKLEBACK	YOLK-SAC	6
YELLOW PERCH	YOLK-SAC	1
UNIDENTIFIED	EGG	2

SAMPLING PERIOD: 28-29JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 29JUN06 DIEL PERIOD: NIGHT START TIME: 0:52 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 108.092
STUDY GRAB TEMPERATURE (F): 59.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.6

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	37
RAINBOW SMELT	POST YOLK-SAC	5
UNID STICKLEBACK	YOLK-SAC	4
YELLOW PERCH	YOLK-SAC	1
SLIMY SCULPIN	POST YOLK-SAC	1
UNIDENTIFIED	EGG	3

SAMPLING PERIOD: 28-29JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 29JUN06 DIEL PERIOD: NIGHT START TIME: 0:52 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 104.422
STUDY GRAB TEMPERATURE (F): 59.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.6

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	33
RAINBOW SMELT	POST YOLK-SAC	2
RAINBOW SMELT	YOLK-SAC	4
UNID CATOSTOMID	EGG	3
UNID STICKLEBACK	POST YOLK-SAC	1
YELLOW PERCH	YOLK-SAC	1

SAMPLING PERIOD: 28-29JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 29JUN06 DIEL PERIOD: NIGHT START TIME: 0:05 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 123.830
STUDY GRAB TEMPERATURE (F): 55.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.0

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	43
RAINBOW SMELT	POST YOLK-SAC	6
UNID STICKLEBACK	YOLK-SAC	4
SLIMY SCULPIN	POST YOLK-SAC	1

SAMPLING PERIOD: 28-29JUN06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 29JUN06 DIEL PERIOD: NIGHT START TIME: 0:05 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 120.581
STUDY GRAB TEMPERATURE (F): 55.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.0

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	45
RAINBOW SMELT	POST YOLK-SAC	4
RAINBOW SMELT	YOLK-SAC	1
UNID STICKLEBACK	POST YOLK-SAC	2
YELLOW PERCH	YOLK-SAC	1
SLIMY SCULPIN	POST YOLK-SAC	2

SAMPLING PERIOD: 05-06JUL06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 06JUL06 DIEL PERIOD: DAY START TIME: 10:35 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 157.751
STUDY GRAB TEMPERATURE (F): 69.1 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.0

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	1
UNID CLUPEIDAE	YOLK-SAC	2
RAINBOW SMELT	POST YOLK-SAC	5

SAMPLING PERIOD: 05-06JUL06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 06JUL06 DIEL PERIOD: DAY START TIME: 10:35 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 135.748
STUDY GRAB TEMPERATURE (F): 69.1 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.0

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	1
RAINBOW SMELT	POST YOLK-SAC	1

SAMPLING PERIOD: 05-06JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 06JUL06 DIEL PERIOD: DAY START TIME: 10:15 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 125.580
STUDY GRAB TEMPERATURE (F): 68.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.2

TAXA	LIFE STAGE	PLUS COUNT
ALEWIFE	YOLK-SAC	2
YELLOW PERCH	YOLK-SAC	3

SAMPLING PERIOD: 05-06JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 06JUL06 DIEL PERIOD: DAY START TIME: 10:15 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 137.267
STUDY GRAB TEMPERATURE (F): 68.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.2

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	3
UNID CLUPEIDAE	YOLK-SAC	4
ALEWIFE type	EGG	1

SAMPLING PERIOD: 05-06JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 06JUL06 DIEL PERIOD: DAY START TIME: 9:56 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 115.476
STUDY GRAB TEMPERATURE (F): 63.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.6

TAXA	LIFE STAGE	PLUS COUNT
UNID CLUPEIDAE	YOLK-SAC	2
UNID CATOSTOMID	EGG	2
YELLOW PERCH	YOLK-SAC	1

SAMPLING PERIOD: 05-06JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 06JUL06 DIEL PERIOD: DAY START TIME: 9:56 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 145.663
STUDY GRAB TEMPERATURE (F): 63.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.6

TAXA	LIFE STAGE	PLUS COUNT
UNID CLUPEIDAE	YOLK-SAC	3
ALEWIFE type	EGG	1
YELLOW PERCH	YOLK-SAC	2

SAMPLING PERIOD: 05-06JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 06JUL06 DIEL PERIOD: DAY START TIME: 9:41 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 129.926
STUDY GRAB TEMPERATURE (F): 56.4 STUDY GRAB DISSOLVED OXYGEN (mg/l): 15.6

TAXA	LIFE STAGE	PLUS COUNT
UNID CATOSTOMID	EGG	1

SAMPLING PERIOD: 05-06JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 06JUL06 DIEL PERIOD: DAY START TIME: 9:41 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 146.866
STUDY GRAB TEMPERATURE (F): 56.4 STUDY GRAB DISSOLVED OXYGEN (mg/l): 15.6

TAXA	LIFE STAGE	PLUS COUNT
UNID CLUPEIDAE	YOLK-SAC	1
ALEWIFE type	EGG	2

SAMPLING PERIOD: 05-06JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 06JUL06 DIEL PERIOD: DAY START TIME: 9:18 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 101.068
STUDY GRAB TEMPERATURE (F): 63.1 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.1

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	1

SAMPLING PERIOD: 05-06JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 06JUL06 DIEL PERIOD: DAY START TIME: 9:18 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 119.632
STUDY GRAB TEMPERATURE (F): 63.1 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.1

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 05-06JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 06JUL06 DIEL PERIOD: DAY START TIME: 9:00 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 110.983
STUDY GRAB TEMPERATURE (F): 62.0 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.9

TAXA	LIFE STAGE	PLUS COUNT
RAINBOW SMELT	YOLK-SAC	2
YELLOW PERCH	YOLK-SAC	2

SAMPLING PERIOD: 05-06JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 06JUL06 DIEL PERIOD: DAY START TIME: 9:00 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 132.626
STUDY GRAB TEMPERATURE (F): 62.0 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.9

TAXA	LIFE STAGE	PLUS COUNT
RAINBOW SMELT	POST YOLK-SAC	1
YELLOW PERCH	YOLK-SAC	1

SAMPLING PERIOD: 05-06JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 06JUL06 DIEL PERIOD: DAY START TIME: 8:38 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 102.882
STUDY GRAB TEMPERATURE (F): 52.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 15.7

TAXA	LIFE STAGE	PLUS COUNT
YELLOW PERCH	YOLK-SAC	1

SAMPLING PERIOD: 05-06JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 06JUL06 DIEL PERIOD: DAY START TIME: 8:38 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 134.019
STUDY GRAB TEMPERATURE (F): 52.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 15.7

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 05-06JUL06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 06JUL06 DIEL PERIOD: NIGHT START TIME: 0:42 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 140.706
STUDY GRAB TEMPERATURE (F): 58.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 15.5

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	75
UNID CLUPEIDAE	YOLK-SAC	6
PIMEPHALES type	YOLK-SAC	3
UNID CATOSTOMID	EGG	7
UNID STICKLEBACK	YOLK-SAC	1
UNIDENTIFIED	LARVAE	1

SAMPLING PERIOD: 05-06JUL06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 06JUL06 DIEL PERIOD: NIGHT START TIME: 0:42 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 144.608
STUDY GRAB TEMPERATURE (F): 58.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 15.5

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	20
UNID CLUPEIDAE	YOLK-SAC	2
PIMEPHALES type	YOLK-SAC	2

SAMPLING PERIOD: 05-06JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 06JUL06 DIEL PERIOD: NIGHT START TIME: 0:19 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 128.492
STUDY GRAB TEMPERATURE (F): 60.9 STUDY GRAB DISSOLVED OXYGEN (mg/l): 14.1

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	15
UNID CLUPEIDAE	YOLK-SAC	4
RAINBOW SMELT	POST YOLK-SAC	4
UNID STICKLEBACK	YOLK-SAC	4

SAMPLING PERIOD: 05-06JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 06JUL06 DIEL PERIOD: NIGHT START TIME: 0:19 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 133.069
STUDY GRAB TEMPERATURE (F): 60.9 STUDY GRAB DISSOLVED OXYGEN (mg/l): 14.1

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	18
UNID CLUPEIDAE	YOLK-SAC	2
RAINBOW SMELT	POST YOLK-SAC	2
UNID STICKLEBACK	POST YOLK-SAC	5

SAMPLING PERIOD: 05-06JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 05JUL06 DIEL PERIOD: NIGHT START TIME: 23:59 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 128.471
STUDY GRAB TEMPERATURE (F): 56.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 14.7

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	5
UNID CLUPEIDAE	YOLK-SAC	2
RAINBOW SMELT	POST YOLK-SAC	5
UNID STICKLEBACK	YOLK-SAC	6

SAMPLING PERIOD: 05-06JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 05JUL06 DIEL PERIOD: NIGHT START TIME: 23:59 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 139.503
STUDY GRAB TEMPERATURE (F): 56.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 14.7

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	11
UNID CLUPEIDAE	YOLK-SAC	1
RAINBOW SMELT	POST YOLK-SAC	4
UNID STICKLEBACK	POST YOLK-SAC	5

SAMPLING PERIOD: 05-06JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 05JUL06 DIEL PERIOD: NIGHT START TIME: 23:38 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 128.681
STUDY GRAB TEMPERATURE (F): 56.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 14.5

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	17
RAINBOW SMELT	POST YOLK-SAC	6
UNID STICKLEBACK	YOLK-SAC	2
SLIMY SCULPIN	POST YOLK-SAC	1

SAMPLING PERIOD: 05-06JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 05JUL06 DIEL PERIOD: NIGHT START TIME: 23:38 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 138.702
STUDY GRAB TEMPERATURE (F): 56.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 14.5

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	18
RAINBOW SMELT	POST YOLK-SAC	6
UNID STICKLEBACK	YOLK-SAC	9

SAMPLING PERIOD: 05-06JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 05JUL06 DIEL PERIOD: NIGHT START TIME: 23:15 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 125.813
STUDY GRAB TEMPERATURE (F): 62.7 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.5

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	29
RAINBOW SMELT	POST YOLK-SAC	4
UNID STICKLEBACK	YOLK-SAC	10
YELLOW PERCH	YOLK-SAC	1

SAMPLING PERIOD: 05-06JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 05JUL06 DIEL PERIOD: NIGHT START TIME: 23:15 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 132.057
STUDY GRAB TEMPERATURE (F): 62.7 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.5

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	41
RAINBOW SMELT	POST YOLK-SAC	4
UNID STICKLEBACK	POST YOLK-SAC	4
YELLOW PERCH	YOLK-SAC	1

SAMPLING PERIOD: 05-06JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 05JUL06 DIEL PERIOD: NIGHT START TIME: 22:40 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 132.331
STUDY GRAB TEMPERATURE (F): 53.7 STUDY GRAB DISSOLVED OXYGEN (mg/l): 14.9

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	55
RAINBOW SMELT	POST YOLK-SAC	5
UNID STICKLEBACK	POST YOLK-SAC	13

SAMPLING PERIOD: 05-06JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 05JUL06 DIEL PERIOD: NIGHT START TIME: 22:40 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 137.985
STUDY GRAB TEMPERATURE (F): 53.7 STUDY GRAB DISSOLVED OXYGEN (mg/l): 14.9

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	55
RAINBOW SMELT	POST YOLK-SAC	4
UNID STICKLEBACK	POST YOLK-SAC	20

SAMPLING PERIOD: 05-06JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 05JUL06 DIEL PERIOD: NIGHT START TIME: 22:13 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 129.335
STUDY GRAB TEMPERATURE (F): 53.0 STUDY GRAB DISSOLVED OXYGEN (mg/l): 15.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	40
RAINBOW SMELT	POST YOLK-SAC	7
UNID CYPRINID	YOLK-SAC	1
UNID STICKLEBACK	POST YOLK-SAC	16

SAMPLING PERIOD: 05-06JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 05JUL06 DIEL PERIOD: NIGHT START TIME: 22:13 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 135.411
STUDY GRAB TEMPERATURE (F): 53.0 STUDY GRAB DISSOLVED OXYGEN (mg/l): 15.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	51
ALEWIFE type	EGG	1
RAINBOW SMELT	POST YOLK-SAC	4
UNID STICKLEBACK	POST YOLK-SAC	7
SLIMY SCULPIN	POST YOLK-SAC	1

SAMPLING PERIOD: 12-13JUL06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 12JUL06 DIEL PERIOD: DAY START TIME: 14:26 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 144.376
STUDY GRAB TEMPERATURE (F): 61.4 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.5

TAXA	LIFE STAGE	PLUS COUNT
UNID CLUPEIDAE	YOLK-SAC	5

SAMPLING PERIOD: 12-13JUL06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 12JUL06 DIEL PERIOD: DAY START TIME: 14:26 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 153.131
STUDY GRAB TEMPERATURE (F): 61.4 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.5

TAXA	LIFE STAGE	PLUS COUNT
UNID CYPRINID	YOLK-SAC	1
UNIDENTIFIED	YOLK-SAC	1

SAMPLING PERIOD: 12-13JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 12JUL06 DIEL PERIOD: DAY START TIME: 13:39 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 140.200
STUDY GRAB TEMPERATURE (F): 65.1 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.2

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	1
UNID CLUPEIDAE	YOLK-SAC	2

SAMPLING PERIOD: 12-13JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 12JUL06 DIEL PERIOD: DAY START TIME: 13:39 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 137.879
STUDY GRAB TEMPERATURE (F): 65.1 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.2

TAXA	LIFE STAGE	PLUS COUNT
ALEWIFE type	EGG	2

SAMPLING PERIOD: 12-13JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 12JUL06 DIEL PERIOD: DAY START TIME: 13:53 TOW DURATION (min.): 3.50 VOLUME SAMPLED (m^3): 180.175
STUDY GRAB TEMPERATURE (F): 58.7 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.0

TAXA	LIFE STAGE	PLUS COUNT
UNID CLUPEIDAE	YOLK-SAC	2
UNID CLUPEIDAE	POST YOLK-SAC	1

SAMPLING PERIOD: 12-13JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 12JUL06 DIEL PERIOD: DAY START TIME: 13:53 TOW DURATION (min.): 3.50 VOLUME SAMPLED (m^3): 193.086
STUDY GRAB TEMPERATURE (F): 58.7 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.0

TAXA	LIFE STAGE	PLUS COUNT
RAINBOW SMELT	POST YOLK-SAC	1

SAMPLING PERIOD: 12-13JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 12JUL06 DIEL PERIOD: DAY START TIME: 14:12 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 144.651
STUDY GRAB TEMPERATURE (F): 58.5 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.1

TAXA	LIFE STAGE	PLUS COUNT
Gammarus		1
UNID CLUPEIDAE	YOLK-SAC	1
UNID CATOSTOMID	EGG	39
SLIMY SCULPIN	POST YOLK-SAC	1

SAMPLING PERIOD: 12-13JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 12JUL06 DIEL PERIOD: DAY START TIME: 14:12 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 169.775
STUDY GRAB TEMPERATURE (F): 58.5 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.1

TAXA	LIFE STAGE	PLUS COUNT
Gammarus		3
ALEWIFE type	EGG	11
UNID ALOSA	YOLK-SAC	1
YELLOW PERCH	YOLK-SAC	1

SAMPLING PERIOD: 12-13JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 12JUL06 DIEL PERIOD: DAY START TIME: 12:22 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 111.552
STUDY GRAB TEMPERATURE (F): 61.7 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.5

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH		0

SAMPLING PERIOD: 12-13JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 12JUL06 DIEL PERIOD: DAY START TIME: 12:22 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 100.477
STUDY GRAB TEMPERATURE (F): 61.7 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.5

TAXA	LIFE STAGE	PLUS COUNT
Gammarus		1

SAMPLING PERIOD: 12-13JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 12JUL06 DIEL PERIOD: DAY START TIME: 13:03 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 146.781
STUDY GRAB TEMPERATURE (F): 57.2 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.9

TAXA	LIFE STAGE	PLUS COUNT
UNID CLUPEIDAE	YOLK-SAC	3

SAMPLING PERIOD: 12-13JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 12JUL06 DIEL PERIOD: DAY START TIME: 13:03 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 144.039
STUDY GRAB TEMPERATURE (F): 57.2 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.9

TAXA	LIFE STAGE	PLUS COUNT
YELLOW PERCH	YOLK-SAC	1

SAMPLING PERIOD: 12-13JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 12JUL06 DIEL PERIOD: DAY START TIME: 13:17 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 141.824
STUDY GRAB TEMPERATURE (F): 56.7 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.3

TAXA	LIFE STAGE	PLUS COUNT
YELLOW PERCH	YOLK-SAC	1

SAMPLING PERIOD: 12-13JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 12JUL06 DIEL PERIOD: DAY START TIME: 13:17 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 155.072
STUDY GRAB TEMPERATURE (F): 56.7 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.3

TAXA	LIFE STAGE	PLUS COUNT
Gammarus		1
UNID CLUPEIDAE	YOLK-SAC	1
RAINBOW SMELT	YOLK-SAC	1

SAMPLING PERIOD: 12-13JUL06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 13JUL06 DIEL PERIOD: NIGHT START TIME: 1:34 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 146.465
STUDY GRAB TEMPERATURE (F): 65.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.3

TAXA	LIFE STAGE	PLUS COUNT
Gammarus		3
UNID CLUPEIDAE	YOLK-SAC	24
ALEWIFE type	EGG	849
COMMON CARP	YOLK-SAC	9

SAMPLING PERIOD: 12-13JUL06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 13JUL06 DIEL PERIOD: NIGHT START TIME: 1:34 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 154.080
STUDY GRAB TEMPERATURE (F): 65.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.3

TAXA	LIFE STAGE	PLUS COUNT
Gammarus		2
ALEWIFE type	EGG	248
UNID ALOSA	YOLK-SAC	29
COMMON CARP	YOLK-SAC	10
UNID STICKLEBACK	POST YOLK-SAC	1

SAMPLING PERIOD: 12-13JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 13JUL06 DIEL PERIOD: NIGHT START TIME: 0:23 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 126.256
STUDY GRAB TEMPERATURE (F): 64.9 STUDY GRAB DISSOLVED OXYGEN (mg/l): 16.2

TAXA	LIFE STAGE	PLUS COUNT
Gammarus		3
UNID CLUPEIDAE	YOLK-SAC	13
RAINBOW SMELT	POST YOLK-SAC	1
YELLOW PERCH	YOLK-SAC	2

SAMPLING PERIOD: 12-13JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 13JUL06 DIEL PERIOD: NIGHT START TIME: 0:23 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 133.407
STUDY GRAB TEMPERATURE (F): 64.9 STUDY GRAB DISSOLVED OXYGEN (mg/l): 16.2

TAXA	LIFE STAGE	PLUS COUNT
Gammarus		7
ALEWIFE type	EGG	11
UNID ALOSA	YOLK-SAC	11
RAINBOW SMELT	POST YOLK-SAC	1
YELLOW PERCH	YOLK-SAC	2

SAMPLING PERIOD: 12-13JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 13JUL06 DIEL PERIOD: NIGHT START TIME: 0:07 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 150.389
STUDY GRAB TEMPERATURE (F): 61.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.8

TAXA	LIFE STAGE	PLUS COUNT
Gammarus		7
UNID CLUPEIDAE	YOLK-SAC	14
ALEWIFE type	EGG	13
RAINBOW SMELT	JUVENILE	1
RAINBOW SMELT	POST YOLK-SAC	2

SAMPLING PERIOD: 12-13JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 13JUL06 DIEL PERIOD: NIGHT START TIME: 0:07 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 157.920
STUDY GRAB TEMPERATURE (F): 61.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.8

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	1
ALEWIFE type	EGG	12
UNID ALOSA	YOLK-SAC	12
RAINBOW SMELT	POST YOLK-SAC	1

SAMPLING PERIOD: 12-13JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 12JUL06 DIEL PERIOD: NIGHT START TIME: 23:53 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 148.659
STUDY GRAB TEMPERATURE (F): 57.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.7

TAXA	LIFE STAGE	PLUS COUNT
UNID STICKLEBACK	POST YOLK-SAC	1
SLIMY SCULPIN	POST YOLK-SAC	2

SAMPLING PERIOD: 12-13JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 12JUL06 DIEL PERIOD: NIGHT START TIME: 23:53 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 155.430
STUDY GRAB TEMPERATURE (F): 57.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.7

TAXA	LIFE STAGE	PLUS COUNT
UNID ALOSA	YOLK-SAC	2
RAINBOW SMELT	POST YOLK-SAC	1
UNID STICKLEBACK	POST YOLK-SAC	4
SLIMY SCULPIN	POST YOLK-SAC	2

SAMPLING PERIOD: 12-13JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 12JUL06 DIEL PERIOD: NIGHT START TIME: 23:20 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 127.500
STUDY GRAB TEMPERATURE (F): 65.0 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.0

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	6

SAMPLING PERIOD: 12-13JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 12JUL06 DIEL PERIOD: NIGHT START TIME: 23:20 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 166.505
STUDY GRAB TEMPERATURE (F): 65.0 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.0

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	9
UNID STICKLEBACK	POST YOLK-SAC	2
YELLOW PERCH	YOLK-SAC	1

SAMPLING PERIOD: 12-13JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 12JUL06 DIEL PERIOD: NIGHT START TIME: 23:02 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 145.178
STUDY GRAB TEMPERATURE (F): 58.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.2

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	19
RAINBOW SMELT	POST YOLK-SAC	3
UNID STICKLEBACK	POST YOLK-SAC	7

SAMPLING PERIOD: 12-13JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 12JUL06 DIEL PERIOD: NIGHT START TIME: 23:02 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 159.881
STUDY GRAB TEMPERATURE (F): 58.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.2

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	39
UNID ALOSA	YOLK-SAC	1
RAINBOW SMELT	POST YOLK-SAC	9
UNID STICKLEBACK	POST YOLK-SAC	4
YELLOW PERCH	YOLK-SAC	1

SAMPLING PERIOD: 12-13JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 12JUL06 DIEL PERIOD: NIGHT START TIME: 22:44 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 155.198
STUDY GRAB TEMPERATURE (F): 57.0 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.6

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	161
RAINBOW SMELT	POST YOLK-SAC	4
UNID STICKLEBACK	POST YOLK-SAC	6
UNID STICKLEBACK	YOLK-SAC	1

SAMPLING PERIOD: 12-13JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 12JUL06 DIEL PERIOD: NIGHT START TIME: 22:44 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 164.776
STUDY GRAB TEMPERATURE (F): 57.0 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.6

TAXA	LIFE STAGE	PLUS COUNT
Gammarus		88
RAINBOW SMELT	POST YOLK-SAC	3
UNID STICKLEBACK	POST YOLK-SAC	6
YELLOW PERCH	YOLK-SAC	1

SAMPLING PERIOD: 19-20JUL06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 19JUL06 DIEL PERIOD: DAY START TIME: 15:08 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 157.751
STUDY GRAB TEMPERATURE (F): 61.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.9

TAXA	LIFE STAGE	PLUS COUNT
UNID CLUPEIDAE	YOLK-SAC	16

SAMPLING PERIOD: 19-20JUL06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 19JUL06 DIEL PERIOD: DAY START TIME: 15:08 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 157.751
STUDY GRAB TEMPERATURE (F): 61.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.9

TAXA	LIFE STAGE	PLUS COUNT
Gammarus		1
UNID ALOSA	YOLK-SAC	10

SAMPLING PERIOD: 19-20JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 19JUL06 DIEL PERIOD: DAY START TIME: 14:50 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 138.554
STUDY GRAB TEMPERATURE (F): 59.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.6

TAXA	LIFE STAGE	PLUS COUNT
UNID CLUPEIDAE	YOLK-SAC	6
RAINBOW SMELT	POST YOLK-SAC	1

SAMPLING PERIOD: 19-20JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 19JUL06 DIEL PERIOD: DAY START TIME: 14:50 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 138.554
STUDY GRAB TEMPERATURE (F): 59.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.6

TAXA	LIFE STAGE	PLUS COUNT
UNID ALOSA	YOLK-SAC	1

SAMPLING PERIOD: 19-20JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 19JUL06 DIEL PERIOD: DAY START TIME: 14:37 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 168.193
STUDY GRAB TEMPERATURE (F): 59.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.7

TAXA	LIFE STAGE	PLUS COUNT
UNID CLUPEIDAE	YOLK-SAC	17
BURBOT	YOLK-SAC	2

SAMPLING PERIOD: 19-20JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 19JUL06 DIEL PERIOD: DAY START TIME: 14:37 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 168.193
STUDY GRAB TEMPERATURE (F): 59.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.7

TAXA	LIFE STAGE	PLUS COUNT
UNID CLUPEIDAE	POST YOLK-SAC	4
UNID ALOSA	YOLK-SAC	13

SAMPLING PERIOD: 19-20JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 19JUL06 DIEL PERIOD: DAY START TIME: 14:20 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 153.089
STUDY GRAB TEMPERATURE (F): 53.2 STUDY GRAB DISSOLVED OXYGEN (mg/l): 14.5

TAXA	LIFE STAGE	PLUS COUNT
UNID CLUPEIDAE	YOLK-SAC	8
UNID CLUPEIDAE	POST YOLK-SAC	2
RAINBOW SMELT	POST YOLK-SAC	2

SAMPLING PERIOD: 19-20JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 19JUL06 DIEL PERIOD: DAY START TIME: 14:20 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 153.089
STUDY GRAB TEMPERATURE (F): 53.2 STUDY GRAB DISSOLVED OXYGEN (mg/l): 14.5

TAXA	LIFE STAGE	PLUS COUNT
UNID CLUPEIDAE	POST YOLK-SAC	3
UNID ALOSA	YOLK-SAC	4
RAINBOW SMELT	POST YOLK-SAC	1
BURBOT	YOLK-SAC	1

SAMPLING PERIOD: 19-20JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 19JUL06 DIEL PERIOD: DAY START TIME: 13:51 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 162.096
STUDY GRAB TEMPERATURE (F): 62.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.3

TAXA	LIFE STAGE	PLUS COUNT
ALEWIFE	EGG	1

SAMPLING PERIOD: 19-20JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 19JUL06 DIEL PERIOD: DAY START TIME: 13:51 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 162.096
STUDY GRAB TEMPERATURE (F): 62.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.3

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 19-20JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 19JUL06 DIEL PERIOD: DAY START TIME: 13:30 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 176.926
STUDY GRAB TEMPERATURE (F): 56.5 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.7

TAXA	LIFE STAGE	PLUS COUNT
UNID CLUPEIDAE	POST YOLK-SAC	1

SAMPLING PERIOD: 19-20JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 19JUL06 DIEL PERIOD: DAY START TIME: 13:30 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 176.926
STUDY GRAB TEMPERATURE (F): 56.5 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.7

TAXA	LIFE STAGE	PLUS COUNT
ALEWIFE	EGG	1

SAMPLING PERIOD: 19-20JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 19JUL06 DIEL PERIOD: DAY START TIME: 12:02 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 158.173
STUDY GRAB TEMPERATURE (F): 55.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.9

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	1
UNID CLUPEIDAE	POST YOLK-SAC	4
ALEWIFE	EGG	3
UNIDENTIFIED	EGG	1

SAMPLING PERIOD: 19-20JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 19JUL06 DIEL PERIOD: DAY START TIME: 12:02 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 152.456
STUDY GRAB TEMPERATURE (F): 55.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.9

TAXA	LIFE STAGE	PLUS COUNT
ALEWIFE	EGG	2

SAMPLING PERIOD: 19-20JUL06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 19JUL06 DIEL PERIOD: NIGHT START TIME: 21:37 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 132.078
STUDY GRAB TEMPERATURE (F): 53.5 STUDY GRAB DISSOLVED OXYGEN (mg/l): 14.0

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	2
UNID CLUPEIDAE	YOLK-SAC	41
UNID CLUPEIDAE	POST YOLK-SAC	2
ALEWIFE type	EGG	26
RAINBOW SMELT	POST YOLK-SAC	1
PIMEPHALES type	YOLK-SAC	1

SAMPLING PERIOD: 19-20JUL06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 19JUL06 DIEL PERIOD: NIGHT START TIME: 21:37 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 122.332
STUDY GRAB TEMPERATURE (F): 53.5 STUDY GRAB DISSOLVED OXYGEN (mg/l): 14.0

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	7
ALEWIFE	EGG	2
ALEWIFE type	EGG	2
UNID ALOSA	YOLK-SAC	22
UNIDENTIFIED	LARVAE	5

SAMPLING PERIOD: 19-20JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 19JUL06 DIEL PERIOD: NIGHT START TIME: 22:06 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 127.943
STUDY GRAB TEMPERATURE (F): 57.7 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	3
UNID CLUPEIDAE	YOLK-SAC	6
UNID ALOSA	YOLK-SAC	33
RAINBOW SMELT	POST YOLK-SAC	3
UNID STICKLEBACK	POST YOLK-SAC	1
UNIDENTIFIED	LARVAE	2

SAMPLING PERIOD: 19-20JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 19JUL06 DIEL PERIOD: NIGHT START TIME: 22:06 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 131.255
STUDY GRAB TEMPERATURE (F): 57.7 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	6
UNID ALOSA	YOLK-SAC	40
RAINBOW SMELT	POST YOLK-SAC	1
UNID CYPRINID	YOLK-SAC	1
UNIDENTIFIED	LARVAE	4

SAMPLING PERIOD: 19-20JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 19JUL06 DIEL PERIOD: NIGHT START TIME: 22:23 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 136.276
STUDY GRAB TEMPERATURE (F): 50.5 STUDY GRAB DISSOLVED OXYGEN (mg/l): 14.5

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	6
UNID CLUPEIDAE	YOLK-SAC	3
UNID ALOSA	YOLK-SAC	4
RAINBOW SMELT	POST YOLK-SAC	1

SAMPLING PERIOD: 19-20JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 19JUL06 DIEL PERIOD: NIGHT START TIME: 22:23 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 130.854
STUDY GRAB TEMPERATURE (F): 50.5 STUDY GRAB DISSOLVED OXYGEN (mg/l): 14.5

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	6
UNID ALOSA	YOLK-SAC	6
RAINBOW SMELT	POST YOLK-SAC	2

SAMPLING PERIOD: 19-20JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 19JUL06 DIEL PERIOD: NIGHT START TIME: 22:42 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 128.618
STUDY GRAB TEMPERATURE (F): 50.1 STUDY GRAB DISSOLVED OXYGEN (mg/l): 14.3

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	8

SAMPLING PERIOD: 19-20JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 19JUL06 DIEL PERIOD: NIGHT START TIME: 22:42 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 122.965
STUDY GRAB TEMPERATURE (F): 50.1 STUDY GRAB DISSOLVED OXYGEN (mg/l): 14.3

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	20
UNID CLUPEIDAE	YOLK-SAC	1
RAINBOW SMELT	POST YOLK-SAC	2

SAMPLING PERIOD: 19-20JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 19JUL06 DIEL PERIOD: NIGHT START TIME: 23:13 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 128.745
STUDY GRAB TEMPERATURE (F): 56.0 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	7
UNID CLUPEIDAE	YOLK-SAC	2
RAINBOW SMELT	POST YOLK-SAC	14
UNID STICKLEBACK	YOLK-SAC	7
UNID STICKLEBACK	POST YOLK-SAC	1

SAMPLING PERIOD: 19-20JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 19JUL06 DIEL PERIOD: NIGHT START TIME: 23:13 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 129.715
STUDY GRAB TEMPERATURE (F): 56.0 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	14
UNID CLUPEIDAE	POST YOLK-SAC	1
UNID ALOSA	YOLK-SAC	5
RAINBOW SMELT	POST YOLK-SAC	8

UNID STICKLEBACK	POST YOLK-SAC	5
SLIMY SCULPIN	POST YOLK-SAC	1

SAMPLING PERIOD: 19-20JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 19JUL06 DIEL PERIOD: NIGHT START TIME: 22:28 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 131.867
STUDY GRAB TEMPERATURE (F): 48.9 STUDY GRAB DISSOLVED OXYGEN (mg/l): 14.6

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	8
UNID CLUPEIDAE	YOLK-SAC	1
UNID CLUPEIDAE	POST YOLK-SAC	1
RAINBOW SMELT	POST YOLK-SAC	9
BURBOT	YOLK-SAC	1
UNID STICKLEBACK	YOLK-SAC	1

SAMPLING PERIOD: 19-20JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 19JUL06 DIEL PERIOD: NIGHT START TIME: 22:28 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 130.643
STUDY GRAB TEMPERATURE (F): 48.9 STUDY GRAB DISSOLVED OXYGEN (mg/l): 14.6

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	9
UNID CLUPEIDAE	POST YOLK-SAC	1
UNID ALOSA	YOLK-SAC	3
RAINBOW SMELT	POST YOLK-SAC	17
UNID STICKLEBACK	POST YOLK-SAC	2

SAMPLING PERIOD: 19-20JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 19JUL06 DIEL PERIOD: NIGHT START TIME: 23:44 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 136.044
STUDY GRAB TEMPERATURE (F): 48.5 STUDY GRAB DISSOLVED OXYGEN (mg/l): 14.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	6
UNID CLUPEIDAE	YOLK-SAC	1
UNID CLUPEIDAE	POST YOLK-SAC	2
RAINBOW SMELT	POST YOLK-SAC	23
UNID STICKLEBACK	YOLK-SAC	4
SLIMY SCULPIN	POST YOLK-SAC	1

SAMPLING PERIOD: 19-20JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 19JUL06 DIEL PERIOD: NIGHT START TIME: 23:44 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 131.572
STUDY GRAB TEMPERATURE (F): 48.5 STUDY GRAB DISSOLVED OXYGEN (mg/l): 14.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	3
UNID ALOSA	YOLK-SAC	1
RAINBOW SMELT	POST YOLK-SAC	25
BURBOT	POST YOLK-SAC	1
BURBOT	YOLK-SAC	1
UNID STICKLEBACK	POST YOLK-SAC	2
SLIMY SCULPIN	POST YOLK-SAC	3

SAMPLING PERIOD: 26-27JUL06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 26JUL06 DIEL PERIOD: DAY START TIME: 13:59 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 120.117
STUDY GRAB TEMPERATURE (F): 59.0 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	1
UNID CLUPEIDAE	YOLK-SAC	6
ALEWIFE type	EGG	19
RAINBOW SMELT	POST YOLK-SAC	1
UNIDENTIFIED	LARVAE	2

SAMPLING PERIOD: 26-27JUL06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 26JUL06 DIEL PERIOD: DAY START TIME: 13:59 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 120.349
STUDY GRAB TEMPERATURE (F): 59.0 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	4
UNID CLUPEIDAE	YOLK-SAC	1
ALEWIFE	EGG	3
ALEWIFE type	EGG	3

SAMPLING PERIOD: 26-27JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 26JUL06 DIEL PERIOD: DAY START TIME: 14:49 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 129.251
STUDY GRAB TEMPERATURE (F): 62.7 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.4

TAXA	LIFE STAGE	PLUS COUNT
ALEWIFE	YOLK-SAC	1

SAMPLING PERIOD: 26-27JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 26JUL06 DIEL PERIOD: DAY START TIME: 14:49 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 118.598
STUDY GRAB TEMPERATURE (F): 62.7 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.4

TAXA	LIFE STAGE	PLUS COUNT
UNID ALOSA	YOLK-SAC	1

SAMPLING PERIOD: 26-27JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 26JUL06 DIEL PERIOD: DAY START TIME: 15:11 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 116.299
STUDY GRAB TEMPERATURE (F): 60.4 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.7

TAXA	LIFE STAGE	PLUS COUNT
UNID CLUPEIDAE	YOLK-SAC	6
UNID CLUPEIDAE	POST YOLK-SAC	6

SAMPLING PERIOD: 26-27JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 26JUL06 DIEL PERIOD: DAY START TIME: 15:11 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 121.551
STUDY GRAB TEMPERATURE (F): 60.4 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.7

TAXA	LIFE STAGE	PLUS COUNT
UNID ALOSA	YOLK-SAC	11
UNID ALOSA	POST YOLK-SAC	6

SAMPLING PERIOD: 26-27JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 26JUL06 DIEL PERIOD: DAY START TIME: 15:41 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 132.922
STUDY GRAB TEMPERATURE (F): 56.1 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.9

TAXA	LIFE STAGE	PLUS COUNT
UNID CLUPEIDAE	YOLK-SAC	15
UNID CLUPEIDAE	POST YOLK-SAC	5

SAMPLING PERIOD: 26-27JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 26JUL06 DIEL PERIOD: DAY START TIME: 15:41 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 136.656
STUDY GRAB TEMPERATURE (F): 56.1 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.9

TAXA	LIFE STAGE	PLUS COUNT
UNID CLUPEIDAE	POST YOLK-SAC	6
UNID ALOSA	YOLK-SAC	10

SAMPLING PERIOD: 26-27JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 26JUL06 DIEL PERIOD: DAY START TIME: 16:02 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 122.395
STUDY GRAB TEMPERATURE (F): 61.9 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.2

TAXA	LIFE STAGE	PLUS COUNT
UNID CLUPEIDAE	YOLK-SAC	2
UNID CLUPEIDAE	POST YOLK-SAC	3
ALEWIFE	YOLK-SAC	1

SAMPLING PERIOD: 26-27JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 26JUL06 DIEL PERIOD: DAY START TIME: 16:02 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 133.365
STUDY GRAB TEMPERATURE (F): 61.9 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.2

TAXA	LIFE STAGE	PLUS COUNT
UNID ALOSA	YOLK-SAC	2

SAMPLING PERIOD: 26-27JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 26JUL06 DIEL PERIOD: DAY START TIME: 16:36 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 129.293
STUDY GRAB TEMPERATURE (F): 55.9 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.4

TAXA	LIFE STAGE	PLUS COUNT
UNID CLUPEIDAE	POST YOLK-SAC	6
UNID CLUPEIDAE	YOLK-SAC	17
ALEWIFE	POST YOLK-SAC	1
RAINBOW SMELT	POST YOLK-SAC	1

SAMPLING PERIOD: 26-27JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 26JUL06 DIEL PERIOD: DAY START TIME: 16:36 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 130.538
STUDY GRAB TEMPERATURE (F): 55.9 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.4

TAXA	LIFE STAGE	PLUS COUNT
UNID CLUPEIDAE	POST YOLK-SAC	3
UNID ALOSA	YOLK-SAC	16

SAMPLING PERIOD: 26-27JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 26JUL06 DIEL PERIOD: DAY START TIME: 17:02 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 134.651
STUDY GRAB TEMPERATURE (F): 54.5 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.1

TAXA	LIFE STAGE	PLUS COUNT
UNID CLUPEIDAE	YOLK-SAC	5
UNID CLUPEIDAE	POST YOLK-SAC	2
RAINBOW SMELT	POST YOLK-SAC	1
BURBOT	YOLK-SAC	1

SAMPLING PERIOD: 26-27JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 26JUL06 DIEL PERIOD: DAY START TIME: 17:02 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 132.774
STUDY GRAB TEMPERATURE (F): 54.5 STUDY GRAB DISSOLVED OXYGEN (mg/l): 13.1

TAXA	LIFE STAGE	PLUS COUNT
UNID CLUPEIDAE	POST YOLK-SAC	5
UNID ALOSA	YOLK-SAC	10
RAINBOW SMELT	POST YOLK-SAC	1
BURBOT	YOLK-SAC	2

SAMPLING PERIOD: 26-27JUL06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 27JUL06 DIEL PERIOD: NIGHT START TIME: 0:35 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 106.320
STUDY GRAB TEMPERATURE (F): 59.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.9

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	36
UNID CLUPEIDAE	YOLK-SAC	2
RAINBOW SMELT	YOLK-SAC	3
UNIDENTIFIED	LARVAE	2

SAMPLING PERIOD: 26-27JUL06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 27JUL06 DIEL PERIOD: NIGHT START TIME: 0:35 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 113.493
STUDY GRAB TEMPERATURE (F): 59.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.9

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	43
UNID CLUPEIDAE	YOLK-SAC	6
UNID ALOSA	YOLK-SAC	3
RAINBOW SMELT	POST YOLK-SAC	1
UNIDENTIFIED	LARVAE	1

SAMPLING PERIOD: 26-27JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 27JUL06 DIEL PERIOD: NIGHT START TIME: 0:13 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 106.974
STUDY GRAB TEMPERATURE (F): 60.4 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	5
UNID CLUPEIDAE	YOLK-SAC	20
RAINBOW SMELT	POST YOLK-SAC	4

SAMPLING PERIOD: 26-27JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 27JUL06 DIEL PERIOD: NIGHT START TIME: 0:13 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 111.426
STUDY GRAB TEMPERATURE (F): 60.4 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	11
UNID CLUPEIDAE	LARVAE	2
UNID ALOSA	YOLK-SAC	29
RAINBOW SMELT	POST YOLK-SAC	6
UNID STICKLEBACK	POST YOLK-SAC	1

SAMPLING PERIOD: 26-27JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 26JUL06 DIEL PERIOD: NIGHT START TIME: 23:50 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 117.417
STUDY GRAB TEMPERATURE (F): 57.2 STUDY GRAB DISSOLVED OXYGEN (mg/l): 14.0

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	17
UNID CLUPEIDAE	YOLK-SAC	1
UNID CLUPEIDAE	YOLK-SAC	19
RAINBOW SMELT	POST YOLK-SAC	10

UNID STICKLEBACK	POST YOLK-SAC	1
SLIMY SCULPIN	POST YOLK-SAC	1

SAMPLING PERIOD: 26-27JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 26JUL06 DIEL PERIOD: NIGHT START TIME: 23:50 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 115.075
STUDY GRAB TEMPERATURE (F): 57.2 STUDY GRAB DISSOLVED OXYGEN (mg/l): 14.0

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	7
UNID ALOSA	YOLK-SAC	16
RAINBOW SMELT	POST YOLK-SAC	7

SAMPLING PERIOD: 26-27JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 26JUL06 DIEL PERIOD: NIGHT START TIME: 23:31 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 116.974
STUDY GRAB TEMPERATURE (F): 55.9 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.5

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	9
UNID CLUPEIDAE	YOLK-SAC	10
UNID CLUPEIDAE	LARVAE	1
UNID ALOSA	YOLK-SAC	7
RAINBOW SMELT	POST YOLK-SAC	5
UNIDENTIFIED	LARVAE	3

SAMPLING PERIOD: 26-27JUL06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 26JUL06 DIEL PERIOD: NIGHT START TIME: 23:31 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 115.856
STUDY GRAB TEMPERATURE (F): 55.9 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.5

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	6
UNID CLUPEIDAE	YOLK-SAC	8
UNID CLUPEIDAE	LARVAE	5
UNID ALOSA	YOLK-SAC	17
RAINBOW SMELT	POST YOLK-SAC	6
BURBOT	YOLK-SAC	1
UNID STICKLEBACK	POST YOLK-SAC	1

SAMPLING PERIOD: 26-27JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 26JUL06 DIEL PERIOD: NIGHT START TIME: 22:20 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 119.146
STUDY GRAB TEMPERATURE (F): 62.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.0

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	6
UNID CLUPEIDAE	POST YOLK-SAC	7
UNID CLUPEIDAE	YOLK-SAC	15
RAINBOW SMELT	POST YOLK-SAC	8
UNID STICKLEBACK	POST YOLK-SAC	2

SAMPLING PERIOD: 26-27JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 26JUL06 DIEL PERIOD: NIGHT START TIME: 22:20 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 119.062
STUDY GRAB TEMPERATURE (F): 62.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 11.0

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	2
UNID CLUPEIDAE	YOLK-SAC	7
UNID CLUPEIDAE	POST YOLK-SAC	1
UNID ALOSA	YOLK-SAC	24
RAINBOW SMELT	POST YOLK-SAC	4
UNID STICKLEBACK	POST YOLK-SAC	3

SAMPLING PERIOD: 26-27JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 26JUL06 DIEL PERIOD: NIGHT START TIME: 22:38 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 117.606
STUDY GRAB TEMPERATURE (F): 55.4 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.5

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	27
UNID CLUPEIDAE	POST YOLK-SAC	1
RAINBOW SMELT	POST YOLK-SAC	15
BURBOT	YOLK-SAC	2
UNID STICKLEBACK	POST YOLK-SAC	3
SLIMY SCULPIN	POST YOLK-SAC	1

SAMPLING PERIOD: 26-27JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 26JUL06 DIEL PERIOD: NIGHT START TIME: 22:38 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 126.382
STUDY GRAB TEMPERATURE (F): 55.4 STUDY GRAB DISSOLVED OXYGEN (mg/l): 12.5

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	43
UNID ALOSA	YOLK-SAC	2
RAINBOW SMELT	LARVAE	1
RAINBOW SMELT	POST YOLK-SAC	15
UNID STICKLEBACK	POST YOLK-SAC	2
SLIMY SCULPIN	POST YOLK-SAC	1

SAMPLING PERIOD: 26-27JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 26JUL06 DIEL PERIOD: NIGHT START TIME: 23:11 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 130.179
STUDY GRAB TEMPERATURE (F): 54.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 14.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	24
UNID CLUPEIDAE	YOLK-SAC	4
ALEWIFE	YOLK-SAC	2
RAINBOW SMELT	POST YOLK-SAC	18
BURBOT	POST YOLK-SAC	3
UNID STICKLEBACK	POST YOLK-SAC	4

SAMPLING PERIOD: 26-27JUL06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 26JUL06 DIEL PERIOD: NIGHT START TIME: 23:11 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 125.686
STUDY GRAB TEMPERATURE (F): 54.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 14.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	17
UNID CLUPEIDAE	POST YOLK-SAC	2
UNID ALOSA	YOLK-SAC	2
RAINBOW SMELT	POST YOLK-SAC	17
BURBOT	YOLK-SAC	2
UNID STICKLEBACK	POST YOLK-SAC	4

SAMPLING PERIOD: 09-10AUG06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 09AUG06 DIEL PERIOD: DAY START TIME: 13:32 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 159.586
STUDY GRAB TEMPERATURE (F): 69.4 STUDY GRAB DISSOLVED OXYGEN (mg/l): 10.4

TAXA	LIFE STAGE	PLUS COUNT
UNID CLUPEIDAE	YOLK-SAC	1

SAMPLING PERIOD: 09-10AUG06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 09AUG06 DIEL PERIOD: DAY START TIME: 13:32 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 150.621
STUDY GRAB TEMPERATURE (F): 69.4 STUDY GRAB DISSOLVED OXYGEN (mg/l): 10.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	1

SAMPLING PERIOD: 09-10AUG06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 09AUG06 DIEL PERIOD: DAY START TIME: 13:55 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 128.260
STUDY GRAB TEMPERATURE (F): 72.2 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.8

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 09-10AUG06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 09AUG06 DIEL PERIOD: DAY START TIME: 13:55 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 127.500
STUDY GRAB TEMPERATURE (F): 72.2 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.8

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	1
UNID CLUPEIDAE	POST YOLK-SAC	2

SAMPLING PERIOD: 09-10AUG06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 09AUG06 DIEL PERIOD: DAY START TIME: 14:10 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 126.699
STUDY GRAB TEMPERATURE (F): 68.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.5

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 09-10AUG06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 09AUG06 DIEL PERIOD: DAY START TIME: 14:10 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 121.678
STUDY GRAB TEMPERATURE (F): 68.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.5

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 09-10AUG06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 09AUG06 DIEL PERIOD: DAY START TIME: 14:26 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 128.449
STUDY GRAB TEMPERATURE (F): 68.5 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.6

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 09-10AUG06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 09AUG06 DIEL PERIOD: DAY START TIME: 14:26 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 126.445
STUDY GRAB TEMPERATURE (F): 68.5 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.6

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 09-10AUG06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 09AUG06 DIEL PERIOD: DAY START TIME: 14:51 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 135.875
STUDY GRAB TEMPERATURE (F): 70.5 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.1

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 09-10AUG06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 09AUG06 DIEL PERIOD: DAY START TIME: 14:51 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 131.361
STUDY GRAB TEMPERATURE (F): 70.5 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.1

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 09-10AUG06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 09AUG06 DIEL PERIOD: DAY START TIME: 15:05 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 119.737
STUDY GRAB TEMPERATURE (F): 69.4 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.2

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 09-10AUG06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 09AUG06 DIEL PERIOD: DAY START TIME: 15:05 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 121.699
STUDY GRAB TEMPERATURE (F): 69.4 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.2

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 09-10AUG06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 09AUG06 DIEL PERIOD: DAY START TIME: 15:22 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 140.010
STUDY GRAB TEMPERATURE (F): 67.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.7

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 09-10AUG06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 09AUG06 DIEL PERIOD: DAY START TIME: 15:22 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 148.047
STUDY GRAB TEMPERATURE (F): 67.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.7

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 09-10AUG06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 10AUG06 DIEL PERIOD: NIGHT START TIME: 0:28 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 120.855
STUDY GRAB TEMPERATURE (F): 70.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.6

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	193
COMMON CARP	YOLK-SAC	13

SAMPLING PERIOD: 09-10AUG06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 10AUG06 DIEL PERIOD: NIGHT START TIME: 0:28 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 112.037
STUDY GRAB TEMPERATURE (F): 70.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.6

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	345
UNID ALOSA	YOLK-SAC	1
COMMON CARP	YOLK-SAC	23

SAMPLING PERIOD: 09-10AUG06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 10AUG06 DIEL PERIOD: NIGHT START TIME: 0:08 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 123.471
STUDY GRAB TEMPERATURE (F): 70.7 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.2

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	4

SAMPLING PERIOD: 09-10AUG06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 10AUG06 DIEL PERIOD: NIGHT START TIME: 0:08 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 114.484
STUDY GRAB TEMPERATURE (F): 70.7 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.2

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	23

SAMPLING PERIOD: 09-10AUG06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 09AUG06 DIEL PERIOD: NIGHT START TIME: 23:52 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 127.901
STUDY GRAB TEMPERATURE (F): 69.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.3

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	39
COMMON CARP	YOLK-SAC	2

SAMPLING PERIOD: 09-10AUG06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 09AUG06 DIEL PERIOD: NIGHT START TIME: 23:52 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 131.572
STUDY GRAB TEMPERATURE (F): 69.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.3

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	95
UNID CLUPEIDAE	YOLK-SAC	1

SAMPLING PERIOD: 09-10AUG06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 09AUG06 DIEL PERIOD: NIGHT START TIME: 23:37 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 119.695
STUDY GRAB TEMPERATURE (F): 68.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.9

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	12

SAMPLING PERIOD: 09-10AUG06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 09AUG06 DIEL PERIOD: NIGHT START TIME: 23:37 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 123.808
STUDY GRAB TEMPERATURE (F): 68.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.9

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	19

SAMPLING PERIOD: 09-10AUG06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 09AUG06 DIEL PERIOD: NIGHT START TIME: 23:19 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 139.524
STUDY GRAB TEMPERATURE (F): 71.2 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	3
COMMON CARP	YOLK-SAC	2

SAMPLING PERIOD: 09-10AUG06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 09AUG06 DIEL PERIOD: NIGHT START TIME: 23:19 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 115.687
STUDY GRAB TEMPERATURE (F): 71.2 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	4

SAMPLING PERIOD: 09-10AUG06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 09AUG06 DIEL PERIOD: NIGHT START TIME: 23:09 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 131.888
STUDY GRAB TEMPERATURE (F): 70.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.1

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	3

SAMPLING PERIOD: 09-10AUG06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 09AUG06 DIEL PERIOD: NIGHT START TIME: 23:09 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 124.779
STUDY GRAB TEMPERATURE (F): 70.3 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.1

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	9
UNID STICKLEBACK	POST YOLK-SAC	1

SAMPLING PERIOD: 09-10AUG06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 09AUG06 DIEL PERIOD: NIGHT START TIME: 22:50 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 146.507
STUDY GRAB TEMPERATURE (F): 68.2 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.5

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	59
ALEWIFE	POST YOLK-SAC	1

SAMPLING PERIOD: 09-10AUG06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 09AUG06 DIEL PERIOD: NIGHT START TIME: 22:50 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 137.436
STUDY GRAB TEMPERATURE (F): 68.2 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.5

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	46
UNID STICKLEBACK	POST YOLK-SAC	2

SAMPLING PERIOD: 23-24AUG06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 23AUG06 DIEL PERIOD: DAY START TIME: 12:46 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 133.660
STUDY GRAB TEMPERATURE (F): 69.5 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.3

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 23-24AUG06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 23AUG06 DIEL PERIOD: DAY START TIME: 12:46 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 132.373
STUDY GRAB TEMPERATURE (F): 69.5 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.3

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 23-24AUG06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 23AUG06 DIEL PERIOD: DAY START TIME: 13:21 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 137.710
STUDY GRAB TEMPERATURE (F): 69.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.2

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	2

SAMPLING PERIOD: 23-24AUG06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 23AUG06 DIEL PERIOD: DAY START TIME: 13:21 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 144.081
STUDY GRAB TEMPERATURE (F): 69.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.2

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	1

SAMPLING PERIOD: 23-24AUG06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 23AUG06 DIEL PERIOD: DAY START TIME: 13:42 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 142.710
STUDY GRAB TEMPERATURE (F): 69.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.3

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 23-24AUG06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 23AUG06 DIEL PERIOD: DAY START TIME: 13:42 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 140.115
STUDY GRAB TEMPERATURE (F): 69.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.3

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 23-24AUG06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 23AUG06 DIEL PERIOD: DAY START TIME: 14:10 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 134.799
STUDY GRAB TEMPERATURE (F): 69.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.3

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 23-24AUG06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 23AUG06 DIEL PERIOD: DAY START TIME: 14:10 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 140.495
STUDY GRAB TEMPERATURE (F): 69.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.3

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 23-24AUG06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 23AUG06 DIEL PERIOD: DAY START TIME: 14:43 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 135.031
STUDY GRAB TEMPERATURE (F): 70.0 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.4

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 23-24AUG06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 23AUG06 DIEL PERIOD: DAY START TIME: 14:43 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 138.385
STUDY GRAB TEMPERATURE (F): 70.0 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.4

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 23-24AUG06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 23AUG06 DIEL PERIOD: DAY START TIME: 15:21 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 143.258
STUDY GRAB TEMPERATURE (F): 70.0 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.3

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 23-24AUG06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 23AUG06 DIEL PERIOD: DAY START TIME: 15:21 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 144.651
STUDY GRAB TEMPERATURE (F): 70.0 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.3

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 23-24AUG06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 23AUG06 DIEL PERIOD: DAY START TIME: 15:38 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 139.672
STUDY GRAB TEMPERATURE (F): 69.9 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.3

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 23-24AUG06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 23AUG06 DIEL PERIOD: DAY START TIME: 15:38 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 140.896
STUDY GRAB TEMPERATURE (F): 69.9 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.3

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 23-24AUG06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 24AUG06 DIEL PERIOD: NIGHT START TIME: 2:11 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 127.163
STUDY GRAB TEMPERATURE (F): 71.2 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.3

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	110
UNID CLUPEIDAE	POST YOLK-SAC	2
UNID ALOSA	JUVENILE	7
RAINBOW SMELT	POST YOLK-SAC	1

SAMPLING PERIOD: 23-24AUG06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 24AUG06 DIEL PERIOD: NIGHT START TIME: 2:11 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 132.247
STUDY GRAB TEMPERATURE (F): 71.2 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.3

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	110
ALEWIFE	JUVENILE	1
UNID ALOSA	POST YOLK-SAC	10

SAMPLING PERIOD: 23-24AUG06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 24AUG06 DIEL PERIOD: NIGHT START TIME: 2:30 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 124.694
STUDY GRAB TEMPERATURE (F): 70.0 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.7

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	5
UNID CLUPEIDAE	POST YOLK-SAC	1
UNID ALOSA	JUVENILE	1

SAMPLING PERIOD: 23-24AUG06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 24AUG06 DIEL PERIOD: NIGHT START TIME: 2:30 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 125.981
STUDY GRAB TEMPERATURE (F): 70.0 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.7

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	1
UNID ALOSA	POST YOLK-SAC	1

SAMPLING PERIOD: 23-24AUG06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 24AUG06 DIEL PERIOD: NIGHT START TIME: 2:48 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 106.109
STUDY GRAB TEMPERATURE (F): 69.9 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.5

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	4
UNID ALOSA	POST YOLK-SAC	1

SAMPLING PERIOD: 23-24AUG06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 24AUG06 DIEL PERIOD: NIGHT START TIME: 2:48 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 112.818
STUDY GRAB TEMPERATURE (F): 69.9 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.5

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	3
UNID ALOSA	POST YOLK-SAC	2
RAINBOW SMELT	POST YOLK-SAC	1

SAMPLING PERIOD: 23-24AUG06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 24AUG06 DIEL PERIOD: NIGHT START TIME: 3:07 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 110.750
STUDY GRAB TEMPERATURE (F): 69.5 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.3

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	22
ALEWIFE	POST YOLK-SAC	3
RAINBOW SMELT	POST YOLK-SAC	1

SAMPLING PERIOD: 23-24AUG06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 24AUG06 DIEL PERIOD: NIGHT START TIME: 3:07 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 122.880
STUDY GRAB TEMPERATURE (F): 69.5 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.3

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	10
RAINBOW SMELT	POST YOLK-SAC	1

SAMPLING PERIOD: 23-24AUG06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 24AUG06 DIEL PERIOD: NIGHT START TIME: 4:11 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 126.931
STUDY GRAB TEMPERATURE (F): 69.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.7

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	4

SAMPLING PERIOD: 23-24AUG06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 24AUG06 DIEL PERIOD: NIGHT START TIME: 4:11 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 123.365
STUDY GRAB TEMPERATURE (F): 69.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.7

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	2

SAMPLING PERIOD: 23-24AUG06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 24AUG06 DIEL PERIOD: NIGHT START TIME: 3:30 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 126.783
STUDY GRAB TEMPERATURE (F): 69.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.6

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	14

SAMPLING PERIOD: 23-24AUG06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 24AUG06 DIEL PERIOD: NIGHT START TIME: 3:30 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 135.263
STUDY GRAB TEMPERATURE (F): 69.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.6

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	11

SAMPLING PERIOD: 23-24AUG06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 24AUG06 DIEL PERIOD: NIGHT START TIME: 3:51 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 129.884
STUDY GRAB TEMPERATURE (F): 69.9 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.7

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	14
RAINBOW SMELT	POST YOLK-SAC	1

SAMPLING PERIOD: 23-24AUG06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 24AUG06 DIEL PERIOD: NIGHT START TIME: 3:51 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 131.213
STUDY GRAB TEMPERATURE (F): 69.9 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.7

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	9
RAINBOW SMELT	POST YOLK-SAC	1

SAMPLING PERIOD: 06-07SEP06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 06SEP06 DIEL PERIOD: DAY START TIME: 13:58 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 119.589
STUDY GRAB TEMPERATURE (F): 70.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.5

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	1
UNID CLUPEIDAE	POST YOLK-SAC	1

SAMPLING PERIOD: 06-07SEP06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 06SEP06 DIEL PERIOD: DAY START TIME: 13:58 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 107.206
STUDY GRAB TEMPERATURE (F): 70.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.5

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 06-07SEP06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 06SEP06 DIEL PERIOD: DAY START TIME: 14:26 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 142.541
STUDY GRAB TEMPERATURE (F): 70.4 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.0

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 06-07SEP06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 06SEP06 DIEL PERIOD: DAY START TIME: 14:26 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 117.185
STUDY GRAB TEMPERATURE (F): 70.4 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.0

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 06-07SEP06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 06SEP06 DIEL PERIOD: DAY START TIME: 14:37 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 115.856
STUDY GRAB TEMPERATURE (F): 70.5 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.9

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 06-07SEP06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 06SEP06 DIEL PERIOD: DAY START TIME: 14:37 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 99.823
STUDY GRAB TEMPERATURE (F): 70.5 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.9

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 06-07SEP06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 06SEP06 DIEL PERIOD: DAY START TIME: 14:53 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 108.768
STUDY GRAB TEMPERATURE (F): 70.4 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.9

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	1

SAMPLING PERIOD: 06-07SEP06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 06SEP06 DIEL PERIOD: DAY START TIME: 14:53 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 106.806
STUDY GRAB TEMPERATURE (F): 70.4 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.9

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 06-07SEP06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 06SEP06 DIEL PERIOD: DAY START TIME: 15:12 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 110.118
STUDY GRAB TEMPERATURE (F): 70.7 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.8

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 06-07SEP06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 06SEP06 DIEL PERIOD: DAY START TIME: 15:12 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 111.784
STUDY GRAB TEMPERATURE (F): 70.7 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.8

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 06-07SEP06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 06SEP06 DIEL PERIOD: DAY START TIME: 15:30 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 152.435
STUDY GRAB TEMPERATURE (F): 70.7 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.7

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 06-07SEP06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 06SEP06 DIEL PERIOD: DAY START TIME: 15:30 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 124.948
STUDY GRAB TEMPERATURE (F): 70.7 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.7

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 06-07SEP06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 06SEP06 DIEL PERIOD: DAY START TIME: 16:10 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 148.363
STUDY GRAB TEMPERATURE (F): 70.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.3

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 06-07SEP06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 06SEP06 DIEL PERIOD: DAY START TIME: 16:10 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 143.575
STUDY GRAB TEMPERATURE (F): 70.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.3

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 06-07SEP06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 06SEP06 DIEL PERIOD: NIGHT START TIME: 22:19 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 130.496
STUDY GRAB TEMPERATURE (F): 71.4 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	54

SAMPLING PERIOD: 06-07SEP06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 06SEP06 DIEL PERIOD: NIGHT START TIME: 22:19 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 123.197
STUDY GRAB TEMPERATURE (F): 71.4 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.4

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	50

SAMPLING PERIOD: 06-07SEP06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 06SEP06 DIEL PERIOD: NIGHT START TIME: 22:37 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 132.458
STUDY GRAB TEMPERATURE (F): 70.4 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.5

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	41

SAMPLING PERIOD: 06-07SEP06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 06SEP06 DIEL PERIOD: NIGHT START TIME: 22:37 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 129.821
STUDY GRAB TEMPERATURE (F): 70.4 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.5

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	31

SAMPLING PERIOD: 06-07SEP06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 06SEP06 DIEL PERIOD: NIGHT START TIME: 22:50 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 143.132
STUDY GRAB TEMPERATURE (F): 70.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.7

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	45

SAMPLING PERIOD: 06-07SEP06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 06SEP06 DIEL PERIOD: NIGHT START TIME: 22:50 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 137.626
STUDY GRAB TEMPERATURE (F): 70.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.7

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 06-07SEP06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 06SEP06 DIEL PERIOD: NIGHT START TIME: 23:01 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 120.581
STUDY GRAB TEMPERATURE (F): 70.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.8

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 06-07SEP06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 06SEP06 DIEL PERIOD: NIGHT START TIME: 23:01 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 124.863
STUDY GRAB TEMPERATURE (F): 70.6 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.8

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	33

SAMPLING PERIOD: 06-07SEP06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 06SEP06 DIEL PERIOD: NIGHT START TIME: 23:20 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 134.398
STUDY GRAB TEMPERATURE (F): 70.7 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.6

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	4
RAINBOW SMELT	JUVENILE	1

SAMPLING PERIOD: 06-07SEP06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 06SEP06 DIEL PERIOD: NIGHT START TIME: 23:20 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 127.964
STUDY GRAB TEMPERATURE (F): 70.7 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.6

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	6

SAMPLING PERIOD: 06-07SEP06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 06SEP06 DIEL PERIOD: NIGHT START TIME: 23:38 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 136.234
STUDY GRAB TEMPERATURE (F): 70.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.9

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	5

SAMPLING PERIOD: 06-07SEP06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 06SEP06 DIEL PERIOD: NIGHT START TIME: 23:38 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 139.419
STUDY GRAB TEMPERATURE (F): 70.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.9

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	2

SAMPLING PERIOD: 06-07SEP06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 06SEP06 DIEL PERIOD: NIGHT START TIME: 23:52 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 137.752
STUDY GRAB TEMPERATURE (F): 70.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.5

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	3

SAMPLING PERIOD: 06-07SEP06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 06SEP06 DIEL PERIOD: NIGHT START TIME: 23:52 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 135.031
STUDY GRAB TEMPERATURE (F): 70.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.5

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	2

SAMPLING PERIOD: 18-19SEP06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 18SEP06 DIEL PERIOD: DAY START TIME: 12:45 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 128.365
STUDY GRAB TEMPERATURE (F): 60.0 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.5

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 18-19SEP06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 18SEP06 DIEL PERIOD: DAY START TIME: 12:45 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 126.931
STUDY GRAB TEMPERATURE (F): 60.0 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.5

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 18-19SEP06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 18SEP06 DIEL PERIOD: DAY START TIME: 13:12 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 140.685
STUDY GRAB TEMPERATURE (F): 58.2 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.6

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 18-19SEP06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 18SEP06 DIEL PERIOD: DAY START TIME: 13:12 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 147.077
STUDY GRAB TEMPERATURE (F): 58.2 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.6

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 18-19SEP06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 18SEP06 DIEL PERIOD: DAY START TIME: 13:32 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 156.738
STUDY GRAB TEMPERATURE (F): 55.9 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.7

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 18-19SEP06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 18SEP06 DIEL PERIOD: DAY START TIME: 13:32 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 146.845
STUDY GRAB TEMPERATURE (F): 55.9 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.7

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 18-19SEP06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 18SEP06 DIEL PERIOD: DAY START TIME: 13:50 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 147.013
STUDY GRAB TEMPERATURE (F): 49.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.3

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 18-19SEP06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 18SEP06 DIEL PERIOD: DAY START TIME: 13:50 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 150.093
STUDY GRAB TEMPERATURE (F): 49.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.3

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	7

SAMPLING PERIOD: 18-19SEP06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 18SEP06 DIEL PERIOD: DAY START TIME: 14:10 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 120.560
STUDY GRAB TEMPERATURE (F): 52.5 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.5

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 18-19SEP06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 18SEP06 DIEL PERIOD: DAY START TIME: 14:10 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 108.852
STUDY GRAB TEMPERATURE (F): 52.5 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.5

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 18-19SEP06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 18SEP06 DIEL PERIOD: DAY START TIME: 14:34 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 141.381
STUDY GRAB TEMPERATURE (F): 49.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.6

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 18-19SEP06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 18SEP06 DIEL PERIOD: DAY START TIME: 14:34 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 153.679
STUDY GRAB TEMPERATURE (F): 49.8 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.6

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 18-19SEP06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: A
DATE: 18SEP06 DIEL PERIOD: DAY START TIME: 14:54 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 131.382
STUDY GRAB TEMPERATURE (F): 45.5 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.0

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 18-19SEP06 GEAR: NET DEPTH CONTOUR: 30FT SAMPLING DEPTH: BOT REPLICATE: B
DATE: 18SEP06 DIEL PERIOD: DAY START TIME: 14:54 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 136.677
STUDY GRAB TEMPERATURE (F): 45.5 STUDY GRAB DISSOLVED OXYGEN (mg/l): 9.0

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 18-19SEP06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: A
DATE: 18SEP06 DIEL PERIOD: NIGHT START TIME: 22:09 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 121.193
STUDY GRAB TEMPERATURE (F): 50.9 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.6

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	51
RAINBOW SMELT	JUVENILE	4

SAMPLING PERIOD: 18-19SEP06 GEAR: NET DEPTH CONTOUR: 6-8FT SAMPLING DEPTH: MID REPLICATE: B
DATE: 18SEP06 DIEL PERIOD: NIGHT START TIME: 22:09 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 126.509
STUDY GRAB TEMPERATURE (F): 50.9 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.6

TAXA	LIFE STAGE	PLUS COUNT
Gammarus	.	33
RAINBOW SMELT	POST YOLK-SAC	1

SAMPLING PERIOD: 18-19SEP06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: A
DATE: 18SEP06 DIEL PERIOD: NIGHT START TIME: 21:55 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 121.361
STUDY GRAB TEMPERATURE (F): 50.2 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.5

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

SAMPLING PERIOD: 18-19SEP06 GEAR: NET DEPTH CONTOUR: 18FT SAMPLING DEPTH: SUR REPLICATE: B
DATE: 18SEP06 DIEL PERIOD: NIGHT START TIME: 21:55 TOW DURATION (min.): 3.00 VOLUME SAMPLED (m^3): 119.083
STUDY GRAB TEMPERATURE (F): 50.2 STUDY GRAB DISSOLVED OXYGEN (mg/l): 8.5

TAXA	LIFE STAGE	PLUS COUNT
NO ICHTHYOPLANKTON OR SHELLFISH	.	0

APPENDIX B - RAW IMPINGEMENT DATA LISTING - DECEMBER 2005-NOVEMBER 2006

SAMPLING PERIOD: 07-08DEC05 START DATE AND TIME: 07DEC05:10:00 END DATE AND TIME: 08DEC05:10:00
SAMPLING DURATION (hrs.): 24.00 CW VOLUME SAMPLED (gals x 10^6): 564.4800
INTAKE TEMPERATURES (F): MINIMUM= 34.4 MEAN= 36.4 MAXIMUM= 43.8
DISCHARGE TEMPERATURES (F): MINIMUM= 66.3 MEAN= 69.8 MAXIMUM= 77.8 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 04-10DEC05 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 3951.5

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GREAT LAKES CRAYFISH	.	.	1	.	Fresh Dead	
GIZZARD SHAD	95	6	.	.	Fresh Dead	
RAINBOW SMELT	106	4	.	.	Fresh Dead	
RAINBOW SMELT	49	1	.	.	Fresh Dead	
WHITE SUCKER	497	1000	.	.	Live	
BLACK BULLHEAD	220	190	.	.	Live	
CHANNEL CATFISH	531	1450	.	.	Live	
BURBOT	171	40	.	.	Fresh Dead	
BURBOT	164	30	.	.	Fresh Dead	
SMALLMOUTH BASS	163	69	.	.	Live	
SMALLMOUTH BASS	120	16	.	.	Fresh Dead	
YELLOW PERCH	85	5	.	.	Fresh Dead	
YELLOW PERCH	67	4	.	.	Live	
YELLOW PERCH	66	3	.	.	Fresh Dead	
SLIMY SCULPIN	66	5	.	.	Live	
SLIMY SCULPIN	80	6	.	.	Live	
SLIMY SCULPIN	74	6	.	.	Live	
SLIMY SCULPIN	74	5	.	.	Live	
SLIMY SCULPIN	55	2	.	.	Live	
SLIMY SCULPIN	93	9	.	.	Live	
SLIMY SCULPIN	66	4	.	.	Fresh Dead	

SAMPLING PERIOD: 14-15DEC05 START DATE AND TIME: 14DEC05:10:00 END DATE AND TIME: 15DEC05:10:00
SAMPLING DURATION (hrs.): 24.00 CW VOLUME SAMPLED (gals x 10^6): 310.0720
INTAKE TEMPERATURES (F): MINIMUM= 33.8 MEAN= 35.5 MAXIMUM= 38.7
DISCHARGE TEMPERATURES (F): MINIMUM= 34.9 MEAN= 53.5 MAXIMUM= 72.7 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 11-17DEC05 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 3739.4

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GIZZARD SHAD	175	48	.	.	Fresh Dead	
GIZZARD SHAD	157	33	.	.	Fresh Dead	
GIZZARD SHAD	175	48	.	.	Fresh Dead	
GIZZARD SHAD	182	45	.	.	Fresh Dead	
GIZZARD SHAD	174	40	.	.	Fresh Dead	
GIZZARD SHAD	132	28	.	.	Fresh Dead	
GIZZARD SHAD	100	7	.	.	Fresh Dead	
GIZZARD SHAD	175	39	.	.	Fresh Dead	
GIZZARD SHAD	119	29	.	.	Fresh Dead	
GIZZARD SHAD	204	79	.	.	Live	
GIZZARD SHAD	174	47	.	.	Fresh Dead	
LAKE WHITEFISH	106	8	.	.	Fresh Dead	
ROUND WHITEFISH	430	590	.	.	Fresh Dead	
ROUND WHITEFISH	455	750	.	.	Live	
ROUND WHITEFISH	393	544	.	.	Fresh Dead	
BROWN TROUT	253	189	.	.	Fresh Dead	
BROWN TROUT	254	203	.	.	Fresh Dead	
BROWN TROUT	222	112	.	.	Fresh Dead	
BROWN TROUT	240	159	.	.	Fresh Dead	
BROWN TROUT	213	105	.	.	Fresh Dead	
RAINBOW SMELT	55	1	.	.	Fresh Dead	
RAINBOW SMELT	78	2	.	.	Fresh Dead	
RAINBOW SMELT	43	1	.	.	Fresh Dead	
COMMON CARP	62	4	.	.	Fresh Dead	
COMMON CARP	90	13	.	.	Fresh Dead	
COMMON CARP	87	12	.	.	Fresh Dead	
SPOTTAIL SHINER	91	8	.	.	Fresh Dead	
SPOTTAIL SHINER	55	1	.	.	Fresh Dead	
SPOTTAIL SHINER	110	11	.	.	Fresh Dead	
SPOTTAIL SHINER	100	10	.	.	Fresh Dead	
SPOTTAIL SHINER	94	7	.	.	Live	
SPOTTAIL SHINER	50	1	.	.	Fresh Dead	
SPOTTAIL SHINER	85	5	.	.	Fresh Dead	
SPOTTAIL SHINER	121	10	.	.	Fresh Dead	
LONGNOSE DACE	55	2	.	.	Fresh Dead	
LONGNOSE SUCKER	451	1000	.	.	Live	
BLACK BULLHEAD	195	105	.	.	Live	
CHANNEL CATFISH	69	3	.	.	Fresh Dead	
CHANNEL CATFISH	154	29	.	.	Live	
CHANNEL CATFISH	104	10	.	.	Fresh Dead	
CHANNEL CATFISH	92	6	.	.	Fresh Dead	
CHANNEL CATFISH	85	4	.	.	Fresh Dead	
CHANNEL CATFISH	459	1150	.	.	Live	
CHANNEL CATFISH	95	8	.	.	Live	
BURBOT	100	9	.	.	Live	
BURBOT	107	12	.	.	Live	

BURBOT	100	8	.	.	Fresh Dead
BURBOT	103	8	.	.	Fresh Dead
BURBOT	67	3	.	.	Live
BURBOT	118	15	.	.	Fresh Dead
BURBOT	66	2	.	.	Fresh Dead
BROOK STICKLEBACK	45	1	.	.	Fresh Dead
PUMPKINSEED	71	8	.	.	Fresh Dead
SMALLMOUTH BASS	356	240	.	.	Fresh Dead
YELLOW PERCH	79	4	.	.	Fresh Dead
YELLOW PERCH	72	3	.	.	Fresh Dead
YELLOW PERCH	60	1	.	.	Fresh Dead
YELLOW PERCH	84	5	.	.	Fresh Dead
YELLOW PERCH	55	2	.	.	Fresh Dead
YELLOW PERCH	70	2	.	.	Fresh Dead
YELLOW PERCH	57	1	.	.	Fresh Dead
YELLOW PERCH	66	2	.	.	Fresh Dead
YELLOW PERCH	76	3	.	.	Fresh Dead
YELLOW PERCH	85	5	.	.	Fresh Dead
YELLOW PERCH	68	3	.	.	Fresh Dead
YELLOW PERCH	64	2	.	.	Fresh Dead
YELLOW PERCH	80	5	.	.	Fresh Dead
YELLOW PERCH	65	2	.	.	Fresh Dead
YELLOW PERCH	64	2	.	.	Fresh Dead
YELLOW PERCH	73	3	.	.	Fresh Dead
YELLOW PERCH	68	2	.	.	Fresh Dead
YELLOW PERCH	60	2	.	.	Fresh Dead
YELLOW PERCH	61	1	.	.	Fresh Dead
YELLOW PERCH	81	8	.	.	Live
YELLOW PERCH	64	1	.	.	Fresh Dead
YELLOW PERCH	70	3	.	.	Fresh Dead
YELLOW PERCH	57	2	.	.	Fresh Dead
YELLOW PERCH	65	3	.	.	Live
YELLOW PERCH	48	1	.	.	Fresh Dead
YELLOW PERCH	68	2	.	.	Fresh Dead
YELLOW PERCH	70	3	.	.	Fresh Dead
YELLOW PERCH	55	1	.	.	Fresh Dead
YELLOW PERCH	55	1	.	.	Fresh Dead
YELLOW PERCH	80	4	.	.	Fresh Dead
YELLOW PERCH	72	4	.	.	Fresh Dead
YELLOW PERCH	76	4	.	.	Fresh Dead
YELLOW PERCH	79	4	.	.	Fresh Dead
YELLOW PERCH	68	3	.	.	Fresh Dead
YELLOW PERCH	72	3	.	.	Live
YELLOW PERCH	66	2	.	.	Fresh Dead
YELLOW PERCH	52	1	.	.	Fresh Dead
YELLOW PERCH	66	2	.	.	Fresh Dead
YELLOW PERCH	64	2	.	.	Fresh Dead
YELLOW PERCH	72	2	.	.	Fresh Dead
YELLOW PERCH	76	4	.	.	Live
YELLOW PERCH	65	2	.	.	Fresh Dead
YELLOW PERCH	67	2	.	.	Fresh Dead
YELLOW PERCH	85	4	.	.	Fresh Dead
YELLOW PERCH	81	4	.	.	Live
YELLOW PERCH	78	5	.	.	Fresh Dead
YELLOW PERCH	84	4	.	.	Fresh Dead
YELLOW PERCH	75	4	.	.	Fresh Dead
YELLOW PERCH	76	3	.	.	Fresh Dead
YELLOW PERCH	79	4	.	.	Fresh Dead
YELLOW PERCH	.	.	10	31	Fresh Dead
YELLOW PERCH	.	.	19	70	Fresh Dead
YELLOW PERCH	.	.	14	60	Fresh Dead
FRESHWATER DRUM	456	930	.	.	Fresh Dead
FRESHWATER DRUM	449	1120	.	.	Live
FRESHWATER DRUM	425	950	.	.	Live
FRESHWATER DRUM	349	550	.	.	Live
MOTTLED SCULPIN	85	10	.	.	Fresh Dead
MOTTLED SCULPIN	80	7	.	.	Fresh Dead
MOTTLED SCULPIN	63	3	.	.	Fresh Dead
SLIMY SCULPIN	75	5	.	.	Live
SLIMY SCULPIN	84	6	.	.	Live
SLIMY SCULPIN	63	3	.	.	Fresh Dead
SLIMY SCULPIN	69	4	.	.	Live
SLIMY SCULPIN	67	4	.	.	Live
SLIMY SCULPIN	85	9	.	.	Fresh Dead
SLIMY SCULPIN	65	4	.	.	Fresh Dead
SLIMY SCULPIN	49	2	.	.	Fresh Dead
SLIMY SCULPIN	89	12	.	.	Fresh Dead
DEEPWATER SCULPIN	104	10	.	.	Live

SAMPLING PERIOD: 21-22DEC05 START DATE AND TIME: 21DEC05:10:00 END DATE AND TIME: 22DEC05:10:00
SAMPLING DURATION (hrs.): 24.00 CW VOLUME SAMPLED (gals x 10^6): 564.4800
INTAKE TEMPERATURES (F): MINIMUM= 34.3 MEAN= 37.3 MAXIMUM= 43.3
DISCHARGE TEMPERATURES (F): MINIMUM= 67.2 MEAN= 70.8 MAXIMUM= 77.7 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 18-24DEC05 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 3951.5

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
ROUND WHITEFISH	309	240	.	.	Fresh Dead	
ROUND WHITEFISH	400	510	.	.	Fresh Dead	
ROUND WHITEFISH	465	700	.	.	Fresh Dead	
BROWN TROUT	223	95	.	.	Live	
RAINBOW SMELT	124	10	.	.	Fresh Dead	
RAINBOW SMELT	96	4	.	.	Fresh Dead	
WHITE SUCKER	233	137	.	.	Fresh Dead	
BLACK BULLHEAD	248	180	.	.	Live	
CHANNEL CATFISH	155	30	.	.	Fresh Dead	
CHANNEL CATFISH	105	11	.	.	Fresh Dead	
CHANNEL CATFISH	90	6	.	.	Live	
CHANNEL CATFISH	111	11	.	.	Fresh Dead	
THREESPINE STICKLEBACK	45	1	.	.	Fresh Dead	
NINESPINE STICKLEBACK	76	2	.	.	Fresh Dead	
YELLOW PERCH	98	6	.	.	Live	
YELLOW PERCH	87	5	.	.	Fresh Dead	
FRESHWATER DRUM	526	2050	.	.	Fresh Dead	
MOTTLED SCULPIN	64	3	.	.	Fresh Dead	
SLIMY SCULPIN	92	13	.	.	Fresh Dead	
SLIMY SCULPIN	74	4	.	.	Fresh Dead	
SLIMY SCULPIN	66	3	.	.	Fresh Dead	

SAMPLING PERIOD: 28-29DEC05 START DATE AND TIME: 28DEC05:10:00 END DATE AND TIME: 29DEC05:10:00
SAMPLING DURATION (hrs.): 24.00 CW VOLUME SAMPLED (gals x 10^6): 564.4800
INTAKE TEMPERATURES (F): MINIMUM= 33.9 MEAN= 35.0 MAXIMUM= 36.6
DISCHARGE TEMPERATURES (F): MINIMUM= 66.7 MEAN= 68.3 MAXIMUM= 70.6 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 25-31DEC05 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 3951.5

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GIZZARD SHAD	169	36	.	.	Fresh Dead	
GIZZARD SHAD	151	28	.	.	Fresh Dead	
GIZZARD SHAD	149	29	.	.	Fresh Dead	
GIZZARD SHAD	145	27	.	.	Fresh Dead	
GIZZARD SHAD	160	32	.	.	Fresh Dead	
ROUND WHITEFISH	427	670	.	.	Fresh Dead	
RAINBOW SMELT	45	1	.	.	Fresh Dead	
RAINBOW SMELT	47	1	.	.	Fresh Dead	
RAINBOW SMELT	56	1	.	.	Fresh Dead	
RAINBOW SMELT	48	1	.	.	Fresh Dead	
RAINBOW SMELT	41	1	.	.	Fresh Dead	
RAINBOW SMELT	38	1	.	.	Fresh Dead	
RAINBOW SMELT	40	1	.	.	Fresh Dead	
RAINBOW SMELT	40	1	.	.	Fresh Dead	
RAINBOW SMELT	42	1	.	.	Fresh Dead	
RAINBOW SMELT	45	1	.	.	Fresh Dead	
RAINBOW SMELT	35	1	.	.	Fresh Dead	
RAINBOW SMELT	44	1	.	.	Fresh Dead	
RAINBOW SMELT	43	1	.	.	Fresh Dead	
RAINBOW SMELT	36	1	.	.	Fresh Dead	
RAINBOW SMELT	95	3	.	.	Fresh Dead	
RAINBOW SMELT	98	4	.	.	Fresh Dead	
RAINBOW SMELT	121	8	.	.	Fresh Dead	
RAINBOW SMELT	42	1	.	.	Fresh Dead	
RAINBOW SMELT	44	1	.	.	Fresh Dead	
RAINBOW SMELT	40	1	.	.	Fresh Dead	
RAINBOW SMELT	38	1	.	.	Fresh Dead	
RAINBOW SMELT	46	1	.	.	Fresh Dead	
RAINBOW SMELT	47	1	.	.	Fresh Dead	
RAINBOW SMELT	38	1	.	.	Fresh Dead	
RAINBOW SMELT	39	1	.	.	Fresh Dead	
RAINBOW SMELT	43	1	.	.	Fresh Dead	
RAINBOW SMELT	43	1	.	.	Fresh Dead	
RAINBOW SMELT	34	1	.	.	Fresh Dead	
RAINBOW SMELT	40	1	.	.	Fresh Dead	
RAINBOW SMELT	45	1	.	.	Fresh Dead	
RAINBOW SMELT	76	1	.	.	Fresh Dead	
RAINBOW SMELT	40	1	.	.	Fresh Dead	
RAINBOW SMELT	40	1	.	.	Fresh Dead	
RAINBOW SMELT	47	1	.	.	Fresh Dead	
RAINBOW SMELT	44	1	.	.	Fresh Dead	
RAINBOW SMELT	38	1	.	.	Fresh Dead	
RAINBOW SMELT	50	1	.	.	Fresh Dead	
RAINBOW SMELT	40	1	.	.	Fresh Dead	
RAINBOW SMELT	45	1	.	.	Fresh Dead	
RAINBOW SMELT	44	1	.	.	Fresh Dead	
RAINBOW SMELT	48	1	.	.	Fresh Dead	
RAINBOW SMELT	41	1	.	.	Fresh Dead	
RAINBOW SMELT	42	1	.	.	Fresh Dead	
RAINBOW SMELT	39	1	.	.	Fresh Dead	
RAINBOW SMELT	43	1	.	.	Fresh Dead	
RAINBOW SMELT	31	1	.	.	Fresh Dead	
RAINBOW SMELT	33	1	.	.	Fresh Dead	
RAINBOW SMELT	45	1	.	.	Fresh Dead	
RAINBOW SMELT	51	1	.	.	Fresh Dead	

RAINBOW SMELT	.	.	3	1	Fresh Dead
BURBOT	90	5	.	.	Fresh Dead
BURBOT	86	5	.	.	Fresh Dead
THREESPINE STICKLEBACK	55	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	47	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	55	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	51	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	50	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	49	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	64	2	.	.	Fresh Dead
YELLOW PERCH	72	3	.	.	Fresh Dead
YELLOW PERCH	69	2	.	.	Fresh Dead
YELLOW PERCH	70	2	.	.	Fresh Dead
YELLOW PERCH	61	1	.	.	Fresh Dead
YELLOW PERCH	50	1	.	.	Fresh Dead
YELLOW PERCH	70	3	.	.	Fresh Dead
YELLOW PERCH	70	2	.	.	Fresh Dead
YELLOW PERCH	61	2	.	.	Fresh Dead
YELLOW PERCH	77	3	.	.	Fresh Dead
YELLOW PERCH	80	4	.	.	Fresh Dead
YELLOW PERCH	62	1	.	.	Fresh Dead
YELLOW PERCH	76	3	.	.	Fresh Dead
YELLOW PERCH	76	2	.	.	Fresh Dead
YELLOW PERCH	55	1	.	.	Fresh Dead
YELLOW PERCH	77	3	.	.	Fresh Dead
YELLOW PERCH	72	3	.	.	Fresh Dead
YELLOW PERCH	59	1	.	.	Fresh Dead
YELLOW PERCH	59	1	.	.	Fresh Dead
YELLOW PERCH	61	1	.	.	Fresh Dead
YELLOW PERCH	69	2	.	.	Fresh Dead
YELLOW PERCH	57	1	.	.	Fresh Dead
YELLOW PERCH	60	1	.	.	Fresh Dead
YELLOW PERCH	66	2	.	.	Fresh Dead
YELLOW PERCH	77	3	.	.	Fresh Dead
YELLOW PERCH	65	2	.	.	Fresh Dead
YELLOW PERCH	59	1	.	.	Fresh Dead
YELLOW PERCH	64	2	.	.	Fresh Dead
YELLOW PERCH	48	1	.	.	Fresh Dead
YELLOW PERCH	51	1	.	.	Fresh Dead
YELLOW PERCH	78	4	.	.	Fresh Dead
YELLOW PERCH	67	2	.	.	Fresh Dead
YELLOW PERCH	57	1	.	.	Fresh Dead
YELLOW PERCH	75	4	.	.	Fresh Dead
MOTTLED SCULPIN	80	8	.	.	Fresh Dead
MOTTLED SCULPIN	64	3	.	.	Fresh Dead
MOTTLED SCULPIN	73	5	.	.	Fresh Dead
MOTTLED SCULPIN	81	7	.	.	Fresh Dead
SLIMY SCULPIN	76	5	.	.	Fresh Dead

SAMPLING PERIOD: 04-05JAN06 START DATE AND TIME: 04JAN06:10:00 END DATE AND TIME: 05JAN06:10:00
SAMPLING DURATION (hrs.): 24.00 CW VOLUME SAMPLED (gals x 10^6): 564.4800
INTAKE TEMPERATURES (F): MINIMUM= 35.1 MEAN= 38.7 MAXIMUM= 43.0
DISCHARGE TEMPERATURES (F): MINIMUM= 67.6 MEAN= 72.2 MAXIMUM= 77.1 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 01-07JAN06 CW VOLUME (gals x 10^6) FOR EXTRAPOLATION PERIOD: 3951.5

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
ROUND WHITEFISH	420	550	.	.	Live	
ROUND WHITEFISH	305	220	.	.	Fresh Dead	
ROUND WHITEFISH	426	670	.	.	Fresh Dead	
BROWN TROUT	438	1050	.	.	Live	
RAINBOW SMELT	93	4	.	.	Fresh Dead	
LONGNOSE SUCKER	457	910	.	.	Live	
BURBOT	272	158	.	.	Fresh Dead	
THREESPINE STICKLEBACK	52	1	.	.	Live	
THREESPINE STICKLEBACK	52	1	.	.	Live	
THREESPINE STICKLEBACK	55	1	.	.	Live	
THREESPINE STICKLEBACK	53	1	.	.	Fresh Dead	
THREESPINE STICKLEBACK	52	1	.	.	Fresh Dead	
YELLOW PERCH	67	2	.	.	Fresh Dead	
MOTTLED SCULPIN	82	7	.	.	Fresh Dead	
SLIMY SCULPIN	75	5	.	.	Fresh Dead	

SAMPLING PERIOD: 11-12JAN06 START DATE AND TIME: 11JAN06:10:00 END DATE AND TIME: 12JAN06:10:00
SAMPLING DURATION (hrs.): 24.00 CW VOLUME SAMPLED (gals x 10^6): 564.4800
INTAKE TEMPERATURES (F): MINIMUM= 33.9 MEAN= 38.0 MAXIMUM= 42.2
DISCHARGE TEMPERATURES (F): MINIMUM= 66.4 MEAN= 71.4 MAXIMUM= 76.2 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 08-14JAN06 CW VOLUME (gals x 10^6) FOR EXTRAPOLATION PERIOD: 3951.5

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
ROUND WHITEFISH	380	460	.	.	Live	
RAINBOW SMELT	108	5	.	.	Fresh Dead	
RAINBOW SMELT	105	8	.	.	Fresh Dead	
RAINBOW SMELT	98	4	.	.	Fresh Dead	
RAINBOW SMELT	91	2	.	.	Fresh Dead	

RAINBOW SMELT	92	3	.	.	Fresh Dead
RAINBOW SMELT	101	4	.	.	Fresh Dead
RAINBOW SMELT	112	9	.	.	Fresh Dead
RAINBOW SMELT	106	5	.	.	Fresh Dead
RAINBOW SMELT	90	5	.	.	Fresh Dead
RAINBOW SMELT	46	1	.	.	Fresh Dead
RAINBOW SMELT	100	5	.	.	Fresh Dead
RAINBOW SMELT	97	4	.	.	Fresh Dead
RAINBOW SMELT	89	4	.	.	Fresh Dead
RAINBOW SMELT	123	9	.	.	Live
RAINBOW SMELT	94	4	.	.	Fresh Dead
RAINBOW SMELT	125	10	.	.	Fresh Dead
RAINBOW SMELT	108	5	.	.	Fresh Dead
RAINBOW SMELT	100	4	.	.	Fresh Dead
RAINBOW SMELT	95	4	.	.	Fresh Dead
RAINBOW SMELT	103	5	.	.	Fresh Dead
RAINBOW SMELT	104	5	.	.	Fresh Dead
RAINBOW SMELT	75	2	.	.	Fresh Dead
RAINBOW SMELT	96	4	.	.	Fresh Dead
RAINBOW SMELT	95	4	.	.	Fresh Dead
RAINBOW SMELT	134	13	.	.	Fresh Dead
RAINBOW SMELT	95	4	.	.	Fresh Dead
RAINBOW SMELT	82	3	.	.	Fresh Dead
RAINBOW SMELT	102	5	.	.	Fresh Dead
RAINBOW SMELT	100	5	.	.	Fresh Dead
RAINBOW SMELT	85	3	.	.	Fresh Dead
RAINBOW SMELT	96	4	.	.	Fresh Dead
RAINBOW SMELT	117	9	.	.	Fresh Dead
CENTRAL MUDMINNOW	80	5	.	.	Fresh Dead
SPOTTAIL SHINER	119	15	.	.	Fresh Dead
THREESPINE STICKLEBACK	57	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	51	1	.	.	Live
THREESPINE STICKLEBACK	53	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	59	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	57	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	54	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	55	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	52	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	51	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	52	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	53	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	55	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	51	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	52	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	50	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	50	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	54	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	55	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	56	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	55	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	53	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	55	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	49	1	.	.	Live
THREESPINE STICKLEBACK	52	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	48	1	.	.	Live
THREESPINE STICKLEBACK	52	1	.	.	Fresh Dead
YELLOW PERCH	85	5	.	.	Live
YELLOW PERCH	65	2	.	.	Fresh Dead
YELLOW PERCH	70	3	.	.	Fresh Dead
YELLOW PERCH	70	3	.	.	Live
YELLOW PERCH	80	4	.	.	Live
YELLOW PERCH	69	3	.	.	Live
YELLOW PERCH	68	2	.	.	Fresh Dead
YELLOW PERCH	63	2	.	.	Fresh Dead
MOTTLED SCULPIN	85	8	.	.	Fresh Dead
MOTTLED SCULPIN	80	6	.	.	Fresh Dead

SAMPLING PERIOD: 18-19JAN06 START DATE AND TIME: 18JAN06:10:00 END DATE AND TIME: 19JAN06:10:00
SAMPLING DURATION (hrs.): 24.00 CW VOLUME SAMPLED (gals x 10^6): 564.4800
INTAKE TEMPERATURES (F): MINIMUM= 35.0 MEAN= 39.4 MAXIMUM= 42.2
DISCHARGE TEMPERATURES (F): MINIMUM= 67.4 MEAN= 72.7 MAXIMUM= 75.8 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 15-21JAN06 CW VOLUME (gals x 10^6) FOR EXTRAPOLATION PERIOD: 3951.5

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GREAT LAKES CRAYFISH	.	.	1	.	Fresh Dead	
BROWN TROUT	231	134	.	.	Fresh Dead	
RAINBOW SMELT	88	4	.	.	Fresh Dead	
LONGNOSE SUCKER	243	185	.	.	Fresh Dead	
WHITE SUCKER	507	1080	.	.	Live	
BLACK BULLHEAD	222	199	.	.	Live	
THREESPINE STICKLEBACK	60	2	.	.	Live	
THREESPINE STICKLEBACK	56	2	.	.	Fresh Dead	
THREESPINE STICKLEBACK	54	1	.	.	Live	
THREESPINE STICKLEBACK	53	1	.	.	Fresh Dead	
THREESPINE STICKLEBACK	51	1	.	.	Live	
YELLOW PERCH	66	2	.	.	Fresh Dead	

SAMPLING PERIOD: 25-26JAN06 START DATE AND TIME: 25JAN06:17:00 END DATE AND TIME: 26JAN06:10:00
SAMPLING DURATION (hrs.): 17.00 CW VOLUME SAMPLED (gals x 10^6): 399.8400
INTAKE TEMPERATURES (F): MINIMUM= 35.4 MEAN= 36.2 MAXIMUM= 37.4
DISCHARGE TEMPERATURES (F): MINIMUM= 67.5 MEAN= 69.4 MAXIMUM= 72.0 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 22-28JAN06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 3951.5

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GIZZARD SHAD	170	39	.	.	Fresh Dead	
GIZZARD SHAD	230	98	.	.	Fresh Dead	
RAINBOW SMELT	93	3	.	.	Live	
RAINBOW SMELT	109	6	.	.	Fresh Dead	
RAINBOW SMELT	86	3	.	.	Fresh Dead	
RAINBOW SMELT	90	3	.	.	Live	
RAINBOW SMELT	98	4	.	.	Fresh Dead	
BLACK BULLHEAD	237	210	.	.	Fresh Dead	
BURBOT	146	21	.	.	Fresh Dead	
YELLOW PERCH	76	3	.	.	Live	
YELLOW PERCH	85	5	.	.	Live	
MOTTLED SCULPIN	76	5	.	.	Fresh Dead	

SAMPLING PERIOD: 01-02FEB06 START DATE AND TIME: 01FEB06:10:34 END DATE AND TIME: 02FEB06:10:30
SAMPLING DURATION (hrs.): 23.93 CW VOLUME SAMPLED (gals x 10^6): 562.9120
INTAKE TEMPERATURES (F): MINIMUM= 34.9 MEAN= 39.3 MAXIMUM= 41.6
DISCHARGE TEMPERATURES (F): MINIMUM= 67.0 MEAN= 72.2 MAXIMUM= 75.2 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 29JAN-04FEB06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 4009.4

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GREAT LAKES CRAYFISH	45	2	.	.	Fresh Dead	
ROUND WHITEFISH	382	390	.	.	Fresh Dead	
ROUND WHITEFISH	320	225	.	.	Fresh Dead	
ROUND WHITEFISH	365	390	.	.	Live	
ROUND WHITEFISH	165	36	.	.	Fresh Dead	
ROUND WHITEFISH	184	44	.	.	Fresh Dead	
RAINBOW SMELT	189	40	.	.	Fresh Dead	
RAINBOW SMELT	104	6	.	.	Fresh Dead	
RAINBOW SMELT	114	8	.	.	Fresh Dead	
RAINBOW SMELT	94	4	.	.	Fresh Dead	
RAINBOW SMELT	108	8	.	.	Fresh Dead	
RAINBOW SMELT	90	4	.	.	Fresh Dead	
RAINBOW SMELT	93	5	.	.	Fresh Dead	
RAINBOW SMELT	100	5	.	.	Fresh Dead	
RAINBOW SMELT	136	14	.	.	Fresh Dead	
RAINBOW SMELT	145	18	.	.	Fresh Dead	
RAINBOW SMELT	100	5	.	.	Fresh Dead	
RAINBOW SMELT	97	5	.	.	Fresh Dead	
RAINBOW SMELT	37	1	.	.	Fresh Dead	
RAINBOW SMELT	38	1	.	.	Fresh Dead	
RAINBOW SMELT	45	1	.	.	Fresh Dead	
RAINBOW SMELT	36	1	.	.	Fresh Dead	
RAINBOW SMELT	79	2	.	.	Fresh Dead	
RAINBOW SMELT	91	4	.	.	Fresh Dead	
RAINBOW SMELT	53	1	.	.	Fresh Dead	
RAINBOW SMELT	46	1	.	.	Fresh Dead	
RAINBOW SMELT	47	1	.	.	Fresh Dead	
RAINBOW SMELT	80	2	.	.	Fresh Dead	
RAINBOW SMELT	126	15	.	.	Fresh Dead	
RAINBOW SMELT	44	1	.	.	Fresh Dead	
RAINBOW SMELT	95	5	.	.	Fresh Dead	
RAINBOW SMELT	94	4	.	.	Fresh Dead	
RAINBOW SMELT	114	9	.	.	Fresh Dead	
RAINBOW SMELT	140	13	.	.	Fresh Dead	
RAINBOW SMELT	84	3	.	.	Fresh Dead	
RAINBOW SMELT	102	6	.	.	Fresh Dead	
RAINBOW SMELT	57	1	.	.	Fresh Dead	
RAINBOW SMELT	47	1	.	.	Fresh Dead	
RAINBOW SMELT	50	1	.	.	Fresh Dead	
RAINBOW SMELT	44	1	.	.	Fresh Dead	
RAINBOW SMELT	48	1	.	.	Fresh Dead	
RAINBOW SMELT	84	3	.	.	Fresh Dead	
RAINBOW SMELT	50	1	.	.	Fresh Dead	
RAINBOW SMELT	36	1	.	.	Fresh Dead	
RAINBOW SMELT	41	1	.	.	Fresh Dead	
RAINBOW SMELT	34	1	.	.	Fresh Dead	
RAINBOW SMELT	45	1	.	.	Fresh Dead	
RAINBOW SMELT	99	6	.	.	Fresh Dead	
RAINBOW SMELT	45	1	.	.	Fresh Dead	
RAINBOW SMELT	57	1	.	.	Fresh Dead	
RAINBOW SMELT	58	1	.	.	Fresh Dead	
RAINBOW SMELT	47	1	.	.	Fresh Dead	
RAINBOW SMELT	42	1	.	.	Fresh Dead	
RAINBOW SMELT	41	1	.	.	Fresh Dead	
RAINBOW SMELT	50	1	.	.	Fresh Dead	
RAINBOW SMELT	45	1	.	.	Fresh Dead	
RAINBOW SMELT	.	.	340	1000	Fresh Dead	
SPOTTAIL SHINER	53	1	.	.	Fresh Dead	

BROOK STICKLEBACK	83	3	.	.	Fresh Dead
BROOK STICKLEBACK	76	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	50	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	55	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	56	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	53	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	53	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	55	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	57	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	49	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	46	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	53	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	48	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	50	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	54	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	55	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	55	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	60	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	58	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	50	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	57	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	45	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	57	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	46	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	54	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	50	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	55	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	47	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	55	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	54	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	50	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	52	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	51	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	55	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	50	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	53	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	48	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	52	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	50	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	55	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	49	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	50	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	48	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	51	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	50	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	47	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	49	1	.	.	Fresh Dead
SMALLMOUTH BASS	135	29	.	.	Fresh Dead
YELLOW PERCH	88	5	.	.	Fresh Dead
YELLOW PERCH	69	3	.	.	Fresh Dead
YELLOW PERCH	75	4	.	.	Fresh Dead
YELLOW PERCH	55	1	.	.	Fresh Dead
YELLOW PERCH	70	3	.	.	Fresh Dead
YELLOW PERCH	76	4	.	.	Fresh Dead
YELLOW PERCH	76	4	.	.	Fresh Dead
YELLOW PERCH	75	3	.	.	Fresh Dead
YELLOW PERCH	79	4	.	.	Fresh Dead
YELLOW PERCH	81	5	.	.	Fresh Dead
YELLOW PERCH	77	4	.	.	Fresh Dead
YELLOW PERCH	76	4	.	.	Fresh Dead
YELLOW PERCH	69	3	.	.	Fresh Dead
YELLOW PERCH	76	3	.	.	Fresh Dead
YELLOW PERCH	87	5	.	.	Fresh Dead
YELLOW PERCH	68	3	.	.	Fresh Dead
YELLOW PERCH	63	2	.	.	Fresh Dead
YELLOW PERCH	65	2	.	.	Fresh Dead
YELLOW PERCH	72	3	.	.	Fresh Dead
YELLOW PERCH	74	4	.	.	Fresh Dead
YELLOW PERCH	95	6	.	.	Fresh Dead
YELLOW PERCH	67	2	.	.	Fresh Dead
YELLOW PERCH	71	3	.	.	Fresh Dead
YELLOW PERCH	69	2	.	.	Fresh Dead
YELLOW PERCH	61	2	.	.	Fresh Dead
YELLOW PERCH	66	2	.	.	Fresh Dead
YELLOW PERCH	57	1	.	.	Fresh Dead
YELLOW PERCH	75	3	.	.	Fresh Dead
YELLOW PERCH	68	3	.	.	Fresh Dead
YELLOW PERCH	91	6	.	.	Fresh Dead
YELLOW PERCH	53	3	.	.	Fresh Dead
YELLOW PERCH	64	3	.	.	Fresh Dead
YELLOW PERCH	74	4	.	.	Fresh Dead
YELLOW PERCH	86	3	.	.	Fresh Dead
YELLOW PERCH	60	1	.	.	Fresh Dead
MOTTLED SCULPIN	75	5	.	.	Fresh Dead
MOTTLED SCULPIN	75	6	.	.	Fresh Dead

SAMPLING PERIOD: 08-09FEB06 START DATE AND TIME: 08FEB06:10:00 END DATE AND TIME: 09FEB06:10:00
SAMPLING DURATION (hrs.): 24.00 CW VOLUME SAMPLED (gals x 10^6): 564.4800
INTAKE TEMPERATURES (F): MINIMUM= 35.2 MEAN= 36.0 MAXIMUM= 37.5
DISCHARGE TEMPERATURES (F): MINIMUM= 67.3 MEAN= 69.2 MAXIMUM= 71.8 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 05-11FEB06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 3951.5

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GIZZARD SHAD	176	54	.	.	Fresh Dead	
RAINBOW SMELT	110	6	.	.	Fresh Dead	
RAINBOW SMELT	43	1	.	.	Fresh Dead	
RAINBOW SMELT	32	1	.	.	Fresh Dead	
RAINBOW SMELT	49	1	.	.	Fresh Dead	
RAINBOW SMELT	40	1	.	.	Fresh Dead	
WHITE SUCKER	305	300	.	.	Live	
BLACK BULLHEAD	232	240	.	.	Live	
CHANNEL CATFISH	650	3800	.	.	Long Dead	
YELLOW PERCH	101	7	.	.	Live	
YELLOW PERCH	67	2	.	.	Fresh Dead	
YELLOW PERCH	55	1	.	.	Fresh Dead	
FRESHWATER DRUM	550	2200	.	.	Fresh Dead	
MOTTLED SCULPIN	63	4	.	.	Fresh Dead	
MOTTLED SCULPIN	56	2	.	.	Fresh Dead	

SAMPLING PERIOD: 15-16FEB06 START DATE AND TIME: 15FEB06:10:15 END DATE AND TIME: 16FEB06:10:00
SAMPLING DURATION (hrs.): 23.75 CW VOLUME SAMPLED (gals x 10^6): 558.6000
INTAKE TEMPERATURES (F): MINIMUM= 34.0 MEAN= 38.3 MAXIMUM= 42.8
DISCHARGE TEMPERATURES (F): MINIMUM= 65.7 MEAN= 71.4 MAXIMUM= 76.9 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 12-18FEB06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 3951.5

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
SPOTTAIL SHINER	76	5	.	.	Fresh Dead	
WHITE SUCKER	582	1800	.	.	Live	
BLACK BULLHEAD	234	194	.	.	Live	
BURBOT	322	232	.	.	Fresh Dead	
THREESPINE STICKLEBACK	56	1	.	.	Live	
THREESPINE STICKLEBACK	56	1	.	.	Live	
THREESPINE STICKLEBACK	49	1	.	.	Live	
THREESPINE STICKLEBACK	54	1	.	.	Live	
THREESPINE STICKLEBACK	52	1	.	.	Live	
YELLOW PERCH	69	2	.	.	Live	
YELLOW PERCH	57	1	.	.	Fresh Dead	
YELLOW PERCH	92	6	.	.	Live	
MOTTLED SCULPIN	76	8	.	.	Live	
MOTTLED SCULPIN	66	5	.	.	Live	
MOTTLED SCULPIN	63	4	.	.	Live	
SLIMY SCULPIN	70	7	.	.	Live	

SAMPLING PERIOD: 22-23FEB06 START DATE AND TIME: 22FEB06:10:00 END DATE AND TIME: 23FEB06:10:00
SAMPLING DURATION (hrs.): 24.00 CW VOLUME SAMPLED (gals x 10^6): 564.4800
INTAKE TEMPERATURES (F): MINIMUM= 33.6 MEAN= 39.1 MAXIMUM= 44.2
DISCHARGE TEMPERATURES (F): MINIMUM= 66.2 MEAN= 72.2 MAXIMUM= 78.6 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 19-25FEB06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 3951.5

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GREAT LAKES CRAYFISH	70	9	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	35	1	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	50	4	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	24	1	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	42	2	.	.	Fresh Dead	
ROUND WHITEFISH	420	650	.	.	Fresh Dead	
ROUND WHITEFISH	405	600	.	.	Fresh Dead	
BROWN TROUT	265	170	.	.	Fresh Dead	
RAINBOW SMELT	112	6	.	.	Fresh Dead	
RAINBOW SMELT	107	5	.	.	Fresh Dead	
RAINBOW SMELT	53	1	.	.	Fresh Dead	
RAINBOW SMELT	62	1	.	.	Fresh Dead	
RAINBOW SMELT	90	3	.	.	Fresh Dead	
RAINBOW SMELT	108	5	.	.	Fresh Dead	
RAINBOW SMELT	107	5	.	.	Fresh Dead	
RAINBOW SMELT	85	2	.	.	Fresh Dead	
RAINBOW SMELT	167	25	.	.	Fresh Dead	
RAINBOW SMELT	115	9	.	.	Fresh Dead	
RAINBOW SMELT	96	3	.	.	Fresh Dead	
RAINBOW SMELT	106	6	.	.	Fresh Dead	
RAINBOW SMELT	101	6	.	.	Fresh Dead	
RAINBOW SMELT	84	2	.	.	Fresh Dead	
RAINBOW SMELT	95	4	.	.	Fresh Dead	
RAINBOW SMELT	109	6	.	.	Fresh Dead	
RAINBOW SMELT	92	3	.	.	Fresh Dead	
RAINBOW SMELT	97	3	.	.	Fresh Dead	
RAINBOW SMELT	60	1	.	.	Fresh Dead	
RAINBOW SMELT	114	9	.	.	Fresh Dead	

RAINBOW SMELT	100	5	.	.	Fresh Dead
RAINBOW SMELT	112	9	.	.	Fresh Dead
RAINBOW SMELT	101	5	.	.	Fresh Dead
RAINBOW SMELT	90	3	.	.	Fresh Dead
RAINBOW SMELT	96	4	.	.	Fresh Dead
RAINBOW SMELT	106	6	.	.	Fresh Dead
RAINBOW SMELT	87	2	.	.	Fresh Dead
RAINBOW SMELT	106	5	.	.	Fresh Dead
RAINBOW SMELT	41	1	.	.	Fresh Dead
RAINBOW SMELT	93	4	.	.	Fresh Dead
RAINBOW SMELT	110	5	.	.	Fresh Dead
RAINBOW SMELT	54	1	.	.	Fresh Dead
RAINBOW SMELT	53	1	.	.	Fresh Dead
RAINBOW SMELT	101	5	.	.	Fresh Dead
RAINBOW SMELT	109	5	.	.	Fresh Dead
RAINBOW SMELT	94	4	.	.	Fresh Dead
RAINBOW SMELT	95	4	.	.	Fresh Dead
RAINBOW SMELT	86	3	.	.	Fresh Dead
RAINBOW SMELT	90	3	.	.	Fresh Dead
RAINBOW SMELT	98	5	.	.	Fresh Dead
RAINBOW SMELT	92	4	.	.	Fresh Dead
RAINBOW SMELT	75	2	.	.	Fresh Dead
RAINBOW SMELT	103	5	.	.	Fresh Dead
RAINBOW SMELT	100	5	.	.	Fresh Dead
RAINBOW SMELT	54	1	.	.	Fresh Dead
RAINBOW SMELT	45	1	.	.	Fresh Dead
RAINBOW SMELT	46	1	.	.	Fresh Dead
RAINBOW SMELT	46	1	.	.	Fresh Dead
RAINBOW SMELT	52	1	.	.	Fresh Dead
RAINBOW SMELT	53	1	.	.	Fresh Dead
RAINBOW SMELT	.	.	59	230	Fresh Dead
SPOTTAIL SHINER	102	8	.	.	Fresh Dead
THREESPINE STICKLEBACK	55	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	57	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	43	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	50	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	60	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	52	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	62	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	59	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	50	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	53	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	52	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	48	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	54	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	51	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	53	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	49	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	57	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	54	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	55	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	54	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	54	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	51	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	52	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	54	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	51	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	45	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	54	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	65	2	.	.	Fresh Dead
WHITE PERCH	235	225	.	.	Fresh Dead
YELLOW PERCH	72	2	.	.	Fresh Dead
YELLOW PERCH	79	4	.	.	Fresh Dead
YELLOW PERCH	83	4	.	.	Fresh Dead
YELLOW PERCH	69	2	.	.	Fresh Dead
YELLOW PERCH	87	5	.	.	Fresh Dead
YELLOW PERCH	75	4	.	.	Fresh Dead
YELLOW PERCH	90	6	.	.	Live
MOTTLED SCULPIN	56	2	.	.	Fresh Dead
MOTTLED SCULPIN	72	6	.	.	Fresh Dead
MOTTLED SCULPIN	74	7	.	.	Fresh Dead
MOTTLED SCULPIN	60	4	.	.	Fresh Dead
MOTTLED SCULPIN	77	9	.	.	Fresh Dead
MOTTLED SCULPIN	65	5	.	.	Fresh Dead
SLIMY SCULPIN	86	10	.	.	Fresh Dead
SLIMY SCULPIN	82	8	.	.	Fresh Dead
SLIMY SCULPIN	77	7	.	.	Fresh Dead
SLIMY SCULPIN	76	6	.	.	Fresh Dead

SAMPLING PERIOD: 01-02MAR06 START DATE AND TIME: 01MAR06:10:00 END DATE AND TIME: 02MAR06:10:00
SAMPLING DURATION (hrs.): 24.00 CW VOLUME SAMPLED (gals x 10^6): 564.4800
INTAKE TEMPERATURES (F): MINIMUM= 33.7 MEAN= 36.4 MAXIMUM= 41.7
DISCHARGE TEMPERATURES (F): MINIMUM= 65.3 MEAN= 69.3 MAXIMUM= 75.6 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 26FEB-04MAR06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 3951.5

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GREAT LAKES CRAYFISH	50	4	.	.	Live	
GIZZARD SHAD	213	79	.	.	Fresh Dead	
YELLOW PERCH	93	7	.	.	Live	
YELLOW PERCH	75	3	.	.	Live	
MOTTLED SCULPIN	84	10	.	.	Live	
MOTTLED SCULPIN	69	5	.	.	Live	
MOTTLED SCULPIN	80	8	.	.	Live	
MOTTLED SCULPIN	78	8	.	.	Live	
MOTTLED SCULPIN	70	8	.	.	Live	
MOTTLED SCULPIN	66	5	.	.	Live	
MOTTLED SCULPIN	69	6	.	.	Live	
MOTTLED SCULPIN	67	6	.	.	Fresh Dead	
SLIMY SCULPIN	74	6	.	.	Live	
SLIMY SCULPIN	88	13	.	.	Live	
SLIMY SCULPIN	102	14	.	.	Live	
SLIMY SCULPIN	74	7	.	.	Live	
SLIMY SCULPIN	70	5	.	.	Live	
SLIMY SCULPIN	66	5	.	.	Live	
SLIMY SCULPIN	72	8	.	.	Live	

SAMPLING PERIOD: 08-09MAR06 START DATE AND TIME: 08MAR06:10:15 END DATE AND TIME: 09MAR06:10:00
SAMPLING DURATION (hrs.): 23.75 CW VOLUME SAMPLED (gals x 10^6): 558.6000
INTAKE TEMPERATURES (F): MINIMUM= 35.5 MEAN= 37.0 MAXIMUM= 43.7
DISCHARGE TEMPERATURES (F): MINIMUM= 66.7 MEAN= 69.4 MAXIMUM= 74.4 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 05-11MAR06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 3951.5

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GREAT LAKES CRAYFISH	69	7	.	.	Fresh Dead	
GIZZARD SHAD	172	42	.	.	Fresh Dead	
GIZZARD SHAD	160	40	.	.	Live	
GIZZARD SHAD	177	48	.	.	Fresh Dead	
GIZZARD SHAD	155	34	.	.	Fresh Dead	
GIZZARD SHAD	174	40	.	.	Fresh Dead	
GIZZARD SHAD	175	42	.	.	Fresh Dead	
GIZZARD SHAD	164	38	.	.	Fresh Dead	
GIZZARD SHAD	229	90	.	.	Fresh Dead	
GIZZARD SHAD	162	44	.	.	Fresh Dead	
GIZZARD SHAD	161	37	.	.	Fresh Dead	
GIZZARD SHAD	182	44	.	.	Fresh Dead	
GIZZARD SHAD	173	44	.	.	Live	
GIZZARD SHAD	166	40	.	.	Fresh Dead	
GIZZARD SHAD	165	40	.	.	Fresh Dead	
GIZZARD SHAD	154	36	.	.	Fresh Dead	
GIZZARD SHAD	163	41	.	.	Live	
GIZZARD SHAD	187	51	.	.	Fresh Dead	
GIZZARD SHAD	179	42	.	.	Fresh Dead	
GIZZARD SHAD	190	54	.	.	Fresh Dead	
GIZZARD SHAD	165	33	.	.	Fresh Dead	
GIZZARD SHAD	154	33	.	.	Fresh Dead	
GIZZARD SHAD	176	47	.	.	Fresh Dead	
GIZZARD SHAD	185	49	.	.	Fresh Dead	
GIZZARD SHAD	159	35	.	.	Fresh Dead	
GIZZARD SHAD	167	35	.	.	Fresh Dead	
GIZZARD SHAD	168	42	.	.	Fresh Dead	
GIZZARD SHAD	160	31	.	.	Fresh Dead	
GIZZARD SHAD	169	41	.	.	Fresh Dead	
GIZZARD SHAD	170	38	.	.	Fresh Dead	
GIZZARD SHAD	172	41	.	.	Live	
GIZZARD SHAD	170	44	.	.	Live	
GIZZARD SHAD	158	32	.	.	Fresh Dead	
GIZZARD SHAD	183	47	.	.	Fresh Dead	
GIZZARD SHAD	183	57	.	.	Fresh Dead	
GIZZARD SHAD	174	47	.	.	Fresh Dead	
GIZZARD SHAD	175	54	.	.	Fresh Dead	
GIZZARD SHAD	159	35	.	.	Fresh Dead	
GIZZARD SHAD	158	31	.	.	Fresh Dead	
GIZZARD SHAD	174	46	.	.	Fresh Dead	
GIZZARD SHAD	166	46	.	.	Fresh Dead	
GIZZARD SHAD	185	59	.	.	Fresh Dead	
GIZZARD SHAD	155	37	.	.	Fresh Dead	
GIZZARD SHAD	220	82	.	.	Fresh Dead	
GIZZARD SHAD	161	38	.	.	Live	
GIZZARD SHAD	175	50	.	.	Live	
GIZZARD SHAD	175	40	.	.	Fresh Dead	
GIZZARD SHAD	169	38	.	.	Fresh Dead	
GIZZARD SHAD	167	34	.	.	Fresh Dead	
GIZZARD SHAD	163	35	.	.	Fresh Dead	
GIZZARD SHAD	220	80	.	.	Fresh Dead	
GIZZARD SHAD	.	.	12	550	Fresh Dead	
GIZZARD SHAD	.	.	3	150	Fresh Dead	
ROUND WHITEFISH	365	390	.	.	Fresh Dead	
ROUND WHITEFISH	436	550	.	.	Fresh Dead	
SPOTTAIL SHINER	47	1	.	.	Fresh Dead	
CHANNEL CATFISH	300	360	.	.	Fresh Dead	

CHANNEL CATFISH	514	1200	.	.	Fresh Dead
CHANNEL CATFISH	.	.	1	.	Long Dead
BURBOT	358	310	.	.	Live
BURBOT	123	14	.	.	Live
THREESPINE STICKLEBACK	47	1	.	.	Fresh Dead
SMALLMOUTH BASS	298	400	.	.	Fresh Dead
MOTTLED SCULPIN	66	5	.	.	Fresh Dead
MOTTLED SCULPIN	82	10	.	.	Fresh Dead
MOTTLED SCULPIN	73	6	.	.	Fresh Dead
MOTTLED SCULPIN	57	4	.	.	Fresh Dead
MOTTLED SCULPIN	79	7	.	.	Fresh Dead
MOTTLED SCULPIN	79	6	.	.	Fresh Dead
SLIMY SCULPIN	61	4	.	.	Fresh Dead
SLIMY SCULPIN	75	7	.	.	Fresh Dead
SLIMY SCULPIN	65	5	.	.	Fresh Dead
SLIMY SCULPIN	90	12	.	.	Fresh Dead
SLIMY SCULPIN	69	6	.	.	Fresh Dead
SLIMY SCULPIN	74	7	.	.	Fresh Dead
SLIMY SCULPIN	86	10	.	.	Fresh Dead
SLIMY SCULPIN	72	6	.	.	Fresh Dead

SAMPLING PERIOD: 15-16MAR06 START DATE AND TIME: 15MAR06:10:00 END DATE AND TIME: 16MAR06:10:00
SAMPLING DURATION (hrs.): 24.00 CW VOLUME SAMPLED (gals x 10^6): 941.8000
INTAKE TEMPERATURES (F): MINIMUM= 36.3 MEAN= 40.5 MAXIMUM= 43.2
DISCHARGE TEMPERATURES (F): MINIMUM= 54.9 MEAN= 59.2 MAXIMUM= 61.8 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 12-18MAR06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 5869.9

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GIZZARD SHAD	155	39	.	.	Long Dead	
ROUND WHITEFISH	385	420	.	.	Fresh Dead	
RAINBOW SMELT	118	10	.	.	Fresh Dead	
RAINBOW SMELT	110	6	.	.	Fresh Dead	
RAINBOW SMELT	105	6	.	.	Fresh Dead	
RAINBOW SMELT	151	19	.	.	Fresh Dead	
RAINBOW SMELT	136	14	.	.	Fresh Dead	
SPOTTAIL SHINER	75	5	.	.	Fresh Dead	
THREESPINE STICKLEBACK	51	1	.	.	Live	
THREESPINE STICKLEBACK	52	1	.	.	Live	
THREESPINE STICKLEBACK	59	2	.	.	Fresh Dead	
THREESPINE STICKLEBACK	56	1	.	.	Fresh Dead	
THREESPINE STICKLEBACK	51	1	.	.	Fresh Dead	
THREESPINE STICKLEBACK	50	1	.	.	Fresh Dead	
THREESPINE STICKLEBACK	51	1	.	.	Fresh Dead	
THREESPINE STICKLEBACK	47	1	.	.	Fresh Dead	
NINESPINE STICKLEBACK	68	2	.	.	Fresh Dead	
MOTTLED SCULPIN	73	7	.	.	Fresh Dead	
MOTTLED SCULPIN	75	8	.	.	Live	
SLIMY SCULPIN	87	8	.	.	Live	

SAMPLING PERIOD: 22-23MAR06 START DATE AND TIME: 22MAR06:10:00 END DATE AND TIME: 23MAR06:10:15
SAMPLING DURATION (hrs.): 24.25 CW VOLUME SAMPLED (gals x 10^6): 570.3600
INTAKE TEMPERATURES (F): MINIMUM= 34.4 MEAN= 37.3 MAXIMUM= 41.5
DISCHARGE TEMPERATURES (F): MINIMUM= 65.3 MEAN= 69.2 MAXIMUM= 73.3 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 19-25MAR06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 3951.5

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
ROUND WHITEFISH	433	530	.	.	Fresh Dead	

SAMPLING PERIOD: 29-30MAR06 START DATE AND TIME: 29MAR06:10:00 END DATE AND TIME: 30MAR06:10:00
SAMPLING DURATION (hrs.): 24.00 CW VOLUME SAMPLED (gals x 10^6): 938.4000
INTAKE TEMPERATURES (F): MINIMUM= 39.6 MEAN= 41.6 MAXIMUM= 43.7
DISCHARGE TEMPERATURES (F): MINIMUM= 58.1 MEAN= 60.6 MAXIMUM= 63.6 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 26MAR-01APR06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 5973.2

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
ROUND WHITEFISH	421	600	.	.	Fresh Dead	
RAINBOW SMELT	131	13	.	.	Fresh Dead	
RAINBOW SMELT	98	4	.	.	Fresh Dead	
LONGNOSE SUCKER	571	2000	.	.	Live	
WHITE SUCKER	389	740	.	.	Fresh Dead	
THREESPINE STICKLEBACK	50	1	.	.	Fresh Dead	
SMALLMOUTH BASS	225	132	.	.	Live	
MOTTLED SCULPIN	76	7	.	.	Fresh Dead	
MOTTLED SCULPIN	64	3	.	.	Fresh Dead	

SAMPLING PERIOD: 05-06APR06 START DATE AND TIME: 05APR06:09:55 END DATE AND TIME: 06APR06:10:00
SAMPLING DURATION (hrs.): 24.08 CW VOLUME SAMPLED (gals x 10^6): 982.6000
INTAKE TEMPERATURES (F): MINIMUM= 42.5 MEAN= 44.6 MAXIMUM= 46.8
DISCHARGE TEMPERATURES (F): MINIMUM= 61.2 MEAN= 63.9 MAXIMUM= 68.0 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 02-08APR06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 6854.4

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
RAINBOW SMELT	130	11	.	.	Fresh Dead	
RAINBOW SMELT	118	8	.	.	Fresh Dead	
RAINBOW SMELT	133	12	.	.	Fresh Dead	
RAINBOW SMELT	134	13	.	.	Fresh Dead	
SPOTTAIL SHINER	101	12	.	.	Fresh Dead	

SAMPLING PERIOD: 12-13APR06 START DATE AND TIME: 12APR06:10:15 END DATE AND TIME: 13APR06:09:42
SAMPLING DURATION (hrs.): 23.45 CW VOLUME SAMPLED (gals x 10^6): 943.5694
INTAKE TEMPERATURES (F): MINIMUM= 45.4 MEAN= 47.0 MAXIMUM= 51.1
DISCHARGE TEMPERATURES (F): MINIMUM= 64.2 MEAN= 66.1 MAXIMUM= 78.8 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 09-15APR06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 6368.4

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GREAT LAKES CRAYFISH	65	6	.	.	Fresh Dead	
ALEWIFE	80	2	.	.	Fresh Dead	
ALEWIFE	73	2	.	.	Fresh Dead	
ALEWIFE	66	1	.	.	Fresh Dead	
ALEWIFE	78	2	.	.	Fresh Dead	
ALEWIFE	70	2	.	.	Fresh Dead	
ALEWIFE	75	2	.	.	Fresh Dead	
ALEWIFE	77	2	.	.	Fresh Dead	
ALEWIFE	82	2	.	.	Fresh Dead	
ALEWIFE	73	2	.	.	Fresh Dead	
ALEWIFE	80	2	.	.	Fresh Dead	
ALEWIFE	68	1	.	.	Fresh Dead	
ALEWIFE	72	2	.	.	Fresh Dead	
ALEWIFE	119	11	.	.	Fresh Dead	
ALEWIFE	90	4	.	.	Fresh Dead	
ALEWIFE	72	2	.	.	Fresh Dead	
ALEWIFE	105	6	.	.	Fresh Dead	
ALEWIFE	81	3	.	.	Fresh Dead	
ALEWIFE	81	3	.	.	Fresh Dead	
ALEWIFE	80	3	.	.	Fresh Dead	
ALEWIFE	78	2	.	.	Fresh Dead	
ALEWIFE	70	2	.	.	Fresh Dead	
ALEWIFE	78	3	.	.	Fresh Dead	
ALEWIFE	68	2	.	.	Fresh Dead	
ALEWIFE	74	2	.	.	Fresh Dead	
ALEWIFE	74	2	.	.	Fresh Dead	
ALEWIFE	68	2	.	.	Fresh Dead	
ALEWIFE	70	2	.	.	Fresh Dead	
ALEWIFE	68	2	.	.	Fresh Dead	
RAINBOW SMELT	146	19	.	.	Fresh Dead	
RAINBOW SMELT	94	3	.	.	Fresh Dead	
RAINBOW SMELT	93	4	.	.	Fresh Dead	
RAINBOW SMELT	117	8	.	.	Fresh Dead	
RAINBOW SMELT	110	6	.	.	Fresh Dead	
RAINBOW SMELT	77	2	.	.	Fresh Dead	
RAINBOW SMELT	135	12	.	.	Fresh Dead	
RAINBOW SMELT	131	10	.	.	Fresh Dead	
RAINBOW SMELT	109	7	.	.	Fresh Dead	
RAINBOW SMELT	112	7	.	.	Fresh Dead	
RAINBOW SMELT	102	6	.	.	Fresh Dead	
RAINBOW SMELT	98	4	.	.	Fresh Dead	
RAINBOW SMELT	101	5	.	.	Fresh Dead	
RAINBOW SMELT	102	5	.	.	Fresh Dead	
RAINBOW SMELT	92	4	.	.	Fresh Dead	
RAINBOW SMELT	79	3	.	.	Fresh Dead	
RAINBOW SMELT	90	3	.	.	Fresh Dead	
RAINBOW SMELT	71	2	.	.	Fresh Dead	
RAINBOW SMELT	74	2	.	.	Fresh Dead	
RAINBOW SMELT	47	1	.	.	Fresh Dead	
LONGNOSE DACE	85	7	.	.	Fresh Dead	
WHITE SUCKER	531	1400	.	.	Fresh Dead	
BLACK BULLHEAD	204	100	.	.	Live	
THREESPINE STICKLEBACK	60	2	.	.	Fresh Dead	
THREESPINE STICKLEBACK	59	1	.	.	Fresh Dead	
THREESPINE STICKLEBACK	52	1	.	.	Fresh Dead	
THREESPINE STICKLEBACK	55	1	.	.	Fresh Dead	
THREESPINE STICKLEBACK	57	1	.	.	Fresh Dead	
THREESPINE STICKLEBACK	51	1	.	.	Fresh Dead	
THREESPINE STICKLEBACK	50	1	.	.	Fresh Dead	
THREESPINE STICKLEBACK	53	1	.	.	Fresh Dead	
THREESPINE STICKLEBACK	56	2	.	.	Fresh Dead	
THREESPINE STICKLEBACK	58	2	.	.	Fresh Dead	
THREESPINE STICKLEBACK	53	1	.	.	Fresh Dead	
THREESPINE STICKLEBACK	52	1	.	.	Fresh Dead	
THREESPINE STICKLEBACK	48	1	.	.	Fresh Dead	
THREESPINE STICKLEBACK	55	2	.	.	Fresh Dead	
NINESPINE STICKLEBACK	75	3	.	.	Fresh Dead	
SMALLMOUTH BASS	495	1600	.	.	Live	
YELLOW PERCH	79	4	.	.	Live	
MOTTLED SCULPIN	79	10	.	.	Live	
SLIMY SCULPIN	104	25	.	.	Live	

SAMPLING PERIOD: 19-20APR06 START DATE AND TIME: 19APR06:09:58 END DATE AND TIME: 20APR06:10:05
SAMPLING DURATION (hrs.): 24.12 CW VOLUME SAMPLED (gals x 10^6): 933.8715
INTAKE TEMPERATURES (F): MINIMUM= 46.0 MEAN= 49.0 MAXIMUM= 53.2
DISCHARGE TEMPERATURES (F): MINIMUM= 64.7 MEAN= 69.5 MAXIMUM= 83.7 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 16-22APR06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 6782.4

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GREAT LAKES CRAYFISH	50	3	.	.	Fresh Dead	
ALEWIFE	127	12	.	.	Fresh Dead	
ALEWIFE	78	2	.	.	Fresh Dead	
ALEWIFE	69	2	.	.	Fresh Dead	
ALEWIFE	67	1	.	.	Fresh Dead	
ALEWIFE	94	5	.	.	Fresh Dead	
ALEWIFE	87	5	.	.	Fresh Dead	
ALEWIFE	69	2	.	.	Fresh Dead	
ALEWIFE	85	3	.	.	Fresh Dead	
ALEWIFE	65	2	.	.	Fresh Dead	
ALEWIFE	70	2	.	.	Fresh Dead	
ALEWIFE	72	2	.	.	Fresh Dead	
ALEWIFE	59	1	.	.	Fresh Dead	
UNID ALOSA	.	.	1	1	Fresh Dead	
UNID ALOSA	.	.	1	1	Fresh Dead	
RAINBOW SMELT	122	9	.	.	Fresh Dead	
RAINBOW SMELT	121	8	.	.	Fresh Dead	
RAINBOW SMELT	74	2	.	.	Fresh Dead	
RAINBOW SMELT	114	8	.	.	Fresh Dead	
BURBOT	301	162	.	.	Live	
THREESPINE STICKLEBACK	58	2	.	.	Fresh Dead	
THREESPINE STICKLEBACK	60	2	.	.	Fresh Dead	
THREESPINE STICKLEBACK	56	2	.	.	Fresh Dead	
THREESPINE STICKLEBACK	59	2	.	.	Fresh Dead	
THREESPINE STICKLEBACK	53	1	.	.	Fresh Dead	
THREESPINE STICKLEBACK	53	1	.	.	Fresh Dead	
THREESPINE STICKLEBACK	58	2	.	.	Fresh Dead	
THREESPINE STICKLEBACK	60	2	.	.	Fresh Dead	
THREESPINE STICKLEBACK	54	1	.	.	Fresh Dead	
THREESPINE STICKLEBACK	60	1	.	.	Live	
NINESPINE STICKLEBACK	71	3	.	.	Fresh Dead	
NINESPINE STICKLEBACK	77	3	.	.	Fresh Dead	
NINESPINE STICKLEBACK	66	2	.	.	Live	
MOTTLED SCULPIN	76	7	.	.	Live	
SLIMY SCULPIN	63	5	.	.	Live	
SLIMY SCULPIN	74	7	.	.	Live	
SLIMY SCULPIN	65	5	.	.	Live	

SAMPLING PERIOD: 26-27APR06 START DATE AND TIME: 26APR06:10:10 END DATE AND TIME: 27APR06:06:15
SAMPLING DURATION (hrs.): 20.08 CW VOLUME SAMPLED (gals x 10^6): 819.4000
INTAKE TEMPERATURES (F): MINIMUM= 46.7 MEAN= 48.8 MAXIMUM= 50.4
DISCHARGE TEMPERATURES (F): MINIMUM= 65.3 MEAN= 67.4 MAXIMUM= 68.8 MULTIPLICATION FACTOR: 4.000
WEEKLY EXTRAPOLATION PERIOD: 23-29APR06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 6854.4

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
ALEWIFE	99	4	.	.	Fresh Dead	Yes
ALEWIFE	112	9	.	.	Fresh Dead	Yes
ALEWIFE	126	12	.	.	Fresh Dead	Yes
ALEWIFE	83	3	.	.	Fresh Dead	Yes
ALEWIFE	76	2	.	.	Fresh Dead	Yes
ALEWIFE	90	4	.	.	Fresh Dead	Yes
ALEWIFE	88	4	.	.	Fresh Dead	Yes
ALEWIFE	81	3	.	.	Fresh Dead	Yes
ALEWIFE	106	7	.	.	Fresh Dead	Yes
ALEWIFE	74	2	.	.	Fresh Dead	Yes
ALEWIFE	80	2	.	.	Fresh Dead	Yes
ALEWIFE	84	3	.	.	Fresh Dead	Yes
ALEWIFE	74	2	.	.	Fresh Dead	Yes
ALEWIFE	96	4	.	.	Fresh Dead	Yes
ALEWIFE	97	4	.	.	Fresh Dead	Yes
ALEWIFE	76	2	.	.	Fresh Dead	Yes
ALEWIFE	76	2	.	.	Fresh Dead	Yes
ALEWIFE	142	16	.	.	Fresh Dead	Yes
ALEWIFE	69	1	.	.	Fresh Dead	Yes
ALEWIFE	87	3	.	.	Fresh Dead	Yes
ALEWIFE	76	2	.	.	Fresh Dead	Yes
ALEWIFE	85	3	.	.	Fresh Dead	Yes
ALEWIFE	82	2	.	.	Fresh Dead	Yes
ALEWIFE	82	3	.	.	Fresh Dead	Yes
ALEWIFE	79	2	.	.	Fresh Dead	Yes
ALEWIFE	93	4	.	.	Fresh Dead	Yes
ALEWIFE	129	12	.	.	Fresh Dead	Yes
ALEWIFE	75	2	.	.	Fresh Dead	Yes
ALEWIFE	89	4	.	.	Fresh Dead	Yes
ALEWIFE	72	2	.	.	Fresh Dead	Yes
ALEWIFE	77	2	.	.	Fresh Dead	Yes
ALEWIFE	73	2	.	.	Fresh Dead	Yes
ALEWIFE	82	3	.	.	Fresh Dead	Yes

ALEWIFE	85	4	.	.	Fresh Dead	Yes
ALEWIFE	78	2	.	.	Fresh Dead	Yes
ALEWIFE	84	2	.	.	Fresh Dead	Yes
ALEWIFE	82	3	.	.	Fresh Dead	Yes
ALEWIFE	122	9	.	.	Fresh Dead	Yes
ALEWIFE	168	28	.	.	Fresh Dead	Yes
ALEWIFE	69	1	.	.	Fresh Dead	Yes
ALEWIFE	70	1	.	.	Fresh Dead	Yes
ALEWIFE	84	3	.	.	Fresh Dead	Yes
ALEWIFE	68	1	.	.	Fresh Dead	Yes
ALEWIFE	97	4	.	.	Fresh Dead	Yes
ALEWIFE	96	4	.	.	Fresh Dead	Yes
ALEWIFE	88	3	.	.	Fresh Dead	Yes
ALEWIFE	82	2	.	.	Fresh Dead	Yes
ALEWIFE	64	1	.	.	Fresh Dead	Yes
ALEWIFE	74	2	.	.	Fresh Dead	Yes
ALEWIFE	83	3	.	.	Fresh Dead	Yes
ALEWIFE	.	.	50	155	Fresh Dead	Yes
ALEWIFE	.	.	1333	4800	Fresh Dead	Yes
ALEWIFE	.	.	1583	5700	Fresh Dead	Yes
ALEWIFE	.	.	2306	8300	Fresh Dead	Yes
ALEWIFE	.	.	1750	6300	Fresh Dead	Yes
ALEWIFE	.	.	1139	4100	Fresh Dead	Yes
ALEWIFE	.	.	1444	5200	Fresh Dead	Yes
ALEWIFE	.	.	1611	5800	Fresh Dead	Yes
ALEWIFE	.	.	889	3200	Fresh Dead	Yes
ALEWIFE type	.	.	191	350	Fresh Dead	No
RAINBOW SMELT	116	6	.	.	Fresh Dead	Yes
THREESPINE STICKLEBACK	55	1	.	.	Fresh Dead	Yes
THREESPINE STICKLEBACK	58	2	.	.	Fresh Dead	Yes
THREESPINE STICKLEBACK	53	1	.	.	Fresh Dead	Yes
THREESPINE STICKLEBACK	56	1	.	.	Fresh Dead	Yes
NINESPINE STICKLEBACK	62	2	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	68	2	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	66	2	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	65	2	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	65	2	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	79	3	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	68	2	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	69	3	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	62	2	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	66	2	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	66	3	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	66	2	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	60	2	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	62	2	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	59	2	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	74	3	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	70	3	.	.	Fresh Dead	No
MOTTLED SCULPIN	50	4	.	.	Fresh Dead	Yes
MOTTLED SCULPIN	60	3	.	.	Fresh Dead	Yes
MOTTLED SCULPIN	63	5	.	.	Fresh Dead	Yes
SLIMY SCULPIN	72	5	.	.	Fresh Dead	Yes
SLIMY SCULPIN	65	6	.	.	Fresh Dead	Yes

SAMPLING PERIOD: 03-04MAY06 START DATE AND TIME: 03MAY06:10:15 END DATE AND TIME: 04MAY06:10:00
SAMPLING DURATION (hrs.): 23.75 CW VOLUME SAMPLED (gals x 10^6): 775.0400
INTAKE TEMPERATURES (F): MINIMUM= 44.0 MEAN= 45.9 MAXIMUM= 47.6
DISCHARGE TEMPERATURES (F): MINIMUM= 64.0 MEAN= 70.1 MAXIMUM= 80.0 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 30APR-06MAY06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 6180.5

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GREAT LAKES CRAYFISH	45	1	.	.	Fresh Dead	
ALEWIFE	102	8	.	.	Fresh Dead	
ALEWIFE	75	3	.	.	Fresh Dead	
ALEWIFE	98	6	.	.	Fresh Dead	
ALEWIFE	85	3	.	.	Fresh Dead	
ALEWIFE	99	4	.	.	Fresh Dead	
ALEWIFE	114	8	.	.	Fresh Dead	
ALEWIFE	110	6	.	.	Fresh Dead	
ALEWIFE	94	4	.	.	Fresh Dead	
ALEWIFE	89	4	.	.	Fresh Dead	
ALEWIFE	84	3	.	.	Fresh Dead	
ALEWIFE	85	3	.	.	Fresh Dead	
ALEWIFE	75	2	.	.	Fresh Dead	
ALEWIFE	79	3	.	.	Fresh Dead	
ALEWIFE	82	2	.	.	Fresh Dead	
ALEWIFE	90	4	.	.	Fresh Dead	
ALEWIFE	70	2	.	.	Fresh Dead	
ALEWIFE	70	2	.	.	Fresh Dead	
ALEWIFE	83	3	.	.	Fresh Dead	
ALEWIFE	92	4	.	.	Fresh Dead	
ALEWIFE	93	4	.	.	Fresh Dead	
ALEWIFE	97	6	.	.	Fresh Dead	
ALEWIFE	94	4	.	.	Fresh Dead	
ALEWIFE	63	1	.	.	Fresh Dead	
ALEWIFE	81	3	.	.	Fresh Dead	

ALEWIFE	70	2	.	.	Fresh Dead
ALEWIFE	73	2	.	.	Fresh Dead
ALEWIFE	104	6	.	.	Fresh Dead
ALEWIFE	86	3	.	.	Fresh Dead
ALEWIFE	74	2	.	.	Fresh Dead
ALEWIFE	93	4	.	.	Fresh Dead
ALEWIFE	65	1	.	.	Fresh Dead
ALEWIFE	80	3	.	.	Fresh Dead
ALEWIFE	72	2	.	.	Fresh Dead
ALEWIFE	68	2	.	.	Fresh Dead
ALEWIFE	82	3	.	.	Fresh Dead
ALEWIFE	70	2	.	.	Fresh Dead
ALEWIFE	81	3	.	.	Fresh Dead
ALEWIFE	87	3	.	.	Fresh Dead
ALEWIFE	74	2	.	.	Fresh Dead
ALEWIFE	80	3	.	.	Fresh Dead
ALEWIFE	59	1	.	.	Fresh Dead
ALEWIFE	90	4	.	.	Fresh Dead
ALEWIFE	82	3	.	.	Fresh Dead
ALEWIFE	73	2	.	.	Fresh Dead
ALEWIFE	85	3	.	.	Fresh Dead
ALEWIFE	79	2	.	.	Fresh Dead
ALEWIFE	77	2	.	.	Fresh Dead
ALEWIFE	80	3	.	.	Fresh Dead
ALEWIFE	64	1	.	.	Fresh Dead
ALEWIFE	71	2	.	.	Fresh Dead
ALEWIFE	.	.	40	86	Fresh Dead
ALEWIFE	.	.	26	52	Fresh Dead
ALEWIFE	70	2	.	.	Fresh Dead
ALEWIFE	86	3	.	.	Fresh Dead
ALEWIFE	84	3	.	.	Fresh Dead
ALEWIFE	83	3	.	.	Fresh Dead
ALEWIFE	77	3	.	.	Fresh Dead
ALEWIFE	80	3	.	.	Fresh Dead
ALEWIFE	85	3	.	.	Fresh Dead
ALEWIFE	88	4	.	.	Fresh Dead
ALEWIFE	73	3	.	.	Fresh Dead
ALEWIFE	100	4	.	.	Fresh Dead
ALEWIFE	79	3	.	.	Fresh Dead
ALEWIFE	85	3	.	.	Fresh Dead
ALEWIFE	84	3	.	.	Fresh Dead
ALEWIFE	86	4	.	.	Fresh Dead
ALEWIFE	.	.	154	458	Fresh Dead
ALEWIFE	.	.	215	635	Fresh Dead
ALEWIFE	.	.	487	1850	Fresh Dead
ALEWIFE	.	.	2105	8000	Fresh Dead
ALEWIFE	.	.	2289	8700	Fresh Dead
ALEWIFE	.	.	2211	8400	Fresh Dead
ALEWIFE	.	.	1474	5600	Fresh Dead
ALEWIFE	.	.	1868	7100	Fresh Dead
ALEWIFE	.	.	2395	9100	Fresh Dead
ALEWIFE	.	.	2342	8900	Fresh Dead
ALEWIFE	.	.	1447	5500	Fresh Dead
ALEWIFE	.	.	13158	50000	Fresh Dead
ALEWIFE	.	.	7105	27000	Fresh Dead
ALEWIFE type	.	.	594	2000	Fresh Dead
BROWN TROUT	528	2000	.	.	Fresh Dead
RAINBOW SMELT	120	9	.	.	Fresh Dead
RAINBOW SMELT	153	19	.	.	Fresh Dead
RAINBOW SMELT	115	7	.	.	Fresh Dead
RAINBOW SMELT	124	9	.	.	Fresh Dead
RAINBOW SMELT	133	11	.	.	Fresh Dead
RAINBOW SMELT	127	9	.	.	Fresh Dead
RAINBOW SMELT	113	8	.	.	Fresh Dead
RAINBOW SMELT	154	16	.	.	Fresh Dead
RAINBOW SMELT	145	12	.	.	Fresh Dead
RAINBOW SMELT	124	8	.	.	Fresh Dead
RAINBOW SMELT	121	8	.	.	Fresh Dead
RAINBOW SMELT	116	6	.	.	Fresh Dead
RAINBOW SMELT	120	11	.	.	Fresh Dead
RAINBOW SMELT	127	8	.	.	Fresh Dead
RAINBOW SMELT	133	13	.	.	Fresh Dead
RAINBOW SMELT	131	10	.	.	Fresh Dead
RAINBOW SMELT	112	6	.	.	Fresh Dead
RAINBOW SMELT	108	6	.	.	Fresh Dead
RAINBOW SMELT	139	12	.	.	Fresh Dead
RAINBOW SMELT	120	8	.	.	Fresh Dead
RAINBOW SMELT	125	8	.	.	Fresh Dead
RAINBOW SMELT	112	7	.	.	Fresh Dead
RAINBOW SMELT	126	8	.	.	Fresh Dead
RAINBOW SMELT	139	9	.	.	Fresh Dead
RAINBOW SMELT	118	7	.	.	Fresh Dead
RAINBOW SMELT	112	6	.	.	Fresh Dead
RAINBOW SMELT	132	11	.	.	Fresh Dead
RAINBOW SMELT	127	10	.	.	Fresh Dead
RAINBOW SMELT	135	13	.	.	Fresh Dead
RAINBOW SMELT	82	2	.	.	Fresh Dead
RAINBOW SMELT	59	1	.	.	Fresh Dead
RAINBOW SMELT	110	7	.	.	Fresh Dead
RAINBOW SMELT	127	10	.	.	Fresh Dead

RAINBOW SMELT	124	7	.	.	Fresh Dead
RAINBOW SMELT	123	7	.	.	Fresh Dead
RAINBOW SMELT	105	5	.	.	Fresh Dead
RAINBOW SMELT	54	1	.	.	Fresh Dead
RAINBOW SMELT	99	4	.	.	Fresh Dead
RAINBOW SMELT	95	4	.	.	Fresh Dead
RAINBOW SMELT	114	6	.	.	Fresh Dead
RAINBOW SMELT	107	4	.	.	Fresh Dead
RAINBOW SMELT	117	7	.	.	Fresh Dead
RAINBOW SMELT	135	10	.	.	Fresh Dead
RAINBOW SMELT	112	6	.	.	Fresh Dead
RAINBOW SMELT	127	10	.	.	Fresh Dead
RAINBOW SMELT	120	8	.	.	Fresh Dead
RAINBOW SMELT	130	10	.	.	Fresh Dead
RAINBOW SMELT	134	11	.	.	Fresh Dead
RAINBOW SMELT	113	7	.	.	Fresh Dead
RAINBOW SMELT	127	8	.	.	Fresh Dead
RAINBOW SMELT	.	.	3	20	Fresh Dead
BURBOT	518	1000	.	.	Fresh Dead
BURBOT	460	600	.	.	Fresh Dead
THREESPINE STICKLEBACK	58	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	54	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	60	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	71	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	68	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	69	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	78	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	67	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	64	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	70	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	64	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	62	2	.	.	Fresh Dead
ROUND GOBY	171	85	.	.	Fresh Dead
MOTTLED SCULPIN	62	5	.	.	Fresh Dead
MOTTLED SCULPIN	80	9	.	.	Fresh Dead
MOTTLED SCULPIN	72	6	.	.	Fresh Dead
UNID COTTUS	55	3	.	.	Fresh Dead

SAMPLING PERIOD: 10-11MAY06 START DATE AND TIME: 10MAY06:10:00 END DATE AND TIME: 11MAY06:09:30
SAMPLING DURATION (hrs.): 23.50 CW VOLUME SAMPLED (gals x 10^6): 456.9600
INTAKE TEMPERATURES (F): MINIMUM= 42.9 MEAN= 43.9 MAXIMUM= 47.4
DISCHARGE TEMPERATURES (F): MINIMUM= 61.5 MEAN= 62.8 MAXIMUM= 65.5 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 07-13MAY06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 6854.4

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GREAT LAKES CRAYFISH	55	2	.	.	Fresh Dead	
ALEWIFE	122	9	.	.	Fresh Dead	
ALEWIFE	120	8	.	.	Fresh Dead	
ALEWIFE	103	5	.	.	Fresh Dead	
ALEWIFE	75	3	.	.	Fresh Dead	
ALEWIFE	82	2	.	.	Fresh Dead	
ALEWIFE	104	6	.	.	Fresh Dead	
ALEWIFE	116	8	.	.	Fresh Dead	
ALEWIFE	100	5	.	.	Fresh Dead	
ALEWIFE	89	4	.	.	Fresh Dead	
ALEWIFE	106	6	.	.	Fresh Dead	
ALEWIFE	78	2	.	.	Fresh Dead	
ALEWIFE	109	7	.	.	Fresh Dead	
ALEWIFE	83	2	.	.	Fresh Dead	
ALEWIFE	95	5	.	.	Fresh Dead	
ALEWIFE	88	3	.	.	Fresh Dead	
ALEWIFE	137	13	.	.	Fresh Dead	
ALEWIFE	93	4	.	.	Fresh Dead	
ALEWIFE	84	3	.	.	Fresh Dead	
ALEWIFE	97	5	.	.	Fresh Dead	
ALEWIFE	74	2	.	.	Fresh Dead	
ALEWIFE	85	3	.	.	Fresh Dead	
ALEWIFE	123	11	.	.	Fresh Dead	
ALEWIFE	81	2	.	.	Fresh Dead	
ALEWIFE	86	3	.	.	Fresh Dead	
ALEWIFE	97	4	.	.	Fresh Dead	
ALEWIFE	85	2	.	.	Fresh Dead	
ALEWIFE	108	5	.	.	Fresh Dead	
ALEWIFE	68	1	.	.	Fresh Dead	
ALEWIFE	73	2	.	.	Fresh Dead	
ALEWIFE	102	5	.	.	Fresh Dead	
ALEWIFE	76	2	.	.	Fresh Dead	
ALEWIFE	93	4	.	.	Fresh Dead	
ALEWIFE	80	2	.	.	Fresh Dead	
ALEWIFE	78	2	.	.	Fresh Dead	
ALEWIFE	86	4	.	.	Fresh Dead	
ALEWIFE	89	3	.	.	Fresh Dead	
ALEWIFE	95	4	.	.	Fresh Dead	
ALEWIFE	85	4	.	.	Fresh Dead	
ALEWIFE	90	4	.	.	Fresh Dead	
ALEWIFE	80	2	.	.	Fresh Dead	
ALEWIFE	74	1	.	.	Fresh Dead	

ALEWIFE	86	2	.	.	Fresh Dead
ALEWIFE	93	3	.	.	Fresh Dead
ALEWIFE	71	1	.	.	Fresh Dead
ALEWIFE	95	5	.	.	Fresh Dead
ALEWIFE	85	4	.	.	Fresh Dead
ALEWIFE	69	2	.	.	Fresh Dead
ALEWIFE	88	3	.	.	Fresh Dead
ALEWIFE	73	1	.	.	Fresh Dead
ALEWIFE	70	1	.	.	Fresh Dead
ALEWIFE	.	.	100	350	Fresh Dead
ALEWIFE	.	.	269	970	Fresh Dead
ALEWIFE	.	.	214	770	Fresh Dead
ALEWIFE	.	.	111	400	Fresh Dead
ALEWIFE	.	.	1167	4200	Fresh Dead
ALEWIFE	.	.	1056	3800	Fresh Dead
ALEWIFE	.	.	722	2600	Fresh Dead
ALEWIFE	.	.	1139	4100	Fresh Dead
ALEWIFE	.	.	1139	4100	Fresh Dead
ALEWIFE	.	.	1167	4200	Fresh Dead
ALEWIFE	.	.	889	3200	Fresh Dead
ALEWIFE	.	.	1528	5500	Fresh Dead
RAINBOW SMELT	163	21	.	.	Fresh Dead
RAINBOW SMELT	127	7	.	.	Fresh Dead
RAINBOW SMELT	111	5	.	.	Fresh Dead
RAINBOW SMELT	134	10	.	.	Fresh Dead
RAINBOW SMELT	130	8	.	.	Fresh Dead
RAINBOW SMELT	159	14	.	.	Fresh Dead
RAINBOW SMELT	125	7	.	.	Fresh Dead
RAINBOW SMELT	121	7	.	.	Fresh Dead
RAINBOW SMELT	129	9	.	.	Fresh Dead
RAINBOW SMELT	117	6	.	.	Fresh Dead
RAINBOW SMELT	126	9	.	.	Fresh Dead
RAINBOW SMELT	119	7	.	.	Fresh Dead
RAINBOW SMELT	151	15	.	.	Fresh Dead
RAINBOW SMELT	108	5	.	.	Fresh Dead
RAINBOW SMELT	151	17	.	.	Fresh Dead
RAINBOW SMELT	150	17	.	.	Fresh Dead
RAINBOW SMELT	150	15	.	.	Fresh Dead
RAINBOW SMELT	156	16	.	.	Fresh Dead
RAINBOW SMELT	117	7	.	.	Fresh Dead
RAINBOW SMELT	129	9	.	.	Fresh Dead
RAINBOW SMELT	140	15	.	.	Fresh Dead
RAINBOW SMELT	129	9	.	.	Fresh Dead
RAINBOW SMELT	141	13	.	.	Fresh Dead
RAINBOW SMELT	126	7	.	.	Fresh Dead
RAINBOW SMELT	138	11	.	.	Fresh Dead
RAINBOW SMELT	150	16	.	.	Fresh Dead
RAINBOW SMELT	175	24	.	.	Fresh Dead
RAINBOW SMELT	131	9	.	.	Fresh Dead
RAINBOW SMELT	135	10	.	.	Fresh Dead
RAINBOW SMELT	116	7	.	.	Fresh Dead
RAINBOW SMELT	132	10	.	.	Fresh Dead
RAINBOW SMELT	114	5	.	.	Fresh Dead
RAINBOW SMELT	123	9	.	.	Fresh Dead
RAINBOW SMELT	134	12	.	.	Fresh Dead
RAINBOW SMELT	109	4	.	.	Fresh Dead
RAINBOW SMELT	115	7	.	.	Fresh Dead
RAINBOW SMELT	122	7	.	.	Fresh Dead
RAINBOW SMELT	139	16	.	.	Fresh Dead
RAINBOW SMELT	117	5	.	.	Fresh Dead
RAINBOW SMELT	132	10	.	.	Fresh Dead
RAINBOW SMELT	118	6	.	.	Fresh Dead
RAINBOW SMELT	.	.	4	26	Fresh Dead
THREESPINE STICKLEBACK	56	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	62	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	68	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	66	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	80	4	.	.	Fresh Dead
NINESPINE STICKLEBACK	65	2	.	.	Fresh Dead
MOTTLED SCULPIN	84	9	.	.	Fresh Dead
MOTTLED SCULPIN	75	6	.	.	Fresh Dead
MOTTLED SCULPIN	63	3	.	.	Fresh Dead
MOTTLED SCULPIN	70	6	.	.	Fresh Dead
MOTTLED SCULPIN	65	4	.	.	Fresh Dead
MOTTLED SCULPIN	66	4	.	.	Fresh Dead
SLIMY SCULPIN	60	3	.	.	Fresh Dead

SAMPLING PERIOD: 15-16MAY06 START DATE AND TIME: 15MAY06:10:05 END DATE AND TIME: 16MAY06:10:00
SAMPLING DURATION (hrs.): 23.92 CW VOLUME SAMPLED (gals x 10^6): 542.6400
INTAKE TEMPERATURES (F): MINIMUM= 44.7 MEAN= 47.2 MAXIMUM= 49.2
DISCHARGE TEMPERATURES (F): MINIMUM= 63.3 MEAN= 65.5 MAXIMUM= 67.0 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 14-16MAY06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 2937.6

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GREAT LAKES CRAYFISH	55	3	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	52	2	.	.	Fresh Dead	
ALEWIFE	145	25	.	.	Fresh Dead	

ALEWIFE	189	42	.	.	Fresh Dead
ALEWIFE	178	28	.	.	Fresh Dead
ALEWIFE	175	40	.	.	Fresh Dead
ALEWIFE	139	18	.	.	Fresh Dead
ALEWIFE	76	3	.	.	Fresh Dead
ALEWIFE	77	2	.	.	Fresh Dead
ALEWIFE	97	5	.	.	Fresh Dead
ALEWIFE	81	3	.	.	Fresh Dead
ALEWIFE	79	2	.	.	Fresh Dead
ALEWIFE	84	3	.	.	Fresh Dead
ALEWIFE	77	2	.	.	Fresh Dead
ALEWIFE	82	3	.	.	Fresh Dead
ALEWIFE	75	2	.	.	Fresh Dead
ALEWIFE	73	2	.	.	Fresh Dead
ALEWIFE	63	1	.	.	Fresh Dead
ALEWIFE	75	2	.	.	Fresh Dead
ALEWIFE	69	2	.	.	Fresh Dead
ALEWIFE	69	2	.	.	Fresh Dead
ALEWIFE	96	6	.	.	Fresh Dead
ALEWIFE	80	2	.	.	Fresh Dead
ALEWIFE	88	4	.	.	Fresh Dead
ALEWIFE	77	2	.	.	Fresh Dead
ALEWIFE	79	3	.	.	Fresh Dead
ALEWIFE	72	2	.	.	Fresh Dead
ALEWIFE	79	2	.	.	Fresh Dead
ALEWIFE	74	2	.	.	Fresh Dead
ALEWIFE	78	2	.	.	Fresh Dead
ALEWIFE	72	2	.	.	Fresh Dead
ALEWIFE	73	2	.	.	Fresh Dead
ALEWIFE	70	2	.	.	Fresh Dead
ALEWIFE	76	2	.	.	Fresh Dead
ALEWIFE	84	3	.	.	Fresh Dead
ALEWIFE	81	3	.	.	Fresh Dead
ALEWIFE	86	4	.	.	Fresh Dead
ALEWIFE	80	3	.	.	Fresh Dead
ALEWIFE	73	2	.	.	Fresh Dead
ALEWIFE	76	2	.	.	Fresh Dead
ALEWIFE	82	3	.	.	Fresh Dead
ALEWIFE	76	2	.	.	Fresh Dead
ALEWIFE	80	2	.	.	Fresh Dead
ALEWIFE	70	2	.	.	Fresh Dead
ALEWIFE	65	2	.	.	Fresh Dead
ALEWIFE	66	2	.	.	Fresh Dead
ALEWIFE	65	1	.	.	Fresh Dead
ALEWIFE	74	2	.	.	Fresh Dead
ALEWIFE	64	1	.	.	Fresh Dead
ALEWIFE	73	2	.	.	Fresh Dead
ALEWIFE	73	2	.	.	Fresh Dead
ALEWIFE	94	4	.	.	Fresh Dead
ALEWIFE	.	.	100	300	Fresh Dead
ALEWIFE	.	.	1135	4200	Fresh Dead
ALEWIFE	.	.	1068	3950	Fresh Dead
ALEWIFE	.	.	1176	4350	Fresh Dead
ALEWIFE	.	.	1432	5300	Fresh Dead
ALEWIFE	.	.	1270	4700	Fresh Dead
ALEWIFE	.	.	1108	4100	Fresh Dead
COHO SALMON	85	6	.	.	Fresh Dead
BROWN TROUT	200	85	.	.	Fresh Dead
RAINBOW SMELT	133	11	.	.	Fresh Dead
RAINBOW SMELT	120	8	.	.	Fresh Dead
RAINBOW SMELT	136	13	.	.	Fresh Dead
RAINBOW SMELT	116	7	.	.	Fresh Dead
RAINBOW SMELT	129	10	.	.	Fresh Dead
RAINBOW SMELT	130	10	.	.	Fresh Dead
RAINBOW SMELT	142	11	.	.	Fresh Dead
RAINBOW SMELT	122	10	.	.	Fresh Dead
RAINBOW SMELT	130	9	.	.	Fresh Dead
RAINBOW SMELT	113	8	.	.	Fresh Dead
RAINBOW SMELT	132	10	.	.	Fresh Dead
RAINBOW SMELT	123	9	.	.	Fresh Dead
RAINBOW SMELT	142	15	.	.	Fresh Dead
RAINBOW SMELT	152	17	.	.	Fresh Dead
RAINBOW SMELT	135	12	.	.	Fresh Dead
RAINBOW SMELT	118	7	.	.	Fresh Dead
RAINBOW SMELT	114	7	.	.	Fresh Dead
RAINBOW SMELT	122	8	.	.	Fresh Dead
RAINBOW SMELT	133	11	.	.	Fresh Dead
RAINBOW SMELT	127	10	.	.	Fresh Dead
RAINBOW SMELT	140	12	.	.	Fresh Dead
RAINBOW SMELT	163	21	.	.	Fresh Dead
RAINBOW SMELT	139	14	.	.	Fresh Dead
RAINBOW SMELT	120	8	.	.	Fresh Dead
RAINBOW SMELT	134	14	.	.	Fresh Dead
RAINBOW SMELT	117	7	.	.	Fresh Dead
RAINBOW SMELT	112	7	.	.	Fresh Dead
RAINBOW SMELT	113	7	.	.	Fresh Dead
RAINBOW SMELT	125	9	.	.	Fresh Dead
RAINBOW SMELT	129	10	.	.	Fresh Dead
RAINBOW SMELT	134	13	.	.	Fresh Dead
RAINBOW SMELT	137	14	.	.	Fresh Dead

RAINBOW SMELT	123	7	.	.	Fresh Dead
RAINBOW SMELT	110	6	.	.	Fresh Dead
RAINBOW SMELT	142	11	.	.	Fresh Dead
RAINBOW SMELT	80	2	.	.	Fresh Dead
RAINBOW SMELT	88	3	.	.	Fresh Dead
RAINBOW SMELT	45	1	.	.	Fresh Dead
RAINBOW SMELT	62	1	.	.	Fresh Dead
RAINBOW SMELT	55	1	.	.	Fresh Dead
RAINBOW SMELT	103	3	.	.	Fresh Dead
RAINBOW SMELT	74	2	.	.	Fresh Dead
RAINBOW SMELT	100	5	.	.	Fresh Dead
RAINBOW SMELT	141	15	.	.	Fresh Dead
RAINBOW SMELT	137	13	.	.	Fresh Dead
RAINBOW SMELT	141	13	.	.	Fresh Dead
RAINBOW SMELT	129	10	.	.	Fresh Dead
RAINBOW SMELT	125	7	.	.	Fresh Dead
RAINBOW SMELT	135	12	.	.	Fresh Dead
RAINBOW SMELT	109	5	.	.	Fresh Dead
RAINBOW SMELT	.	.	24	24	Fresh Dead
RAINBOW SMELT	.	.	57	350	Fresh Dead
THREESPINE STICKLEBACK	55	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	53	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	51	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	55	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	56	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	57	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	62	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	61	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	55	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	46	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	51	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	50	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	48	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	54	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	50	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	51	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	52	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	50	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	54	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	49	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	53	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	46	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	45	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	52	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	52	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	49	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	49	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	60	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	58	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	57	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	59	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	64	3	.	.	Fresh Dead
THREESPINE STICKLEBACK	52	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	55	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	60	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	58	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	56	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	57	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	59	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	58	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	49	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	54	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	50	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	58	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	56	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	57	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	59	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	52	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	56	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	58	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	.	.	13	38	Fresh Dead
NINESPINE STICKLEBACK	68	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	72	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	74	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	75	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	71	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	71	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	70	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	66	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	67	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	72	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	72	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	69	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	68	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	74	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	67	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	68	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	64	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	65	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	70	2	.	.	Fresh Dead

NINESPINE STICKLEBACK	66	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	70	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	60	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	72	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	65	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	64	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	61	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	64	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	66	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	56	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	55	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	52	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	57	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	55	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	61	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	58	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	58	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	64	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	68	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	60	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	56	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	59	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	58	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	51	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	57	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	62	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	60	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	58	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	59	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	65	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	63	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	.	.	33	66	Fresh Dead
NINESPINE STICKLEBACK	85	5	.	.	Fresh Dead
MOTTLED SCULPIN	55	1	.	.	Fresh Dead
MOTTLED SCULPIN	75	7	.	.	Fresh Dead
MOTTLED SCULPIN	89	9	.	.	Fresh Dead
MOTTLED SCULPIN	68	4	.	.	Fresh Dead
MOTTLED SCULPIN	98	9	.	.	Fresh Dead
MOTTLED SCULPIN	68	4	.	.	Fresh Dead
MOTTLED SCULPIN	67	3	.	.	Fresh Dead
MOTTLED SCULPIN	70	6	.	.	Fresh Dead
MOTTLED SCULPIN	81	7	.	.	Fresh Dead
MOTTLED SCULPIN	68	4	.	.	Fresh Dead
MOTTLED SCULPIN	50	1	.	.	Fresh Dead

SAMPLING PERIOD: 17-18MAY06 START DATE AND TIME: 17MAY06:10:02 END DATE AND TIME: 18MAY06:10:00
SAMPLING DURATION (hrs.): 23.97 CW VOLUME SAMPLED (gals x 10^6): 814.6400
INTAKE TEMPERATURES (F): MINIMUM= 46.9 MEAN= 48.1 MAXIMUM= 50.3
DISCHARGE TEMPERATURES (F): MINIMUM= 65.6 MEAN= 66.7 MAXIMUM= 68.8 MULTIPLICATION FACTOR: 1.250
WEEKLY EXTRAPOLATION PERIOD: 17-20MAY06 CW VOLUME (gals x 10^6) FOR EXTRAPOLATION PERIOD: 3916.8

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GREAT LAKES CRAYFISH	71	4	.	.	Fresh Dead	No
GREAT LAKES CRAYFISH	70	5	.	.	Fresh Dead	No
ALEWIFE	94	4	.	.	Fresh Dead	Yes
ALEWIFE	81	3	.	.	Fresh Dead	Yes
ALEWIFE	76	2	.	.	Fresh Dead	Yes
ALEWIFE	74	2	.	.	Fresh Dead	Yes
ALEWIFE	64	2	.	.	Fresh Dead	Yes
ALEWIFE	63	1	.	.	Fresh Dead	Yes
ALEWIFE	80	3	.	.	Fresh Dead	Yes
ALEWIFE	84	3	.	.	Fresh Dead	Yes
ALEWIFE	84	3	.	.	Fresh Dead	Yes
ALEWIFE	75	2	.	.	Fresh Dead	Yes
ALEWIFE	77	2	.	.	Fresh Dead	Yes
ALEWIFE	72	2	.	.	Fresh Dead	Yes
ALEWIFE	78	2	.	.	Fresh Dead	Yes
ALEWIFE	71	1	.	.	Fresh Dead	Yes
ALEWIFE	77	2	.	.	Fresh Dead	Yes
ALEWIFE	86	4	.	.	Fresh Dead	Yes
ALEWIFE	73	2	.	.	Fresh Dead	Yes
ALEWIFE	76	2	.	.	Fresh Dead	Yes
ALEWIFE	67	1	.	.	Fresh Dead	Yes
ALEWIFE	101	4	.	.	Fresh Dead	Yes
ALEWIFE	95	5	.	.	Fresh Dead	Yes
ALEWIFE	78	2	.	.	Fresh Dead	Yes
ALEWIFE	72	2	.	.	Fresh Dead	Yes
ALEWIFE	58	1	.	.	Fresh Dead	Yes
ALEWIFE	76	2	.	.	Fresh Dead	Yes
ALEWIFE	70	2	.	.	Fresh Dead	Yes
ALEWIFE	81	3	.	.	Fresh Dead	Yes
ALEWIFE	73	2	.	.	Fresh Dead	Yes
ALEWIFE	60	1	.	.	Fresh Dead	Yes
ALEWIFE	79	3	.	.	Fresh Dead	Yes
ALEWIFE	80	2	.	.	Fresh Dead	Yes
ALEWIFE	64	1	.	.	Fresh Dead	Yes
ALEWIFE	81	3	.	.	Fresh Dead	Yes

ALEWIFE	70	2	.	.	Fresh Dead	Yes
ALEWIFE	72	2	.	.	Fresh Dead	Yes
ALEWIFE	66	1	.	.	Fresh Dead	Yes
ALEWIFE	71	2	.	.	Fresh Dead	Yes
ALEWIFE	69	2	.	.	Fresh Dead	Yes
ALEWIFE	62	1	.	.	Fresh Dead	Yes
ALEWIFE	71	2	.	.	Fresh Dead	Yes
ALEWIFE	73	2	.	.	Fresh Dead	Yes
ALEWIFE	76	3	.	.	Fresh Dead	Yes
ALEWIFE	74	2	.	.	Fresh Dead	Yes
ALEWIFE	74	2	.	.	Fresh Dead	Yes
ALEWIFE	71	2	.	.	Fresh Dead	Yes
ALEWIFE	73	2	.	.	Fresh Dead	Yes
ALEWIFE	61	1	.	.	Fresh Dead	Yes
ALEWIFE	93	4	.	.	Fresh Dead	Yes
ALEWIFE	86	3	.	.	Fresh Dead	Yes
ALEWIFE	79	3	.	.	Fresh Dead	Yes
ALEWIFE	.	.	938	2250	Fresh Dead	Yes
ALEWIFE	.	.	583	1400	Fresh Dead	Yes
ALEWIFE	.	.	100	250	Fresh Dead	Yes
ALEWIFE	.	.	2833	6800	Fresh Dead	Yes
ALEWIFE	.	.	458	1100	Fresh Dead	Yes
ALEWIFE	.	.	1750	4200	Fresh Dead	Yes
ALEWIFE	.	.	1750	4200	Fresh Dead	Yes
ALEWIFE	.	.	2000	4800	Fresh Dead	Yes
ALEWIFE	.	.	2021	4850	Fresh Dead	Yes
ALEWIFE	.	.	1708	4100	Fresh Dead	Yes
ALEWIFE	.	.	1917	4600	Fresh Dead	Yes
ALEWIFE	.	.	1583	3800	Fresh Dead	Yes
ALEWIFE	.	.	1813	4350	Fresh Dead	Yes
ALEWIFE	.	.	1500	3900	Fresh Dead	Yes
ALEWIFE	215	90	.	.	Fresh Dead	No
RAINBOW SMELT	57	1	.	.	Fresh Dead	No
RAINBOW SMELT	63	1	.	.	Fresh Dead	No
RAINBOW SMELT	140	13	.	.	Fresh Dead	No
RAINBOW SMELT	121	9	.	.	Fresh Dead	No
RAINBOW SMELT	128	9	.	.	Fresh Dead	No
RAINBOW SMELT	113	6	.	.	Fresh Dead	No
RAINBOW SMELT	122	8	.	.	Fresh Dead	No
RAINBOW SMELT	116	6	.	.	Fresh Dead	No
RAINBOW SMELT	124	8	.	.	Fresh Dead	No
RAINBOW SMELT	113	7	.	.	Fresh Dead	No
RAINBOW SMELT	110	6	.	.	Fresh Dead	No
RAINBOW SMELT	140	14	.	.	Fresh Dead	No
RAINBOW SMELT	147	14	.	.	Fresh Dead	No
RAINBOW SMELT	147	14	.	.	Fresh Dead	No
RAINBOW SMELT	115	6	.	.	Fresh Dead	No
RAINBOW SMELT	122	7	.	.	Fresh Dead	No
RAINBOW SMELT	124	9	.	.	Fresh Dead	No
RAINBOW SMELT	.	.	4	32	Fresh Dead	No
RAINBOW SMELT	119	7	.	.	Fresh Dead	No
RAINBOW SMELT	136	10	.	.	Fresh Dead	No
RAINBOW SMELT	159	19	.	.	Fresh Dead	No
RAINBOW SMELT	122	7	.	.	Fresh Dead	No
RAINBOW SMELT	124	11	.	.	Fresh Dead	No
RAINBOW SMELT	128	7	.	.	Fresh Dead	No
RAINBOW SMELT	132	12	.	.	Fresh Dead	No
RAINBOW SMELT	124	8	.	.	Fresh Dead	No
RAINBOW SMELT	123	10	.	.	Fresh Dead	No
RAINBOW SMELT	123	7	.	.	Fresh Dead	No
RAINBOW SMELT	129	9	.	.	Fresh Dead	No
RAINBOW SMELT	102	5	.	.	Fresh Dead	No
RAINBOW SMELT	115	6	.	.	Fresh Dead	No
RAINBOW SMELT	125	8	.	.	Fresh Dead	No
RAINBOW SMELT	145	15	.	.	Fresh Dead	No
RAINBOW SMELT	122	8	.	.	Fresh Dead	No
RAINBOW SMELT	124	9	.	.	Fresh Dead	No
RAINBOW SMELT	153	11	.	.	Fresh Dead	No
RAINBOW SMELT	120	8	.	.	Fresh Dead	No
RAINBOW SMELT	106	5	.	.	Fresh Dead	No
RAINBOW SMELT	115	6	.	.	Fresh Dead	No
RAINBOW SMELT	110	5	.	.	Fresh Dead	No
RAINBOW SMELT	137	12	.	.	Fresh Dead	No
RAINBOW SMELT	122	7	.	.	Fresh Dead	No
RAINBOW SMELT	121	5	.	.	Fresh Dead	No
RAINBOW SMELT	119	5	.	.	Fresh Dead	No
RAINBOW SMELT	120	6	.	.	Fresh Dead	No
RAINBOW SMELT	96	3	.	.	Fresh Dead	No
RAINBOW SMELT	131	10	.	.	Fresh Dead	No
RAINBOW SMELT	105	5	.	.	Fresh Dead	No
RAINBOW SMELT	122	8	.	.	Fresh Dead	No
RAINBOW SMELT	131	9	.	.	Fresh Dead	No
RAINBOW SMELT	.	.	42	248	Fresh Dead	No
RAINBOW SMELT	95	8	.	.	Fresh Dead	No
RAINBOW SMELT	112	5	.	.	Fresh Dead	No
RAINBOW SMELT	105	9	.	.	Fresh Dead	No
RAINBOW SMELT	87	6	.	.	Fresh Dead	No
THREESPINE STICKLEBACK	58	2	.	.	Fresh Dead	No
THREESPINE STICKLEBACK	64	3	.	.	Fresh Dead	No
THREESPINE STICKLEBACK	58	2	.	.	Fresh Dead	No

THREESPINE STICKLEBACK	56	1	.	.	Fresh Dead		No
THREESPINE STICKLEBACK	63	2	.	.	Fresh Dead		No
THREESPINE STICKLEBACK	54	1	.	.	Fresh Dead		No
THREESPINE STICKLEBACK	62	2	.	.	Fresh Dead		No
THREESPINE STICKLEBACK	58	2	.	.	Fresh Dead		No
THREESPINE STICKLEBACK	59	2	.	.	Fresh Dead		No
THREESPINE STICKLEBACK	63	4	.	.	Fresh Dead		No
THREESPINE STICKLEBACK	58	3	.	.	Fresh Dead		No
THREESPINE STICKLEBACK	62	2	.	.	Fresh Dead		No
THREESPINE STICKLEBACK	57	2	.	.	Fresh Dead		No
THREESPINE STICKLEBACK	57	2	.	.	Fresh Dead		No
THREESPINE STICKLEBACK	55	1	.	.	Fresh Dead		No
THREESPINE STICKLEBACK	61	2	.	.	Fresh Dead		No
THREESPINE STICKLEBACK	50	1	.	.	Fresh Dead		No
THREESPINE STICKLEBACK	58	2	.	.	Fresh Dead		No
THREESPINE STICKLEBACK	55	1	.	.	Fresh Dead		No
THREESPINE STICKLEBACK	50	1	.	.	Fresh Dead		No
THREESPINE STICKLEBACK	58	2	.	.	Fresh Dead		No
THREESPINE STICKLEBACK	51	1	.	.	Fresh Dead		No
THREESPINE STICKLEBACK	57	2	.	.	Fresh Dead		No
THREESPINE STICKLEBACK	59	2	.	.	Fresh Dead		No
THREESPINE STICKLEBACK	59	2	.	.	Fresh Dead		No
THREESPINE STICKLEBACK	57	2	.	.	Fresh Dead		No
THREESPINE STICKLEBACK	52	1	.	.	Fresh Dead		No
THREESPINE STICKLEBACK	.	.	2	3	Fresh Dead		No
THREESPINE STICKLEBACK	60	2	.	.	Fresh Dead		No
THREESPINE STICKLEBACK	55	1	.	.	Fresh Dead		No
THREESPINE STICKLEBACK	60	2	.	.	Fresh Dead		No
THREESPINE STICKLEBACK	56	2	.	.	Fresh Dead		No
NINESPINE STICKLEBACK	67	3	.	.	Fresh Dead		No
NINESPINE STICKLEBACK	82	3	.	.	Fresh Dead		No
NINESPINE STICKLEBACK	62	1	.	.	Fresh Dead		No
NINESPINE STICKLEBACK	61	1	.	.	Fresh Dead		No
NINESPINE STICKLEBACK	66	2	.	.	Fresh Dead		No
NINESPINE STICKLEBACK	77	3	.	.	Fresh Dead		No
NINESPINE STICKLEBACK	70	2	.	.	Fresh Dead		No
NINESPINE STICKLEBACK	66	2	.	.	Fresh Dead		No
NINESPINE STICKLEBACK	76	4	.	.	Fresh Dead		No
NINESPINE STICKLEBACK	65	2	.	.	Fresh Dead		No
NINESPINE STICKLEBACK	77	3	.	.	Fresh Dead		No
NINESPINE STICKLEBACK	76	3	.	.	Fresh Dead		No
NINESPINE STICKLEBACK	64	2	.	.	Fresh Dead		No
NINESPINE STICKLEBACK	60	2	.	.	Fresh Dead		No
NINESPINE STICKLEBACK	68	2	.	.	Fresh Dead		No
NINESPINE STICKLEBACK	71	3	.	.	Fresh Dead		No
NINESPINE STICKLEBACK	68	2	.	.	Fresh Dead		No
NINESPINE STICKLEBACK	68	3	.	.	Fresh Dead		No
NINESPINE STICKLEBACK	70	3	.	.	Fresh Dead		No
NINESPINE STICKLEBACK	70	3	.	.	Fresh Dead		No
NINESPINE STICKLEBACK	76	3	.	.	Fresh Dead		No
NINESPINE STICKLEBACK	65	2	.	.	Fresh Dead		No
NINESPINE STICKLEBACK	65	2	.	.	Fresh Dead		No
NINESPINE STICKLEBACK	73	3	.	.	Fresh Dead		No
NINESPINE STICKLEBACK	80	4	.	.	Fresh Dead		No
NINESPINE STICKLEBACK	77	4	.	.	Fresh Dead		No
NINESPINE STICKLEBACK	63	2	.	.	Fresh Dead		No
NINESPINE STICKLEBACK	67	2	.	.	Fresh Dead		No
NINESPINE STICKLEBACK	72	3	.	.	Fresh Dead		No
NINESPINE STICKLEBACK	77	3	.	.	Fresh Dead		No
MOTTLED SCULPIN	73	5	.	.	Fresh Dead		No
MOTTLED SCULPIN	75	6	.	.	Fresh Dead		No
MOTTLED SCULPIN	80	7	.	.	Fresh Dead		No
MOTTLED SCULPIN	73	4	.	.	Fresh Dead		No
MOTTLED SCULPIN	64	4	.	.	Fresh Dead		No
MOTTLED SCULPIN	75	6	.	.	Fresh Dead		No
MOTTLED SCULPIN	90	9	.	.	Fresh Dead		No
MOTTLED SCULPIN	65	4	.	.	Fresh Dead		No
MOTTLED SCULPIN	70	4	.	.	Fresh Dead		No
MOTTLED SCULPIN	78	7	.	.	Fresh Dead		No
MOTTLED SCULPIN	75	6	.	.	Fresh Dead		No
MOTTLED SCULPIN	73	6	.	.	Fresh Dead		No
MOTTLED SCULPIN	71	5	.	.	Fresh Dead		No
MOTTLED SCULPIN	61	3	.	.	Fresh Dead		No
MOTTLED SCULPIN	70	3	.	.	Fresh Dead		No
MOTTLED SCULPIN	80	9	.	.	Fresh Dead		No
SLIMY SCULPIN	75	4	.	.	Fresh Dead		No
SLIMY SCULPIN	75	4	.	.	Fresh Dead		No
SLIMY SCULPIN	70	5	.	.	Fresh Dead		No
SLIMY SCULPIN	90	9	.	.	Fresh Dead		No
SLIMY SCULPIN	78	6	.	.	Fresh Dead		No

SAMPLING PERIOD: 22-23MAY06 START DATE AND TIME: 22MAY06:10:19 END DATE AND TIME: 23MAY06:10:21
SAMPLING DURATION (hrs.): 24.03 CW VOLUME SAMPLED (gals x 10^6): 980.5600
INTAKE TEMPERATURES (F): MINIMUM= 47.7 MEAN= 49.0 MAXIMUM= 51.3
DISCHARGE TEMPERATURES (F): MINIMUM= 66.5 MEAN= 68.4 MAXIMUM= 71.8 MULTIPLICATION FACTOR: 1.795
WEEKLY EXTRAPOLATION PERIOD: 21-23MAY06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 2937.6

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GREAT LAKES CRAYFISH	65	5	.	.	Fresh Dead	No
GREAT LAKES CRAYFISH	61	4	.	.	Fresh Dead	No
GREAT LAKES CRAYFISH	62	3	.	.	Fresh Dead	No
GREAT LAKES CRAYFISH	81	6	.	.	Fresh Dead	No
ALEWIFE	81	3	.	.	Fresh Dead	Yes
ALEWIFE	75	3	.	.	Fresh Dead	Yes
ALEWIFE	118	9	.	.	Fresh Dead	Yes
ALEWIFE	108	8	.	.	Fresh Dead	Yes
ALEWIFE	90	4	.	.	Fresh Dead	Yes
ALEWIFE	100	6	.	.	Fresh Dead	Yes
ALEWIFE	80	3	.	.	Fresh Dead	Yes
ALEWIFE	117	9	.	.	Fresh Dead	Yes
ALEWIFE	83	3	.	.	Fresh Dead	Yes
ALEWIFE	87	3	.	.	Fresh Dead	Yes
ALEWIFE	88	3	.	.	Fresh Dead	Yes
ALEWIFE	99	5	.	.	Fresh Dead	Yes
ALEWIFE	98	5	.	.	Fresh Dead	Yes
ALEWIFE	91	4	.	.	Fresh Dead	Yes
ALEWIFE	87	3	.	.	Fresh Dead	Yes
ALEWIFE	92	4	.	.	Fresh Dead	Yes
ALEWIFE	85	4	.	.	Fresh Dead	Yes
ALEWIFE	79	2	.	.	Fresh Dead	Yes
ALEWIFE	95	5	.	.	Fresh Dead	Yes
ALEWIFE	87	3	.	.	Fresh Dead	Yes
ALEWIFE	93	4	.	.	Fresh Dead	Yes
ALEWIFE	89	4	.	.	Fresh Dead	Yes
ALEWIFE	95	4	.	.	Fresh Dead	Yes
ALEWIFE	76	2	.	.	Fresh Dead	Yes
ALEWIFE	74	2	.	.	Fresh Dead	Yes
ALEWIFE	78	2	.	.	Fresh Dead	Yes
ALEWIFE	88	4	.	.	Fresh Dead	Yes
ALEWIFE	79	2	.	.	Fresh Dead	Yes
ALEWIFE	80	3	.	.	Fresh Dead	Yes
ALEWIFE	86	3	.	.	Fresh Dead	Yes
ALEWIFE	76	2	.	.	Fresh Dead	Yes
ALEWIFE	65	1	.	.	Fresh Dead	Yes
ALEWIFE	72	1	.	.	Fresh Dead	Yes
ALEWIFE	95	5	.	.	Fresh Dead	Yes
ALEWIFE	79	2	.	.	Fresh Dead	Yes
ALEWIFE	86	3	.	.	Fresh Dead	Yes
ALEWIFE	84	2	.	.	Fresh Dead	Yes
ALEWIFE	85	4	.	.	Fresh Dead	Yes
ALEWIFE	70	2	.	.	Fresh Dead	Yes
ALEWIFE	79	2	.	.	Fresh Dead	Yes
ALEWIFE	80	3	.	.	Fresh Dead	Yes
ALEWIFE	80	3	.	.	Fresh Dead	Yes
ALEWIFE	72	2	.	.	Fresh Dead	Yes
ALEWIFE	80	2	.	.	Fresh Dead	Yes
ALEWIFE	93	4	.	.	Fresh Dead	Yes
ALEWIFE	87	3	.	.	Fresh Dead	Yes
ALEWIFE	70	2	.	.	Fresh Dead	Yes
ALEWIFE	88	3	.	.	Fresh Dead	Yes
ALEWIFE	84	3	.	.	Fresh Dead	Yes
ALEWIFE	74	2	.	.	Fresh Dead	Yes
ALEWIFE	.	.	100	354	Fresh Dead	Yes
ALEWIFE	.	.	1114	3900	Fresh Dead	Yes
ALEWIFE	.	.	1429	5000	Fresh Dead	Yes
ALEWIFE	.	.	1286	4500	Fresh Dead	Yes
ALEWIFE	.	.	1314	4600	Fresh Dead	Yes
ALEWIFE	.	.	1329	4650	Fresh Dead	Yes
ALEWIFE	.	.	1457	5100	Fresh Dead	Yes
ALEWIFE	.	.	1343	4700	Fresh Dead	Yes
ALEWIFE	.	.	1400	4900	Fresh Dead	Yes
ALEWIFE	.	.	1371	4800	Fresh Dead	Yes
ALEWIFE	.	.	1286	4500	Fresh Dead	Yes
ALEWIFE	.	.	1343	4700	Fresh Dead	Yes
RAINBOW SMELT	134	13	.	.	Fresh Dead	No
RAINBOW SMELT	120	7	.	.	Fresh Dead	No
RAINBOW SMELT	121	9	.	.	Fresh Dead	No
RAINBOW SMELT	121	8	.	.	Fresh Dead	No
RAINBOW SMELT	111	8	.	.	Fresh Dead	No
RAINBOW SMELT	121	7	.	.	Fresh Dead	No
RAINBOW SMELT	119	6	.	.	Fresh Dead	No
RAINBOW SMELT	115	6	.	.	Fresh Dead	No
RAINBOW SMELT	150	10	.	.	Fresh Dead	No
RAINBOW SMELT	102	5	.	.	Fresh Dead	No
RAINBOW SMELT	127	7	.	.	Fresh Dead	No
RAINBOW SMELT	126	8	.	.	Fresh Dead	No
RAINBOW SMELT	91	4	.	.	Fresh Dead	No
RAINBOW SMELT	118	7	.	.	Fresh Dead	No
RAINBOW SMELT	114	6	.	.	Fresh Dead	No
RAINBOW SMELT	128	9	.	.	Fresh Dead	No
RAINBOW SMELT	128	10	.	.	Fresh Dead	No
RAINBOW SMELT	118	7	.	.	Fresh Dead	No
RAINBOW SMELT	127	8	.	.	Fresh Dead	No
RAINBOW SMELT	137	8	.	.	Fresh Dead	No
RAINBOW SMELT	126	7	.	.	Fresh Dead	No

RAINBOW SMELT	127	9	.	.	Fresh Dead	No
RAINBOW SMELT	132	10	.	.	Fresh Dead	No
RAINBOW SMELT	140	12	.	.	Fresh Dead	No
RAINBOW SMELT	114	5	.	.	Fresh Dead	No
RAINBOW SMELT	121	7	.	.	Fresh Dead	No
RAINBOW SMELT	139	11	.	.	Fresh Dead	No
RAINBOW SMELT	114	8	.	.	Fresh Dead	No
RAINBOW SMELT	124	7	.	.	Fresh Dead	No
RAINBOW SMELT	113	5	.	.	Fresh Dead	No
RAINBOW SMELT	125	7	.	.	Fresh Dead	No
RAINBOW SMELT	145	11	.	.	Fresh Dead	No
RAINBOW SMELT	119	7	.	.	Fresh Dead	No
RAINBOW SMELT	117	7	.	.	Fresh Dead	No
RAINBOW SMELT	127	8	.	.	Fresh Dead	No
RAINBOW SMELT	131	7	.	.	Fresh Dead	No
RAINBOW SMELT	109	6	.	.	Fresh Dead	No
RAINBOW SMELT	133	12	.	.	Fresh Dead	No
RAINBOW SMELT	131	11	.	.	Fresh Dead	No
RAINBOW SMELT	151	16	.	.	Fresh Dead	No
RAINBOW SMELT	126	8	.	.	Fresh Dead	No
RAINBOW SMELT	134	10	.	.	Fresh Dead	No
RAINBOW SMELT	121	8	.	.	Fresh Dead	No
RAINBOW SMELT	110	6	.	.	Fresh Dead	No
RAINBOW SMELT	134	10	.	.	Fresh Dead	No
RAINBOW SMELT	138	11	.	.	Fresh Dead	No
RAINBOW SMELT	110	5	.	.	Fresh Dead	No
RAINBOW SMELT	141	10	.	.	Fresh Dead	No
RAINBOW SMELT	137	9	.	.	Fresh Dead	No
RAINBOW SMELT	126	9	.	.	Fresh Dead	No
RAINBOW SMELT	126	7	.	.	Fresh Dead	No
RAINBOW SMELT	123	8	.	.	Fresh Dead	No
RAINBOW SMELT	118	6	.	.	Fresh Dead	No
RAINBOW SMELT	137	11	.	.	Fresh Dead	No
RAINBOW SMELT	.	.	21	204	Fresh Dead	No
RAINBOW SMELT	.	.	16	123	Fresh Dead	No
THREESPINE STICKLEBACK	56	2	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	68	2	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	61	2	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	70	3	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	79	3	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	74	3	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	74	3	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	68	3	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	79	3	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	60	2	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	72	3	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	74	4	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	76	3	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	80	4	.	.	Fresh Dead	No
MOTTLED SCULPIN	84	6	.	.	Fresh Dead	No
MOTTLED SCULPIN	75	5	.	.	Fresh Dead	No
SLIMY SCULPIN	71	5	.	.	Fresh Dead	No
SLIMY SCULPIN	65	5	.	.	Fresh Dead	No
SLIMY SCULPIN	68	4	.	.	Fresh Dead	No
SLIMY SCULPIN	86	10	.	.	Fresh Dead	No
SLIMY SCULPIN	80	8	.	.	Fresh Dead	No
SLIMY SCULPIN	70	6	.	.	Fresh Dead	No
SLIMY SCULPIN	65	5	.	.	Fresh Dead	No
SLIMY SCULPIN	72	7	.	.	Fresh Dead	No
SLIMY SCULPIN	80	6	.	.	Fresh Dead	No
SLIMY SCULPIN	71	5	.	.	Fresh Dead	No
SLIMY SCULPIN	64	4	.	.	Fresh Dead	No
SLIMY SCULPIN	80	7	.	.	Fresh Dead	No
SLIMY SCULPIN	72	4	.	.	Fresh Dead	No
SLIMY SCULPIN	73	5	.	.	Fresh Dead	No
SLIMY SCULPIN	67	4	.	.	Fresh Dead	No
SLIMY SCULPIN	73	5	.	.	Fresh Dead	No
SLIMY SCULPIN	75	5	.	.	Fresh Dead	No
SLIMY SCULPIN	62	3	.	.	Fresh Dead	No

SAMPLING PERIOD: 24-25MAY06 START DATE AND TIME: 24MAY06:10:10 END DATE AND TIME: 25MAY06:10:23
SAMPLING DURATION (hrs.): 24.22 CW VOLUME SAMPLED (gals x 10^6): 760.2400
INTAKE TEMPERATURES (F): MINIMUM= 45.5 MEAN= 47.1 MAXIMUM= 50.3
DISCHARGE TEMPERATURES (F): MINIMUM= 64.5 MEAN= 66.2 MAXIMUM= 70.2 MULTIPLICATION FACTOR: 5.900
WEEKLY EXTRAPOLATION PERIOD: 24-27MAY06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 3916.8

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
ALEWIFE	70	1	.	.	Fresh Dead	Yes
ALEWIFE	88	2	.	.	Fresh Dead	Yes
ALEWIFE	69	1	.	.	Fresh Dead	Yes
ALEWIFE	79	2	.	.	Fresh Dead	Yes
ALEWIFE	79	2	.	.	Fresh Dead	Yes
ALEWIFE	76	1	.	.	Fresh Dead	Yes
ALEWIFE	91	3	.	.	Fresh Dead	Yes
ALEWIFE	113	9	.	.	Fresh Dead	Yes
ALEWIFE	72	1	.	.	Fresh Dead	Yes
ALEWIFE	97	4	.	.	Fresh Dead	Yes

ALEWIFE	81	2	.	.	Fresh Dead	Yes
ALEWIFE	69	1	.	.	Fresh Dead	Yes
ALEWIFE	71	1	.	.	Fresh Dead	Yes
ALEWIFE	75	2	.	.	Fresh Dead	Yes
ALEWIFE	66	1	.	.	Fresh Dead	Yes
ALEWIFE	80	2	.	.	Fresh Dead	Yes
ALEWIFE	96	4	.	.	Fresh Dead	Yes
ALEWIFE	81	2	.	.	Fresh Dead	Yes
ALEWIFE	68	1	.	.	Fresh Dead	Yes
ALEWIFE	78	2	.	.	Fresh Dead	Yes
ALEWIFE	129	11	.	.	Fresh Dead	Yes
ALEWIFE	81	2	.	.	Fresh Dead	Yes
ALEWIFE	93	4	.	.	Fresh Dead	Yes
ALEWIFE	89	2	.	.	Fresh Dead	Yes
ALEWIFE	110	8	.	.	Fresh Dead	Yes
ALEWIFE	80	2	.	.	Fresh Dead	Yes
ALEWIFE	80	3	.	.	Fresh Dead	Yes
ALEWIFE	70	1	.	.	Fresh Dead	Yes
ALEWIFE	86	2	.	.	Fresh Dead	Yes
ALEWIFE	92	4	.	.	Fresh Dead	Yes
ALEWIFE	82	2	.	.	Fresh Dead	Yes
ALEWIFE	80	2	.	.	Fresh Dead	Yes
ALEWIFE	75	1	.	.	Fresh Dead	Yes
ALEWIFE	77	2	.	.	Fresh Dead	Yes
ALEWIFE	80	2	.	.	Fresh Dead	Yes
ALEWIFE	93	3	.	.	Fresh Dead	Yes
ALEWIFE	85	2	.	.	Fresh Dead	Yes
ALEWIFE	79	2	.	.	Fresh Dead	Yes
ALEWIFE	74	2	.	.	Fresh Dead	Yes
ALEWIFE	79	2	.	.	Fresh Dead	Yes
ALEWIFE	73	1	.	.	Fresh Dead	Yes
ALEWIFE	75	1	.	.	Fresh Dead	Yes
ALEWIFE	102	5	.	.	Fresh Dead	Yes
ALEWIFE	95	5	.	.	Fresh Dead	Yes
ALEWIFE	80	2	.	.	Fresh Dead	Yes
ALEWIFE	71	1	.	.	Fresh Dead	Yes
ALEWIFE	69	1	.	.	Fresh Dead	Yes
ALEWIFE	77	2	.	.	Fresh Dead	Yes
ALEWIFE	73	1	.	.	Fresh Dead	Yes
ALEWIFE	78	2	.	.	Fresh Dead	Yes
ALEWIFE	.	.	100	202	Fresh Dead	Yes
ALEWIFE	.	.	2318	5100	Fresh Dead	Yes
ALEWIFE	.	.	1591	3500	Fresh Dead	Yes
ALEWIFE	.	.	2364	5200	Fresh Dead	Yes
ALEWIFE	.	.	2318	5100	Fresh Dead	Yes
ALEWIFE	.	.	2227	4900	Fresh Dead	Yes
ALEWIFE	.	.	2636	5800	Fresh Dead	Yes
ALEWIFE	.	.	2500	5500	Fresh Dead	Yes
ALEWIFE	.	.	1727	3800	Fresh Dead	Yes
ALEWIFE	.	.	2273	5000	Fresh Dead	Yes
ALEWIFE	.	.	2386	5250	Fresh Dead	Yes
ALEWIFE	.	.	2545	5600	Fresh Dead	Yes
ALEWIFE	.	.	205	450	Fresh Dead	Yes
ALEWIFE	.	.	1182	2600	Fresh Dead	Yes
COHO SALMON	90	7	.	.	Fresh Dead	No
RAINBOW SMELT	120	5	.	.	Fresh Dead	Yes
RAINBOW SMELT	123	6	.	.	Fresh Dead	Yes
RAINBOW SMELT	95	5	.	.	Fresh Dead	Yes
RAINBOW SMELT	130	9	.	.	Fresh Dead	Yes
RAINBOW SMELT	115	5	.	.	Fresh Dead	Yes
RAINBOW SMELT	132	9	.	.	Fresh Dead	Yes
RAINBOW SMELT	118	7	.	.	Fresh Dead	Yes
RAINBOW SMELT	129	9	.	.	Fresh Dead	Yes
RAINBOW SMELT	125	7	.	.	Fresh Dead	Yes
RAINBOW SMELT	126	8	.	.	Fresh Dead	Yes
RAINBOW SMELT	119	5	.	.	Fresh Dead	Yes
RAINBOW SMELT	86	1	.	.	Fresh Dead	Yes
RAINBOW SMELT	109	3	.	.	Fresh Dead	Yes
RAINBOW SMELT	115	5	.	.	Fresh Dead	Yes
RAINBOW SMELT	95	5	.	.	Fresh Dead	Yes
RAINBOW SMELT	70	1	.	.	Fresh Dead	Yes
RAINBOW SMELT	115	4	.	.	Fresh Dead	Yes
RAINBOW SMELT	95	1	.	.	Fresh Dead	Yes
RAINBOW SMELT	120	9	.	.	Fresh Dead	Yes
RAINBOW SMELT	112	5	.	.	Fresh Dead	Yes
RAINBOW SMELT	119	8	.	.	Fresh Dead	Yes
RAINBOW SMELT	135	9	.	.	Fresh Dead	Yes
RAINBOW SMELT	115	8	.	.	Fresh Dead	Yes
RAINBOW SMELT	126	10	.	.	Fresh Dead	Yes
RAINBOW SMELT	119	8	.	.	Fresh Dead	Yes
RAINBOW SMELT	44	1	.	.	Fresh Dead	Yes
RAINBOW SMELT	55	1	.	.	Fresh Dead	Yes
RAINBOW SMELT	54	1	.	.	Fresh Dead	Yes
RAINBOW SMELT	46	1	.	.	Fresh Dead	Yes
RAINBOW SMELT	.	.	1	5	Fresh Dead	Yes
RAINBOW SMELT	55	1	.	.	Fresh Dead	Yes
RAINBOW SMELT	147	12	.	.	Fresh Dead	Yes
RAINBOW SMELT	126	7	.	.	Fresh Dead	Yes
RAINBOW SMELT	117	5	.	.	Fresh Dead	Yes
RAINBOW SMELT	109	5	.	.	Fresh Dead	Yes

RAINBOW SMELT	120	7	.	.	Fresh Dead	Yes
RAINBOW SMELT	120	7	.	.	Fresh Dead	Yes
RAINBOW SMELT	121	8	.	.	Fresh Dead	Yes
RAINBOW SMELT	121	8	.	.	Fresh Dead	Yes
RAINBOW SMELT	139	10	.	.	Fresh Dead	Yes
RAINBOW SMELT	127	8	.	.	Fresh Dead	Yes
RAINBOW SMELT	112	5	.	.	Fresh Dead	Yes
RAINBOW SMELT	121	7	.	.	Fresh Dead	Yes
RAINBOW SMELT	115	6	.	.	Fresh Dead	Yes
RAINBOW SMELT	115	6	.	.	Fresh Dead	Yes
RAINBOW SMELT	111	6	.	.	Fresh Dead	Yes
RAINBOW SMELT	122	8	.	.	Fresh Dead	Yes
RAINBOW SMELT	112	6	.	.	Fresh Dead	Yes
RAINBOW SMELT	115	6	.	.	Fresh Dead	Yes
RAINBOW SMELT	115	6	.	.	Fresh Dead	Yes
RAINBOW SMELT	.	.	17	100	Fresh Dead	Yes
RAINBOW SMELT	.	.	8	50	Fresh Dead	Yes
THREESPINE STICKLEBACK	55	1	.	.	Fresh Dead	Yes
THREESPINE STICKLEBACK	52	1	.	.	Fresh Dead	Yes
THREESPINE STICKLEBACK	44	1	.	.	Fresh Dead	Yes
NINESPINE STICKLEBACK	82	4	.	.	Fresh Dead	Yes
NINESPINE STICKLEBACK	58	2	.	.	Fresh Dead	Yes
NINESPINE STICKLEBACK	60	2	.	.	Fresh Dead	Yes
NINESPINE STICKLEBACK	68	3	.	.	Fresh Dead	Yes
NINESPINE STICKLEBACK	67	3	.	.	Fresh Dead	Yes
NINESPINE STICKLEBACK	68	2	.	.	Fresh Dead	Yes
NINESPINE STICKLEBACK	62	2	.	.	Fresh Dead	Yes
MOTTLED SCULPIN	68	5	.	.	Fresh Dead	Yes
MOTTLED SCULPIN	115	29	.	.	Fresh Dead	No
MOTTLED SCULPIN	65	4	.	.	Fresh Dead	No
MOTTLED SCULPIN	60	3	.	.	Fresh Dead	No
MOTTLED SCULPIN	59	3	.	.	Fresh Dead	No
SLIMY SCULPIN	65	4	.	.	Fresh Dead	Yes
SLIMY SCULPIN	68	5	.	.	Fresh Dead	Yes

SAMPLING PERIOD: 29-30MAY06 START DATE AND TIME: 29MAY06:10:15 END DATE AND TIME: 30MAY06:10:15
SAMPLING DURATION (hrs.): 24.00 CW VOLUME SAMPLED (gals x 10^6): 756.1600
INTAKE TEMPERATURES (F): MINIMUM= 44.1 MEAN= 46.6 MAXIMUM= 49.6
DISCHARGE TEMPERATURES (F): MINIMUM= 62.6 MEAN= 65.9 MAXIMUM= 69.9 MULTIPLICATION FACTOR: 15.600
WEEKLY EXTRAPOLATION PERIOD: 28-30MAY06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 2937.6

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
ALEWIFE	.	.	100	440	Fresh Dead	Yes
ALEWIFE	.	.	1317	5400	Fresh Dead	Yes
ALEWIFE	.	.	1244	5100	Fresh Dead	Yes
ALEWIFE	109	7	.	.	Fresh Dead	Yes
ALEWIFE	140	12	.	.	Fresh Dead	Yes
ALEWIFE	91	5	.	.	Fresh Dead	Yes
ALEWIFE	70	1	.	.	Fresh Dead	Yes
ALEWIFE	82	3	.	.	Fresh Dead	Yes
ALEWIFE	85	3	.	.	Fresh Dead	Yes
ALEWIFE	85	3	.	.	Fresh Dead	Yes
ALEWIFE	95	4	.	.	Fresh Dead	Yes
ALEWIFE	77	1	.	.	Fresh Dead	Yes
ALEWIFE	90	4	.	.	Fresh Dead	Yes
ALEWIFE	74	1	.	.	Fresh Dead	Yes
ALEWIFE	99	5	.	.	Fresh Dead	Yes
ALEWIFE	106	6	.	.	Fresh Dead	Yes
ALEWIFE	106	5	.	.	Fresh Dead	Yes
ALEWIFE	80	2	.	.	Fresh Dead	Yes
ALEWIFE	95	4	.	.	Fresh Dead	Yes
ALEWIFE	80	3	.	.	Fresh Dead	Yes
ALEWIFE	111	6	.	.	Fresh Dead	Yes
ALEWIFE	108	6	.	.	Fresh Dead	Yes
ALEWIFE	78	1	.	.	Fresh Dead	Yes
ALEWIFE	67	1	.	.	Fresh Dead	Yes
ALEWIFE	98	4	.	.	Fresh Dead	Yes
ALEWIFE	109	6	.	.	Fresh Dead	Yes
ALEWIFE	82	2	.	.	Fresh Dead	Yes
ALEWIFE	83	2	.	.	Fresh Dead	Yes
ALEWIFE	110	5	.	.	Fresh Dead	Yes
ALEWIFE	96	4	.	.	Fresh Dead	Yes
ALEWIFE	87	3	.	.	Fresh Dead	Yes
ALEWIFE	111	6	.	.	Fresh Dead	Yes
ALEWIFE	97	4	.	.	Fresh Dead	Yes
ALEWIFE	90	3	.	.	Fresh Dead	Yes
ALEWIFE	120	8	.	.	Fresh Dead	Yes
ALEWIFE	83	2	.	.	Fresh Dead	Yes
ALEWIFE	80	2	.	.	Fresh Dead	Yes
ALEWIFE	74	1	.	.	Fresh Dead	Yes
ALEWIFE	88	3	.	.	Fresh Dead	Yes
ALEWIFE	78	1	.	.	Fresh Dead	Yes
ALEWIFE	88	2	.	.	Fresh Dead	Yes
ALEWIFE	69	1	.	.	Fresh Dead	Yes
ALEWIFE	84	4	.	.	Fresh Dead	Yes
ALEWIFE	90	4	.	.	Fresh Dead	Yes
ALEWIFE	87	3	.	.	Fresh Dead	Yes

ALEWIFE	90	4	.	.	Fresh Dead	Yes
ALEWIFE	81	2	.	.	Fresh Dead	Yes
ALEWIFE	85	4	.	.	Fresh Dead	Yes
ALEWIFE	65	1	.	.	Fresh Dead	Yes
ALEWIFE	97	4	.	.	Fresh Dead	Yes
ALEWIFE	99	5	.	.	Fresh Dead	Yes
ALEWIFE	90	3	.	.	Fresh Dead	Yes
ALEWIFE	85	3	.	.	Fresh Dead	Yes
ALEWIFE	.	.	1317	5400	Fresh Dead	Yes
ALEWIFE	.	.	1463	6000	Fresh Dead	Yes
ALEWIFE	.	.	1463	6000	Fresh Dead	Yes
ALEWIFE	.	.	1341	5500	Fresh Dead	Yes
ALEWIFE	.	.	1220	5000	Fresh Dead	Yes
ALEWIFE	.	.	1415	5800	Fresh Dead	Yes
ALEWIFE	.	.	1415	5800	Fresh Dead	Yes
ALEWIFE	.	.	1439	5900	Fresh Dead	Yes
RAINBOW SMELT	113	5	.	.	Fresh Dead	No
RAINBOW SMELT	105	5	.	.	Fresh Dead	No
RAINBOW SMELT	119	7	.	.	Fresh Dead	No
RAINBOW SMELT	120	8	.	.	Fresh Dead	No
RAINBOW SMELT	132	11	.	.	Fresh Dead	No
RAINBOW SMELT	120	4	.	.	Fresh Dead	No
RAINBOW SMELT	144	13	.	.	Fresh Dead	No
RAINBOW SMELT	120	5	.	.	Fresh Dead	No
RAINBOW SMELT	130	11	.	.	Fresh Dead	No
RAINBOW SMELT	123	8	.	.	Fresh Dead	No
RAINBOW SMELT	124	6	.	.	Fresh Dead	No
RAINBOW SMELT	112	6	.	.	Fresh Dead	No
RAINBOW SMELT	127	6	.	.	Fresh Dead	No
RAINBOW SMELT	137	9	.	.	Fresh Dead	No
RAINBOW SMELT	114	6	.	.	Fresh Dead	No
RAINBOW SMELT	126	5	.	.	Fresh Dead	No
RAINBOW SMELT	172	26	.	.	Fresh Dead	No
RAINBOW SMELT	.	.	2	6	Fresh Dead	No
RAINBOW SMELT	138	10	.	.	Fresh Dead	No
RAINBOW SMELT	114	5	.	.	Fresh Dead	No
RAINBOW SMELT	115	6	.	.	Fresh Dead	No
RAINBOW SMELT	106	4	.	.	Fresh Dead	No
RAINBOW SMELT	121	6	.	.	Fresh Dead	No
RAINBOW SMELT	135	9	.	.	Fresh Dead	No
RAINBOW SMELT	122	6	.	.	Fresh Dead	No
RAINBOW SMELT	130	5	.	.	Fresh Dead	No
RAINBOW SMELT	141	11	.	.	Fresh Dead	No
RAINBOW SMELT	119	7	.	.	Fresh Dead	No
RAINBOW SMELT	125	8	.	.	Fresh Dead	No
RAINBOW SMELT	125	8	.	.	Fresh Dead	No
RAINBOW SMELT	60	1	.	.	Fresh Dead	No
RAINBOW SMELT	59	1	.	.	Fresh Dead	No
RAINBOW SMELT	56	1	.	.	Fresh Dead	No
RAINBOW SMELT	50	1	.	.	Fresh Dead	No
RAINBOW SMELT	54	1	.	.	Fresh Dead	No
RAINBOW SMELT	45	1	.	.	Fresh Dead	No
RAINBOW SMELT	90	5	.	.	Fresh Dead	No
RAINBOW SMELT	116	5	.	.	Fresh Dead	No
RAINBOW SMELT	129	10	.	.	Fresh Dead	No
RAINBOW SMELT	120	6	.	.	Fresh Dead	No
RAINBOW SMELT	105	5	.	.	Fresh Dead	No
RAINBOW SMELT	124	9	.	.	Fresh Dead	No
RAINBOW SMELT	126	10	.	.	Fresh Dead	No
RAINBOW SMELT	119	7	.	.	Fresh Dead	No
RAINBOW SMELT	117	7	.	.	Fresh Dead	No
RAINBOW SMELT	114	7	.	.	Fresh Dead	No
RAINBOW SMELT	124	8	.	.	Fresh Dead	No
RAINBOW SMELT	141	11	.	.	Fresh Dead	No
RAINBOW SMELT	145	11	.	.	Fresh Dead	No
RAINBOW SMELT	119	6	.	.	Fresh Dead	No
RAINBOW SMELT	117	7	.	.	Fresh Dead	No
RAINBOW SMELT	120	6	.	.	Fresh Dead	No
RAINBOW SMELT	121	6	.	.	Fresh Dead	No
RAINBOW SMELT	126	9	.	.	Fresh Dead	No
RAINBOW SMELT	118	7	.	.	Fresh Dead	No
RAINBOW SMELT	127	7	.	.	Fresh Dead	No
RAINBOW SMELT	115	5	.	.	Fresh Dead	No
RAINBOW SMELT	120	7	.	.	Fresh Dead	No
RAINBOW SMELT	110	5	.	.	Fresh Dead	No
RAINBOW SMELT	.	.	100	690	Fresh Dead	No
RAINBOW SMELT	.	.	84	610	Fresh Dead	No
BLACK BULLHEAD	168	62	.	.	Live	No
BLACK BULLHEAD	263	229	.	.	Live	No
BURBOT	581	1945	.	.	Fresh Dead	No
THREESPINE STICKLEBACK	46	1	.	.	Fresh Dead	No
THREESPINE STICKLEBACK	60	2	.	.	Fresh Dead	No
THREESPINE STICKLEBACK	54	1	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	56	1	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	55	1	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	58	2	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	68	3	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	76	4	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	60	2	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	58	2	.	.	Fresh Dead	No

NINESPINE STICKLEBACK	57	2	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	78	3	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	74	3	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	69	2	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	64	2	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	59	2	.	.	Fresh Dead	No
MOTTLED SCULPIN	78	5	.	.	Fresh Dead	No
MOTTLED SCULPIN	65	3	.	.	Fresh Dead	No
MOTTLED SCULPIN	80	5	.	.	Fresh Dead	No
MOTTLED SCULPIN	85	5	.	.	Fresh Dead	No
MOTTLED SCULPIN	83	6	.	.	Fresh Dead	No
SLIMY SCULPIN	80	7	.	.	Fresh Dead	No
SLIMY SCULPIN	90	9	.	.	Fresh Dead	No
SLIMY SCULPIN	70	4	.	.	Fresh Dead	No
SLIMY SCULPIN	65	4	.	.	Fresh Dead	No
SLIMY SCULPIN	90	7	.	.	Fresh Dead	No

SAMPLING PERIOD: 31MAY-01JUN06 START DATE AND TIME: 31MAY06:10:00 END DATE AND TIME: 01JUN06:10:00
SAMPLING DURATION (hrs.): 24.00 CW VOLUME SAMPLED (gals x 10^6): 918.0000
INTAKE TEMPERATURES (F): MINIMUM= 46.6 MEAN= 50.2 MAXIMUM= 52.6
DISCHARGE TEMPERATURES (F): MINIMUM= 65.4 MEAN= 68.4 MAXIMUM= 70.7 MULTIPLICATION FACTOR: 13.130
WEEKLY EXTRAPOLATION PERIOD: 31MAY-03JUN06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 3916.8

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
ALEWIFE	.	.	100	440	Fresh Dead	Yes
ALEWIFE	95	4	.	.	Fresh Dead	Yes
ALEWIFE	94	4	.	.	Fresh Dead	Yes
ALEWIFE	91	3	.	.	Fresh Dead	Yes
ALEWIFE	113	8	.	.	Fresh Dead	Yes
ALEWIFE	90	4	.	.	Fresh Dead	Yes
ALEWIFE	86	3	.	.	Fresh Dead	Yes
ALEWIFE	81	3	.	.	Fresh Dead	Yes
ALEWIFE	94	5	.	.	Fresh Dead	Yes
ALEWIFE	153	24	.	.	Fresh Dead	Yes
ALEWIFE	88	4	.	.	Fresh Dead	Yes
ALEWIFE	98	4	.	.	Fresh Dead	Yes
ALEWIFE	90	5	.	.	Fresh Dead	Yes
ALEWIFE	84	3	.	.	Fresh Dead	Yes
ALEWIFE	166	20	.	.	Fresh Dead	Yes
ALEWIFE	87	3	.	.	Fresh Dead	Yes
ALEWIFE	108	7	.	.	Fresh Dead	Yes
ALEWIFE	161	25	.	.	Fresh Dead	Yes
ALEWIFE	107	7	.	.	Fresh Dead	Yes
ALEWIFE	88	4	.	.	Fresh Dead	Yes
ALEWIFE	96	5	.	.	Fresh Dead	Yes
ALEWIFE	122	10	.	.	Fresh Dead	Yes
ALEWIFE	96	4	.	.	Fresh Dead	Yes
ALEWIFE	111	8	.	.	Fresh Dead	Yes
ALEWIFE	95	5	.	.	Fresh Dead	Yes
ALEWIFE	93	4	.	.	Fresh Dead	Yes
ALEWIFE	113	8	.	.	Fresh Dead	Yes
ALEWIFE	156	20	.	.	Fresh Dead	Yes
ALEWIFE	84	4	.	.	Fresh Dead	Yes
ALEWIFE	100	5	.	.	Fresh Dead	Yes
ALEWIFE	110	6	.	.	Fresh Dead	Yes
ALEWIFE	88	3	.	.	Fresh Dead	Yes
ALEWIFE	86	3	.	.	Fresh Dead	Yes
ALEWIFE	116	6	.	.	Fresh Dead	Yes
ALEWIFE	80	3	.	.	Fresh Dead	Yes
ALEWIFE	74	2	.	.	Fresh Dead	Yes
ALEWIFE	93	4	.	.	Fresh Dead	Yes
ALEWIFE	88	3	.	.	Fresh Dead	Yes
ALEWIFE	91	3	.	.	Fresh Dead	Yes
ALEWIFE	122	10	.	.	Fresh Dead	Yes
ALEWIFE	85	3	.	.	Fresh Dead	Yes
ALEWIFE	75	3	.	.	Fresh Dead	Yes
ALEWIFE	92	4	.	.	Fresh Dead	Yes
ALEWIFE	83	3	.	.	Fresh Dead	Yes
ALEWIFE	81	2	.	.	Fresh Dead	Yes
ALEWIFE	89	3	.	.	Fresh Dead	Yes
ALEWIFE	91	4	.	.	Fresh Dead	Yes
ALEWIFE	88	4	.	.	Fresh Dead	Yes
ALEWIFE	79	3	.	.	Fresh Dead	Yes
ALEWIFE	74	2	.	.	Fresh Dead	Yes
ALEWIFE	88	4	.	.	Fresh Dead	Yes
ALEWIFE	.	.	694	3400	Fresh Dead	Yes
ALEWIFE	.	.	1857	9100	Fresh Dead	Yes
ALEWIFE	.	.	1939	9500	Fresh Dead	Yes
ALEWIFE	.	.	127	625	Fresh Dead	Yes
ALEWIFE	.	.	2265	11100	Fresh Dead	Yes
ALEWIFE	.	.	1143	5600	Fresh Dead	Yes
ALEWIFE	.	.	3061	15000	Fresh Dead	Yes
ALEWIFE	.	.	1878	9200	Fresh Dead	Yes
ALEWIFE	.	.	857	4200	Fresh Dead	Yes
ALEWIFE	.	.	765	3747	Fresh Dead	Yes
RAINBOW SMELT	141	14	.	.	Fresh Dead	No
RAINBOW SMELT	123	8	.	.	Fresh Dead	No

RAINBOW SMELT	119	7	.	.	Fresh Dead	No
RAINBOW SMELT	124	8	.	.	Fresh Dead	No
RAINBOW SMELT	130	9	.	.	Fresh Dead	No
RAINBOW SMELT	119	8	.	.	Fresh Dead	No
RAINBOW SMELT	138	11	.	.	Fresh Dead	No
RAINBOW SMELT	127	8	.	.	Fresh Dead	No
RAINBOW SMELT	131	11	.	.	Fresh Dead	No
RAINBOW SMELT	125	8	.	.	Fresh Dead	No
RAINBOW SMELT	126	9	.	.	Fresh Dead	No
RAINBOW SMELT	133	8	.	.	Fresh Dead	No
RAINBOW SMELT	112	4	.	.	Fresh Dead	No
RAINBOW SMELT	97	4	.	.	Fresh Dead	No
RAINBOW SMELT	120	8	.	.	Fresh Dead	No
RAINBOW SMELT	125	9	.	.	Fresh Dead	No
RAINBOW SMELT	118	7	.	.	Fresh Dead	No
RAINBOW SMELT	130	7	.	.	Fresh Dead	No
RAINBOW SMELT	122	7	.	.	Fresh Dead	No
RAINBOW SMELT	118	7	.	.	Fresh Dead	No
RAINBOW SMELT	123	7	.	.	Fresh Dead	No
RAINBOW SMELT	111	6	.	.	Fresh Dead	No
RAINBOW SMELT	113	5	.	.	Fresh Dead	No
RAINBOW SMELT	112	6	.	.	Fresh Dead	No
RAINBOW SMELT	111	5	.	.	Fresh Dead	No
RAINBOW SMELT	123	8	.	.	Fresh Dead	No
RAINBOW SMELT	140	12	.	.	Fresh Dead	No
RAINBOW SMELT	146	13	.	.	Fresh Dead	No
RAINBOW SMELT	141	13	.	.	Fresh Dead	No
RAINBOW SMELT	143	14	.	.	Fresh Dead	No
RAINBOW SMELT	132	10	.	.	Fresh Dead	No
RAINBOW SMELT	156	20	.	.	Fresh Dead	No
RAINBOW SMELT	113	5	.	.	Fresh Dead	No
RAINBOW SMELT	116	4	.	.	Fresh Dead	No
RAINBOW SMELT	105	4	.	.	Fresh Dead	No
RAINBOW SMELT	121	8	.	.	Fresh Dead	No
RAINBOW SMELT	126	9	.	.	Fresh Dead	No
RAINBOW SMELT	70	1	.	.	Fresh Dead	No
RAINBOW SMELT	115	5	.	.	Fresh Dead	No
RAINBOW SMELT	158	19	.	.	Fresh Dead	No
RAINBOW SMELT	113	5	.	.	Fresh Dead	No
RAINBOW SMELT	118	7	.	.	Fresh Dead	No
RAINBOW SMELT	124	8	.	.	Fresh Dead	No
RAINBOW SMELT	131	10	.	.	Fresh Dead	No
RAINBOW SMELT	129	9	.	.	Fresh Dead	No
RAINBOW SMELT	125	8	.	.	Fresh Dead	No
RAINBOW SMELT	107	5	.	.	Fresh Dead	No
RAINBOW SMELT	110	5	.	.	Fresh Dead	No
RAINBOW SMELT	139	9	.	.	Fresh Dead	No
RAINBOW SMELT	130	6	.	.	Fresh Dead	No
RAINBOW SMELT	119	8	.	.	Fresh Dead	No
RAINBOW SMELT	115	6	.	.	Fresh Dead	No
RAINBOW SMELT	135	10	.	.	Fresh Dead	No
RAINBOW SMELT	128	6	.	.	Fresh Dead	No
RAINBOW SMELT	123	8	.	.	Fresh Dead	No
RAINBOW SMELT	116	6	.	.	Fresh Dead	No
RAINBOW SMELT	.	.	2	13	Fresh Dead	No
RAINBOW SMELT	.	.	23	225	Fresh Dead	No
RAINBOW SMELT	.	.	36	186	Fresh Dead	No
BLACK BULLHEAD	221	190	.	.	Fresh Dead	No
THREESPINE STICKLEBACK	54	2	.	.	Fresh Dead	No
THREESPINE STICKLEBACK	58	2	.	.	Fresh Dead	No
THREESPINE STICKLEBACK	59	1	.	.	Fresh Dead	No
THREESPINE STICKLEBACK	59	1	.	.	Fresh Dead	No
THREESPINE STICKLEBACK	54	1	.	.	Fresh Dead	No
THREESPINE STICKLEBACK	55	1	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	65	3	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	75	4	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	65	2	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	59	1	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	63	2	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	69	3	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	75	2	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	.	.	6	18	Fresh Dead	No
YELLOW PERCH	80	3	.	.	Fresh Dead	No
ROUND GOBY	164	64	.	.	Fresh Dead	No
ROUND GOBY	151	65	.	.	Fresh Dead	No
MOTTLED SCULPIN	65	4	.	.	Fresh Dead	No
MOTTLED SCULPIN	64	4	.	.	Fresh Dead	No

SAMPLING PERIOD: 05-06JUN06 START DATE AND TIME: 05JUN06:10:25 END DATE AND TIME: 06JUN06:10:20
SAMPLING DURATION (hrs.): 23.92 CW VOLUME SAMPLED (gals x 10^6): 836.4000
INTAKE TEMPERATURES (F): MINIMUM= 46.0 MEAN= 52.1 MAXIMUM= 61.4
DISCHARGE TEMPERATURES (F): MINIMUM= 64.8 MEAN= 71.5 MAXIMUM= 81.2 MULTIPLICATION FACTOR: 8.200
WEEKLY EXTRAPOLATION PERIOD: 04-06JUN06 CW VOLUME (gals x 10^6) FOR EXTRAPOLATION PERIOD: 2937.6

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
ALEWIFE	82	2	.	.	Fresh Dead	Yes
ALEWIFE	77	2	.	.	Fresh Dead	Yes

ALEWIFE	88	3	.	.	Fresh Dead	Yes
ALEWIFE	105	7	.	.	Fresh Dead	Yes
ALEWIFE	125	9	.	.	Fresh Dead	Yes
ALEWIFE	93	4	.	.	Fresh Dead	Yes
ALEWIFE	83	3	.	.	Fresh Dead	Yes
ALEWIFE	89	3	.	.	Fresh Dead	Yes
ALEWIFE	84	3	.	.	Fresh Dead	Yes
ALEWIFE	67	1	.	.	Fresh Dead	Yes
ALEWIFE	72	2	.	.	Fresh Dead	Yes
ALEWIFE	99	5	.	.	Fresh Dead	Yes
ALEWIFE	93	4	.	.	Fresh Dead	Yes
ALEWIFE	68	2	.	.	Fresh Dead	Yes
ALEWIFE	76	2	.	.	Fresh Dead	Yes
ALEWIFE	87	3	.	.	Fresh Dead	Yes
ALEWIFE	85	3	.	.	Fresh Dead	Yes
ALEWIFE	75	2	.	.	Fresh Dead	Yes
ALEWIFE	113	9	.	.	Fresh Dead	Yes
ALEWIFE	86	3	.	.	Fresh Dead	Yes
ALEWIFE	79	2	.	.	Fresh Dead	Yes
ALEWIFE	95	4	.	.	Fresh Dead	Yes
ALEWIFE	92	3	.	.	Fresh Dead	Yes
ALEWIFE	84	2	.	.	Fresh Dead	Yes
ALEWIFE	78	2	.	.	Fresh Dead	Yes
ALEWIFE	90	4	.	.	Fresh Dead	Yes
ALEWIFE	101	5	.	.	Fresh Dead	Yes
ALEWIFE	75	2	.	.	Fresh Dead	Yes
ALEWIFE	90	4	.	.	Fresh Dead	Yes
ALEWIFE	81	2	.	.	Fresh Dead	Yes
ALEWIFE	82	3	.	.	Fresh Dead	Yes
ALEWIFE	65	2	.	.	Fresh Dead	Yes
ALEWIFE	93	3	.	.	Fresh Dead	Yes
ALEWIFE	77	2	.	.	Fresh Dead	Yes
ALEWIFE	82	2	.	.	Fresh Dead	Yes
ALEWIFE	85	3	.	.	Fresh Dead	Yes
ALEWIFE	76	2	.	.	Fresh Dead	Yes
ALEWIFE	83	3	.	.	Fresh Dead	Yes
ALEWIFE	80	2	.	.	Fresh Dead	Yes
ALEWIFE	76	2	.	.	Fresh Dead	Yes
ALEWIFE	72	2	.	.	Fresh Dead	Yes
ALEWIFE	76	2	.	.	Fresh Dead	Yes
ALEWIFE	72	2	.	.	Fresh Dead	Yes
ALEWIFE	75	2	.	.	Fresh Dead	Yes
ALEWIFE	68	1	.	.	Fresh Dead	Yes
ALEWIFE	75	2	.	.	Fresh Dead	Yes
ALEWIFE	69	2	.	.	Fresh Dead	Yes
ALEWIFE	86	2	.	.	Fresh Dead	Yes
ALEWIFE	101	5	.	.	Fresh Dead	Yes
ALEWIFE	113	8	.	.	Fresh Dead	Yes
ALEWIFE	.	.	100	262	Fresh Dead	Yes
ALEWIFE	.	.	1857	5200	Fresh Dead	Yes
ALEWIFE	.	.	1821	5100	Fresh Dead	Yes
ALEWIFE	.	.	1679	4700	Fresh Dead	Yes
ALEWIFE	.	.	2071	5800	Fresh Dead	Yes
ALEWIFE	.	.	1750	4900	Fresh Dead	Yes
ALEWIFE	.	.	1107	3100	Fresh Dead	Yes
ALEWIFE	.	.	2143	6000	Fresh Dead	Yes
ALEWIFE	.	.	2036	5700	Fresh Dead	Yes
ALEWIFE	.	.	929	2600	Fresh Dead	Yes
ALEWIFE	.	.	2071	5800	Fresh Dead	Yes
ALEWIFE	.	.	2036	5700	Fresh Dead	Yes
ALEWIFE	.	.	1107	3100	Fresh Dead	Yes
RAINBOW SMELT	94	5	.	.	Fresh Dead	No
RAINBOW SMELT	120	8	.	.	Fresh Dead	No
RAINBOW SMELT	118	5	.	.	Fresh Dead	No
RAINBOW SMELT	98	4	.	.	Fresh Dead	No
LONGNOSE DACE	103	13	.	.	Fresh Dead	No
BURBOT	.	.	1	.	Long Dead	No
THREESPINE STICKLEBACK	52	1	.	.	Fresh Dead	No
THREESPINE STICKLEBACK	56	1	.	.	Fresh Dead	No
THREESPINE STICKLEBACK	57	1	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	64	2	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	69	2	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	72	3	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	69	3	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	77	3	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	79	3	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	70	2	.	.	Fresh Dead	No
MOTTLED SCULPIN	63	4	.	.	Fresh Dead	No
MOTTLED SCULPIN	91	12	.	.	Fresh Dead	No
MOTTLED SCULPIN	85	8	.	.	Fresh Dead	No
MOTTLED SCULPIN	88	8	.	.	Fresh Dead	No
MOTTLED SCULPIN	76	6	.	.	Fresh Dead	No
MOTTLED SCULPIN	89	6	.	.	Fresh Dead	No
MOTTLED SCULPIN	72	5	.	.	Fresh Dead	No
MOTTLED SCULPIN	80	7	.	.	Fresh Dead	No
SLIMY SCULPIN	83	7	.	.	Fresh Dead	No

SAMPLING PERIOD: 07-08JUN06 START DATE AND TIME: 07JUN06:10:00 END DATE AND TIME: 08JUN06:09:45
SAMPLING DURATION (hrs.): 23.75 CW VOLUME SAMPLED (gals x 10^6): 132.6000
INTAKE TEMPERATURES (F): MINIMUM= 47.8 MEAN= 50.7 MAXIMUM= 51.9
DISCHARGE TEMPERATURES (F): MINIMUM= 65.5 MEAN= 69.0 MAXIMUM= 70.4 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 07-10JUN06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 3916.8

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
ALEWIFE	103	6	.	.	Fresh Dead	
ALEWIFE	99	5	.	.	Fresh Dead	
ALEWIFE	91	4	.	.	Fresh Dead	
ALEWIFE	97	4	.	.	Fresh Dead	
ALEWIFE	169	33	.	.	Fresh Dead	
ALEWIFE	87	3	.	.	Fresh Dead	
ALEWIFE	122	10	.	.	Fresh Dead	
ALEWIFE	101	6	.	.	Fresh Dead	
ALEWIFE	90	3	.	.	Fresh Dead	
ALEWIFE	100	5	.	.	Fresh Dead	
ALEWIFE	107	5	.	.	Fresh Dead	
ALEWIFE	77	2	.	.	Fresh Dead	
ALEWIFE	84	3	.	.	Fresh Dead	
ALEWIFE	87	3	.	.	Fresh Dead	
ALEWIFE	85	3	.	.	Fresh Dead	
ALEWIFE	92	4	.	.	Fresh Dead	
ALEWIFE	93	4	.	.	Fresh Dead	
ALEWIFE	107	6	.	.	Fresh Dead	
ALEWIFE	98	5	.	.	Fresh Dead	
ALEWIFE	89	3	.	.	Fresh Dead	
ALEWIFE	80	2	.	.	Fresh Dead	
ALEWIFE	96	4	.	.	Fresh Dead	
ALEWIFE	74	2	.	.	Fresh Dead	
ALEWIFE	92	4	.	.	Fresh Dead	
ALEWIFE	94	4	.	.	Fresh Dead	
ALEWIFE	70	2	.	.	Fresh Dead	
ALEWIFE	101	5	.	.	Fresh Dead	
ALEWIFE	112	6	.	.	Fresh Dead	
ALEWIFE	94	4	.	.	Fresh Dead	
ALEWIFE	97	5	.	.	Fresh Dead	
ALEWIFE	85	3	.	.	Fresh Dead	
ALEWIFE	75	2	.	.	Fresh Dead	
ALEWIFE	86	3	.	.	Fresh Dead	
ALEWIFE	84	3	.	.	Fresh Dead	
ALEWIFE	89	4	.	.	Fresh Dead	
ALEWIFE	86	2	.	.	Fresh Dead	
ALEWIFE	83	3	.	.	Fresh Dead	
ALEWIFE	95	4	.	.	Fresh Dead	
ALEWIFE	94	4	.	.	Fresh Dead	
ALEWIFE	80	2	.	.	Fresh Dead	
ALEWIFE	132	14	.	.	Fresh Dead	
ALEWIFE	97	4	.	.	Fresh Dead	
ALEWIFE	109	6	.	.	Fresh Dead	
ALEWIFE	90	4	.	.	Fresh Dead	
ALEWIFE	68	1	.	.	Fresh Dead	
ALEWIFE	82	2	.	.	Fresh Dead	
ALEWIFE	78	2	.	.	Fresh Dead	
ALEWIFE	100	5	.	.	Fresh Dead	
ALEWIFE	88	3	.	.	Fresh Dead	
ALEWIFE	95	4	.	.	Fresh Dead	
ALEWIFE	.	.	100	270	Fresh Dead	
ALEWIFE	.	.	1606	5300	Fresh Dead	
ALEWIFE	.	.	1424	4700	Fresh Dead	
ALEWIFE	.	.	1545	5100	Fresh Dead	
ALEWIFE	.	.	1242	4100	Fresh Dead	
ALEWIFE	.	.	1818	6000	Fresh Dead	
ALEWIFE	.	.	1212	4000	Fresh Dead	
ALEWIFE	.	.	1667	5500	Fresh Dead	
ALEWIFE	.	.	1818	6000	Fresh Dead	
ALEWIFE	.	.	394	1300	Fresh Dead	
ALEWIFE	.	.	455	1500	Fresh Dead	
ALEWIFE	.	.	1848	6100	Fresh Dead	
ALEWIFE	.	.	1970	6500	Fresh Dead	
ALEWIFE	.	.	303	1000	Fresh Dead	
ALEWIFE	.	.	152	500	Fresh Dead	
ALEWIFE	.	.	1545	5100	Fresh Dead	
ALEWIFE	.	.	1758	5800	Fresh Dead	
ALEWIFE	.	.	1758	5800	Fresh Dead	
ALEWIFE	.	.	1848	6100	Fresh Dead	
ALEWIFE	.	.	1939	6400	Fresh Dead	
ALEWIFE	.	.	1848	6100	Fresh Dead	
ALEWIFE	.	.	1697	5600	Fresh Dead	
ALEWIFE	.	.	758	2500	Fresh Dead	
ALEWIFE	.	.	121	400	Fresh Dead	
ALEWIFE	.	.	1485	4900	Fresh Dead	
ALEWIFE	.	.	1212	4000	Fresh Dead	
ALEWIFE	.	.	2394	7900	Fresh Dead	
ALEWIFE	.	.	2515	8300	Fresh Dead	
ALEWIFE	.	.	3091	10200	Fresh Dead	
ALEWIFE	.	.	2970	9800	Fresh Dead	
ALEWIFE	.	.	788	2600	Fresh Dead	

ALEWIFE	.	.	1909	6300	Fresh Dead
ALEWIFE	.	.	3152	10400	Fresh Dead
ALEWIFE	.	.	1182	3900	Fresh Dead
ALEWIFE	.	.	1273	4200	Fresh Dead
ALEWIFE	.	.	1939	6400	Fresh Dead
ALEWIFE	.	.	1394	4600	Fresh Dead
ALEWIFE	.	.	636	2100	Fresh Dead
ALEWIFE	.	.	2970	9800	Fresh Dead
RAINBOW SMELT	120	7	.	.	Fresh Dead
RAINBOW SMELT	164	14	.	.	Fresh Dead
RAINBOW SMELT	118	7	.	.	Fresh Dead
RAINBOW SMELT	124	8	.	.	Fresh Dead
RAINBOW SMELT	114	5	.	.	Fresh Dead
RAINBOW SMELT	153	18	.	.	Fresh Dead
RAINBOW SMELT	110	5	.	.	Fresh Dead
RAINBOW SMELT	135	8	.	.	Fresh Dead
RAINBOW SMELT	149	10	.	.	Fresh Dead
RAINBOW SMELT	111	5	.	.	Fresh Dead
RAINBOW SMELT	110	5	.	.	Fresh Dead
RAINBOW SMELT	102	4	.	.	Fresh Dead
RAINBOW SMELT	120	7	.	.	Fresh Dead
RAINBOW SMELT	116	6	.	.	Fresh Dead
RAINBOW SMELT	133	10	.	.	Fresh Dead
RAINBOW SMELT	108	5	.	.	Fresh Dead
RAINBOW SMELT	129	7	.	.	Fresh Dead
RAINBOW SMELT	114	7	.	.	Fresh Dead
RAINBOW SMELT	120	8	.	.	Fresh Dead
RAINBOW SMELT	95	4	.	.	Fresh Dead
RAINBOW SMELT	114	6	.	.	Fresh Dead
RAINBOW SMELT	110	7	.	.	Fresh Dead
RAINBOW SMELT	88	3	.	.	Fresh Dead
RAINBOW SMELT	115	5	.	.	Fresh Dead
RAINBOW SMELT	150	12	.	.	Fresh Dead
RAINBOW SMELT	118	7	.	.	Fresh Dead
RAINBOW SMELT	115	7	.	.	Fresh Dead
RAINBOW SMELT	125	8	.	.	Fresh Dead
RAINBOW SMELT	128	9	.	.	Fresh Dead
RAINBOW SMELT	120	6	.	.	Fresh Dead
RAINBOW SMELT	111	6	.	.	Fresh Dead
RAINBOW SMELT	134	9	.	.	Fresh Dead
RAINBOW SMELT	133	8	.	.	Fresh Dead
RAINBOW SMELT	128	8	.	.	Fresh Dead
RAINBOW SMELT	122	6	.	.	Fresh Dead
RAINBOW SMELT	146	13	.	.	Fresh Dead
RAINBOW SMELT	119	6	.	.	Fresh Dead
RAINBOW SMELT	156	18	.	.	Fresh Dead
RAINBOW SMELT	120	7	.	.	Fresh Dead
RAINBOW SMELT	111	5	.	.	Fresh Dead
RAINBOW SMELT	146	10	.	.	Fresh Dead
RAINBOW SMELT	111	6	.	.	Fresh Dead
RAINBOW SMELT	130	9	.	.	Fresh Dead
RAINBOW SMELT	142	11	.	.	Fresh Dead
RAINBOW SMELT	112	5	.	.	Fresh Dead
RAINBOW SMELT	112	5	.	.	Fresh Dead
RAINBOW SMELT	78	2	.	.	Fresh Dead
RAINBOW SMELT	128	10	.	.	Fresh Dead
RAINBOW SMELT	137	13	.	.	Fresh Dead
RAINBOW SMELT	126	8	.	.	Fresh Dead
RAINBOW SMELT	125	8	.	.	Fresh Dead
RAINBOW SMELT	125	8	.	.	Fresh Dead
RAINBOW SMELT	124	7	.	.	Fresh Dead
RAINBOW SMELT	121	6	.	.	Fresh Dead
RAINBOW SMELT	113	5	.	.	Fresh Dead
RAINBOW SMELT	151	17	.	.	Fresh Dead
RAINBOW SMELT	155	20	.	.	Fresh Dead
RAINBOW SMELT	124	9	.	.	Fresh Dead
RAINBOW SMELT	86	4	.	.	Fresh Dead
WHITE SUCKER	486	1200	.	.	Fresh Dead
BLACK BULLHEAD	116	21	.	.	Fresh Dead
THREESPINE STICKLEBACK	55	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	56	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	60	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	66	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	54	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	50	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	69	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	75	4	.	.	Fresh Dead
NINESPINE STICKLEBACK	61	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	63	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	58	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	60	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	67	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	75	3	.	.	Fresh Dead
YELLOW PERCH	272	250	.	.	Fresh Dead
MOTTLED SCULPIN	86	9	.	.	Fresh Dead
MOTTLED SCULPIN	70	5	.	.	Fresh Dead
MOTTLED SCULPIN	73	5	.	.	Fresh Dead

SAMPLING PERIOD: 12-13JUN06 START DATE AND TIME: 12JUN06:10:16 END DATE AND TIME: 13JUN06:10:17
SAMPLING DURATION (hrs.): 24.02 CW VOLUME SAMPLED (gals x 10^6): 806.4800
INTAKE TEMPERATURES (F): MINIMUM= 55.9 MEAN= 57.7 MAXIMUM= 60.0
DISCHARGE TEMPERATURES (F): MINIMUM= 74.1 MEAN= 76.4 MAXIMUM= 78.7 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 11-13JUN06 CW VOLUME (gals x 10^6) FOR EXTRAPOLATION PERIOD: 2937.6

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GREAT LAKES CRAYFISH	.	.	2	.	Fresh Dead	
ALEWIFE	81	3	.	.	Fresh Dead	
ALEWIFE	114	6	.	.	Fresh Dead	
ALEWIFE	99	6	.	.	Fresh Dead	
ALEWIFE	88	3	.	.	Fresh Dead	
ALEWIFE	100	6	.	.	Fresh Dead	
ALEWIFE	97	6	.	.	Fresh Dead	
ALEWIFE	84	4	.	.	Fresh Dead	
ALEWIFE	90	4	.	.	Fresh Dead	
ALEWIFE	118	7	.	.	Fresh Dead	
ALEWIFE	97	5	.	.	Fresh Dead	
ALEWIFE	110	6	.	.	Fresh Dead	
ALEWIFE	88	3	.	.	Fresh Dead	
ALEWIFE	109	7	.	.	Fresh Dead	
ALEWIFE	113	6	.	.	Fresh Dead	
ALEWIFE	90	4	.	.	Fresh Dead	
ALEWIFE	80	2	.	.	Fresh Dead	
ALEWIFE	81	3	.	.	Fresh Dead	
ALEWIFE	85	3	.	.	Fresh Dead	
ALEWIFE	96	4	.	.	Fresh Dead	
ALEWIFE	125	12	.	.	Fresh Dead	
ALEWIFE	110	6	.	.	Fresh Dead	
ALEWIFE	95	5	.	.	Fresh Dead	
ALEWIFE	88	3	.	.	Fresh Dead	
ALEWIFE	80	2	.	.	Fresh Dead	
ALEWIFE	111	8	.	.	Fresh Dead	
ALEWIFE	114	8	.	.	Fresh Dead	
ALEWIFE	82	2	.	.	Fresh Dead	
ALEWIFE	76	2	.	.	Fresh Dead	
ALEWIFE	91	3	.	.	Fresh Dead	
ALEWIFE	90	4	.	.	Fresh Dead	
ALEWIFE	89	3	.	.	Fresh Dead	
ALEWIFE	87	3	.	.	Fresh Dead	
ALEWIFE	94	5	.	.	Fresh Dead	
ALEWIFE	90	4	.	.	Fresh Dead	
ALEWIFE	122	12	.	.	Fresh Dead	
ALEWIFE	100	5	.	.	Fresh Dead	
ALEWIFE	93	3	.	.	Fresh Dead	
ALEWIFE	80	3	.	.	Fresh Dead	
ALEWIFE	90	3	.	.	Fresh Dead	
ALEWIFE	100	7	.	.	Fresh Dead	
ALEWIFE	95	3	.	.	Fresh Dead	
ALEWIFE	86	4	.	.	Fresh Dead	
ALEWIFE	71	2	.	.	Fresh Dead	
ALEWIFE	98	5	.	.	Fresh Dead	
ALEWIFE	95	4	.	.	Fresh Dead	
ALEWIFE	80	3	.	.	Fresh Dead	
ALEWIFE	140	18	.	.	Fresh Dead	
ALEWIFE	87	3	.	.	Fresh Dead	
ALEWIFE	89	4	.	.	Fresh Dead	
ALEWIFE	108	6	.	.	Fresh Dead	
ALEWIFE	.	.	100	275	Fresh Dead	
ALEWIFE	.	.	1571	5500	Fresh Dead	
ALEWIFE	.	.	1429	5000	Fresh Dead	
ALEWIFE	.	.	1200	4200	Fresh Dead	
ALEWIFE	.	.	1486	5200	Fresh Dead	
ALEWIFE	.	.	1429	5000	Fresh Dead	
ALEWIFE	.	.	1457	5100	Fresh Dead	
ALEWIFE	.	.	1086	3800	Fresh Dead	
ALEWIFE	.	.	1257	4400	Fresh Dead	
ALEWIFE	.	.	1314	4600	Fresh Dead	
ALEWIFE	.	.	971	3400	Fresh Dead	
ALEWIFE	.	.	1714	6000	Fresh Dead	
CHINOOK SALMON	83	6	.	.	Fresh Dead	
RAINBOW SMELT	142	9	.	.	Fresh Dead	
RAINBOW SMELT	105	5	.	.	Fresh Dead	
RAINBOW SMELT	117	6	.	.	Fresh Dead	
RAINBOW SMELT	112	5	.	.	Fresh Dead	
RAINBOW SMELT	123	6	.	.	Fresh Dead	
RAINBOW SMELT	133	10	.	.	Fresh Dead	
RAINBOW SMELT	118	7	.	.	Fresh Dead	
RAINBOW SMELT	72	1	.	.	Fresh Dead	
RAINBOW SMELT	131	10	.	.	Fresh Dead	
RAINBOW SMELT	99	4	.	.	Fresh Dead	
RAINBOW SMELT	107	6	.	.	Fresh Dead	
RAINBOW SMELT	110	5	.	.	Fresh Dead	
RAINBOW SMELT	82	2	.	.	Fresh Dead	
RAINBOW SMELT	131	9	.	.	Fresh Dead	
RAINBOW SMELT	105	3	.	.	Fresh Dead	
RAINBOW SMELT	116	5	.	.	Fresh Dead	
RAINBOW SMELT	116	6	.	.	Fresh Dead	

RAINBOW SMELT	144	12	.	.	Fresh Dead
RAINBOW SMELT	114	6	.	.	Fresh Dead
RAINBOW SMELT	102	4	.	.	Fresh Dead
RAINBOW SMELT	113	5	.	.	Fresh Dead
RAINBOW SMELT	123	7	.	.	Fresh Dead
RAINBOW SMELT	105	5	.	.	Fresh Dead
RAINBOW SMELT	136	10	.	.	Fresh Dead
RAINBOW SMELT	137	9	.	.	Fresh Dead
RAINBOW SMELT	83	3	.	.	Fresh Dead
RAINBOW SMELT	120	6	.	.	Fresh Dead
RAINBOW SMELT	87	3	.	.	Fresh Dead
RAINBOW SMELT	126	8	.	.	Fresh Dead
RAINBOW SMELT	123	7	.	.	Fresh Dead
RAINBOW SMELT	95	3	.	.	Fresh Dead
RAINBOW SMELT	124	8	.	.	Fresh Dead
RAINBOW SMELT	88	3	.	.	Fresh Dead
RAINBOW SMELT	124	5	.	.	Fresh Dead
RAINBOW SMELT	123	8	.	.	Fresh Dead
RAINBOW SMELT	106	4	.	.	Fresh Dead
RAINBOW SMELT	68	1	.	.	Fresh Dead
RAINBOW SMELT	100	4	.	.	Fresh Dead
RAINBOW SMELT	105	4	.	.	Fresh Dead
RAINBOW SMELT	122	5	.	.	Fresh Dead
RAINBOW SMELT	123	7	.	.	Fresh Dead
RAINBOW SMELT	91	3	.	.	Fresh Dead
RAINBOW SMELT	131	9	.	.	Fresh Dead
RAINBOW SMELT	128	7	.	.	Fresh Dead
RAINBOW SMELT	71	1	.	.	Fresh Dead
RAINBOW SMELT	85	2	.	.	Fresh Dead
RAINBOW SMELT	127	6	.	.	Fresh Dead
RAINBOW SMELT	102	5	.	.	Fresh Dead
RAINBOW SMELT	94	4	.	.	Fresh Dead
RAINBOW SMELT	67	1	.	.	Fresh Dead
RAINBOW SMELT	.	.	14	75	Fresh Dead
RAINBOW SMELT	.	.	10	65	Fresh Dead
SPOTTAIL SHINER	101	10	.	.	Fresh Dead
WHITE SUCKER	461	900	.	.	Fresh Dead
BLACK BULLHEAD	214	110	.	.	Fresh Dead
THREESPINE STICKLEBACK	56	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	47	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	51	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	58	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	58	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	59	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	57	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	42	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	58	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	54	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	52	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	58	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	62	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	68	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	61	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	69	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	78	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	77	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	75	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	60	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	57	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	65	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	73	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	71	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	65	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	56	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	60	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	66	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	60	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	70	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	69	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	77	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	75	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	76	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	78	4	.	.	Fresh Dead
NINESPINE STICKLEBACK	77	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	79	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	65	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	57	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	70	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	71	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	80	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	77	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	69	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	77	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	80	4	.	.	Fresh Dead
NINESPINE STICKLEBACK	61	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	85	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	77	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	73	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	73	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	81	3	.	.	Fresh Dead

NINESPINE STICKLEBACK	80	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	66	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	76	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	74	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	74	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	66	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	69	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	64	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	75	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	59	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	66	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	70	2	.	.	Fresh Dead
YELLOW PERCH	102	8	.	.	Fresh Dead
MOTTLED SCULPIN	75	6	.	.	Fresh Dead
MOTTLED SCULPIN	86	9	.	.	Fresh Dead
MOTTLED SCULPIN	77	6	.	.	Fresh Dead
MOTTLED SCULPIN	103	15	.	.	Fresh Dead
MOTTLED SCULPIN	71	6	.	.	Fresh Dead
MOTTLED SCULPIN	68	5	.	.	Fresh Dead
MOTTLED SCULPIN	66	3	.	.	Fresh Dead
MOTTLED SCULPIN	70	5	.	.	Fresh Dead
MOTTLED SCULPIN	72	6	.	.	Fresh Dead
MOTTLED SCULPIN	72	6	.	.	Fresh Dead
MOTTLED SCULPIN	80	6	.	.	Fresh Dead
MOTTLED SCULPIN	76	7	.	.	Fresh Dead
MOTTLED SCULPIN	69	5	.	.	Fresh Dead
MOTTLED SCULPIN	70	6	.	.	Fresh Dead
MOTTLED SCULPIN	70	4	.	.	Fresh Dead
MOTTLED SCULPIN	70	5	.	.	Fresh Dead
MOTTLED SCULPIN	61	4	.	.	Fresh Dead
SLIMY SCULPIN	75	6	.	.	Fresh Dead
SLIMY SCULPIN	77	6	.	.	Fresh Dead

SAMPLING PERIOD: 14-15JUN06 START DATE AND TIME: 14JUN06:10:00 END DATE AND TIME: 15JUN06:10:07
SAMPLING DURATION (hrs.): 24.12 CW VOLUME SAMPLED (gals x 10^6): 983.9600
INTAKE TEMPERATURES (F): MINIMUM= 57.1 MEAN= 59.7 MAXIMUM= 60.8
DISCHARGE TEMPERATURES (F): MINIMUM= 75.9 MEAN= 78.2 MAXIMUM= 79.3 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 14-17JUN06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 3916.8

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GREAT LAKES CRAYFISH	44	2	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	31	1	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	39	2	.	.	Fresh Dead	
ALEWIFE	.	.	1868	7100	Fresh Dead	
ALEWIFE	.	.	1816	6900	Fresh Dead	
ALEWIFE	.	.	947	3600	Fresh Dead	
ALEWIFE	67	2	.	.	Fresh Dead	
ALEWIFE	110	8	.	.	Fresh Dead	
ALEWIFE	101	5	.	.	Fresh Dead	
ALEWIFE	98	5	.	.	Fresh Dead	
ALEWIFE	79	3	.	.	Fresh Dead	
ALEWIFE	78	3	.	.	Fresh Dead	
ALEWIFE	87	3	.	.	Fresh Dead	
ALEWIFE	95	4	.	.	Fresh Dead	
ALEWIFE	81	3	.	.	Fresh Dead	
ALEWIFE	107	7	.	.	Fresh Dead	
ALEWIFE	111	8	.	.	Fresh Dead	
ALEWIFE	74	3	.	.	Fresh Dead	
ALEWIFE	107	7	.	.	Fresh Dead	
ALEWIFE	104	7	.	.	Fresh Dead	
ALEWIFE	75	2	.	.	Fresh Dead	
ALEWIFE	76	3	.	.	Fresh Dead	
ALEWIFE	91	4	.	.	Fresh Dead	
ALEWIFE	84	3	.	.	Fresh Dead	
ALEWIFE	102	5	.	.	Fresh Dead	
ALEWIFE	90	4	.	.	Fresh Dead	
ALEWIFE	94	4	.	.	Fresh Dead	
ALEWIFE	80	3	.	.	Fresh Dead	
ALEWIFE	101	5	.	.	Fresh Dead	
ALEWIFE	119	9	.	.	Fresh Dead	
ALEWIFE	85	3	.	.	Fresh Dead	
ALEWIFE	79	3	.	.	Fresh Dead	
ALEWIFE	107	6	.	.	Fresh Dead	
ALEWIFE	101	6	.	.	Fresh Dead	
ALEWIFE	86	3	.	.	Fresh Dead	
ALEWIFE	94	5	.	.	Fresh Dead	
ALEWIFE	98	6	.	.	Fresh Dead	
ALEWIFE	87	4	.	.	Fresh Dead	
ALEWIFE	78	3	.	.	Fresh Dead	
ALEWIFE	77	2	.	.	Fresh Dead	
ALEWIFE	105	7	.	.	Fresh Dead	
ALEWIFE	100	6	.	.	Fresh Dead	
ALEWIFE	65	2	.	.	Fresh Dead	
ALEWIFE	83	3	.	.	Fresh Dead	
ALEWIFE	74	3	.	.	Fresh Dead	
ALEWIFE	91	3	.	.	Fresh Dead	
ALEWIFE	80	3	.	.	Fresh Dead	

ALEWIFE	79	2	.	.	Fresh Dead
ALEWIFE	76	3	.	.	Fresh Dead
ALEWIFE	78	2	.	.	Fresh Dead
ALEWIFE	90	3	.	.	Fresh Dead
ALEWIFE	80	3	.	.	Fresh Dead
ALEWIFE	66	1	.	.	Fresh Dead
ALEWIFE	74	2	.	.	Fresh Dead
ALEWIFE	80	2	.	.	Fresh Dead
ALEWIFE	95	5	.	.	Fresh Dead
ALEWIFE	.	.	100	375	Fresh Dead
ALEWIFE	.	.	1263	4800	Fresh Dead
ALEWIFE	.	.	1395	5300	Fresh Dead
ALEWIFE	.	.	1105	4200	Fresh Dead
ALEWIFE	.	.	500	1900	Fresh Dead
ALEWIFE	.	.	1447	5500	Fresh Dead
ALEWIFE	.	.	1158	4400	Fresh Dead
ALEWIFE	.	.	737	2800	Fresh Dead
ALEWIFE	.	.	1421	5400	Fresh Dead
RAINBOW SMELT	106	5	.	.	Fresh Dead
RAINBOW SMELT	118	5	.	.	Fresh Dead
RAINBOW SMELT	111	7	.	.	Fresh Dead
RAINBOW SMELT	127	6	.	.	Fresh Dead
RAINBOW SMELT	106	6	.	.	Fresh Dead
RAINBOW SMELT	105	6	.	.	Fresh Dead
RAINBOW SMELT	109	5	.	.	Fresh Dead
RAINBOW SMELT	122	7	.	.	Fresh Dead
RAINBOW SMELT	112	6	.	.	Fresh Dead
RAINBOW SMELT	92	4	.	.	Fresh Dead
RAINBOW SMELT	122	9	.	.	Fresh Dead
RAINBOW SMELT	108	8	.	.	Fresh Dead
RAINBOW SMELT	104	6	.	.	Fresh Dead
RAINBOW SMELT	114	5	.	.	Fresh Dead
RAINBOW SMELT	113	5	.	.	Fresh Dead
RAINBOW SMELT	101	4	.	.	Fresh Dead
RAINBOW SMELT	121	8	.	.	Fresh Dead
RAINBOW SMELT	117	7	.	.	Fresh Dead
RAINBOW SMELT	97	4	.	.	Fresh Dead
RAINBOW SMELT	115	4	.	.	Fresh Dead
RAINBOW SMELT	135	12	.	.	Fresh Dead
RAINBOW SMELT	127	9	.	.	Fresh Dead
RAINBOW SMELT	101	4	.	.	Fresh Dead
RAINBOW SMELT	96	4	.	.	Fresh Dead
RAINBOW SMELT	110	6	.	.	Fresh Dead
RAINBOW SMELT	109	5	.	.	Fresh Dead
RAINBOW SMELT	67	1	.	.	Fresh Dead
RAINBOW SMELT	101	5	.	.	Fresh Dead
RAINBOW SMELT	125	6	.	.	Fresh Dead
RAINBOW SMELT	96	4	.	.	Fresh Dead
RAINBOW SMELT	95	4	.	.	Fresh Dead
RAINBOW SMELT	100	4	.	.	Fresh Dead
RAINBOW SMELT	120	7	.	.	Fresh Dead
RAINBOW SMELT	123	7	.	.	Fresh Dead
SPOTTAIL SHINER	111	12	.	.	Fresh Dead
BURBOT	556	1700	.	.	Fresh Dead
THREESPINE STICKLEBACK	54	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	57	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	64	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	58	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	59	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	79	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	78	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	70	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	76	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	81	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	65	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	76	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	72	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	80	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	63	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	78	4	.	.	Fresh Dead
NINESPINE STICKLEBACK	73	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	72	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	74	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	82	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	78	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	70	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	61	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	73	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	81	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	55	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	80	4	.	.	Fresh Dead
NINESPINE STICKLEBACK	74	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	79	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	72	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	75	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	76	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	76	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	78	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	78	4	.	.	Fresh Dead
NINESPINE STICKLEBACK	56	2	.	.	Fresh Dead

NINESPINE STICKLEBACK	62	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	71	2	.	.	Fresh Dead
MOTTLED SCULPIN	84	6	.	.	Fresh Dead
MOTTLED SCULPIN	113	22	.	.	Fresh Dead
MOTTLED SCULPIN	89	9	.	.	Fresh Dead
MOTTLED SCULPIN	92	9	.	.	Fresh Dead
MOTTLED SCULPIN	64	3	.	.	Fresh Dead
MOTTLED SCULPIN	75	4	.	.	Fresh Dead
MOTTLED SCULPIN	70	5	.	.	Fresh Dead
MOTTLED SCULPIN	84	7	.	.	Fresh Dead
SLIMY SCULPIN	71	5	.	.	Fresh Dead
SLIMY SCULPIN	71	5	.	.	Fresh Dead

SAMPLING PERIOD: 19-20JUN06 START DATE AND TIME: 19JUN06:10:00 END DATE AND TIME: 20JUN06:09:35
SAMPLING DURATION (hrs.): 23.58 CW VOLUME SAMPLED (gals x 10^6): 920.0400
INTAKE TEMPERATURES (F): MINIMUM= 45.0 MEAN= 47.9 MAXIMUM= 49.9
DISCHARGE TEMPERATURES (F): MINIMUM= 63.4 MEAN= 66.4 MAXIMUM= 68.2 MULTIPLICATION FACTOR: 7.750
WEEKLY EXTRAPOLATION PERIOD: 18-20JUN06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 2937.6

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
ALEWIFE	.	.	50	168	Fresh Dead	Yes
ALEWIFE	.	.	2000	6200	Fresh Dead	Yes
ALEWIFE	.	.	1935	6000	Fresh Dead	Yes
ALEWIFE	.	.	2097	6500	Fresh Dead	Yes
ALEWIFE	.	.	2258	7000	Fresh Dead	Yes
ALEWIFE	.	.	2032	6300	Fresh Dead	Yes
ALEWIFE	.	.	1968	6100	Fresh Dead	Yes
ALEWIFE	.	.	1903	5900	Fresh Dead	Yes
ALEWIFE	.	.	2065	6400	Fresh Dead	Yes
ALEWIFE	.	.	1968	6100	Fresh Dead	Yes
ALEWIFE	.	.	2065	6400	Fresh Dead	Yes
ALEWIFE	76	2	.	.	Fresh Dead	Yes
ALEWIFE	86	3	.	.	Fresh Dead	Yes
ALEWIFE	85	3	.	.	Fresh Dead	Yes
ALEWIFE	88	3	.	.	Fresh Dead	Yes
ALEWIFE	85	3	.	.	Fresh Dead	Yes
ALEWIFE	69	2	.	.	Fresh Dead	Yes
ALEWIFE	80	3	.	.	Fresh Dead	Yes
ALEWIFE	80	3	.	.	Fresh Dead	Yes
ALEWIFE	82	3	.	.	Fresh Dead	Yes
ALEWIFE	83	3	.	.	Fresh Dead	Yes
ALEWIFE	65	1	.	.	Fresh Dead	Yes
ALEWIFE	77	2	.	.	Fresh Dead	Yes
ALEWIFE	81	3	.	.	Fresh Dead	Yes
ALEWIFE	79	2	.	.	Fresh Dead	Yes
ALEWIFE	65	1	.	.	Fresh Dead	Yes
ALEWIFE	97	5	.	.	Fresh Dead	Yes
ALEWIFE	86	4	.	.	Fresh Dead	Yes
ALEWIFE	62	1	.	.	Fresh Dead	Yes
ALEWIFE	72	1	.	.	Fresh Dead	Yes
ALEWIFE	90	3	.	.	Fresh Dead	Yes
ALEWIFE	69	2	.	.	Fresh Dead	Yes
ALEWIFE	82	3	.	.	Fresh Dead	Yes
ALEWIFE	69	2	.	.	Fresh Dead	Yes
ALEWIFE	86	3	.	.	Fresh Dead	Yes
ALEWIFE	86	3	.	.	Fresh Dead	Yes
ALEWIFE	75	2	.	.	Fresh Dead	Yes
ALEWIFE	71	1	.	.	Fresh Dead	Yes
ALEWIFE	87	3	.	.	Fresh Dead	Yes
ALEWIFE	91	4	.	.	Fresh Dead	Yes
ALEWIFE	76	2	.	.	Fresh Dead	Yes
ALEWIFE	66	2	.	.	Fresh Dead	Yes
ALEWIFE	72	2	.	.	Fresh Dead	Yes
ALEWIFE	93	4	.	.	Fresh Dead	Yes
ALEWIFE	87	3	.	.	Fresh Dead	Yes
ALEWIFE	83	3	.	.	Fresh Dead	Yes
ALEWIFE	94	4	.	.	Fresh Dead	Yes
ALEWIFE	95	4	.	.	Fresh Dead	Yes
ALEWIFE	73	2	.	.	Fresh Dead	Yes
ALEWIFE	72	2	.	.	Fresh Dead	Yes
ALEWIFE	68	1	.	.	Fresh Dead	Yes
ALEWIFE	80	3	.	.	Fresh Dead	Yes
ALEWIFE	91	3	.	.	Fresh Dead	Yes
ALEWIFE	113	6	.	.	Fresh Dead	Yes
ALEWIFE	85	3	.	.	Fresh Dead	Yes
ALEWIFE	78	2	.	.	Fresh Dead	Yes
ALEWIFE	74	2	.	.	Fresh Dead	Yes
ALEWIFE	100	5	.	.	Fresh Dead	Yes
ALEWIFE	93	4	.	.	Fresh Dead	Yes
ALEWIFE	102	5	.	.	Fresh Dead	Yes
ALEWIFE	97	4	.	.	Fresh Dead	Yes
RAINBOW SMELT	.	.	1	5	Fresh Dead	No
RAINBOW SMELT	117	6	.	.	Fresh Dead	No
RAINBOW SMELT	116	7	.	.	Fresh Dead	No
RAINBOW SMELT	115	5	.	.	Fresh Dead	No
RAINBOW SMELT	112	5	.	.	Fresh Dead	No
RAINBOW SMELT	110	5	.	.	Fresh Dead	No

RAINBOW SMELT	106	5	.	.	Fresh Dead	No
RAINBOW SMELT	116	7	.	.	Fresh Dead	No
RAINBOW SMELT	121	6	.	.	Fresh Dead	No
RAINBOW SMELT	112	5	.	.	Fresh Dead	No
RAINBOW SMELT	115	5	.	.	Fresh Dead	No
RAINBOW SMELT	59	1	.	.	Fresh Dead	No
RAINBOW SMELT	104	4	.	.	Fresh Dead	No
RAINBOW SMELT	121	6	.	.	Fresh Dead	No
RAINBOW SMELT	112	5	.	.	Fresh Dead	No
RAINBOW SMELT	157	13	.	.	Fresh Dead	No
RAINBOW SMELT	88	2	.	.	Fresh Dead	No
RAINBOW SMELT	113	5	.	.	Fresh Dead	No
WHITE SUCKER	505	1200	.	.	Live	No
WHITE SUCKER	446	1050	.	.	Live	No
THREESPINE STICKLEBACK	58	2	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	69	2	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	66	2	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	84	4	.	.	Live	No
NINESPINE STICKLEBACK	74	2	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	78	3	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	74	3	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	68	3	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	72	3	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	77	4	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	78	4	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	57	2	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	73	3	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	70	2	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	78	3	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	78	3	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	81	4	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	80	3	.	.	Fresh Dead	No
NINESPINE STICKLEBACK	84	4	.	.	Fresh Dead	No
MOTTLED SCULPIN	90	11	.	.	Fresh Dead	No
MOTTLED SCULPIN	84	6	.	.	Fresh Dead	No
MOTTLED SCULPIN	85	7	.	.	Fresh Dead	No
MOTTLED SCULPIN	62	4	.	.	Fresh Dead	No
MOTTLED SCULPIN	60	3	.	.	Fresh Dead	No
MOTTLED SCULPIN	66	3	.	.	Fresh Dead	No
MOTTLED SCULPIN	68	5	.	.	Fresh Dead	No
MOTTLED SCULPIN	73	4	.	.	Fresh Dead	No

SAMPLING PERIOD: 21-22JUN06 START DATE AND TIME: 21JUN06:10:00 END DATE AND TIME: 22JUN06:10:01
SAMPLING DURATION (hrs.): 24.02 CW VOLUME SAMPLED (gals x 10^6): 918.6800
INTAKE TEMPERATURES (F): MINIMUM= 45.9 MEAN= 47.2 MAXIMUM= 48.5
DISCHARGE TEMPERATURES (F): MINIMUM= 64.3 MEAN= 66.0 MAXIMUM= 68.1 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 21-24JUN06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 3916.8

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
ALEWIFE	.	.	1375	4400	Fresh Dead	
ALEWIFE	.	.	100	300	Fresh Dead	
ALEWIFE	116	9	.	.	Fresh Dead	
ALEWIFE	88	4	.	.	Fresh Dead	
ALEWIFE	82	3	.	.	Fresh Dead	
ALEWIFE	78	3	.	.	Fresh Dead	
ALEWIFE	91	4	.	.	Fresh Dead	
ALEWIFE	100	5	.	.	Fresh Dead	
ALEWIFE	110	6	.	.	Fresh Dead	
ALEWIFE	71	2	.	.	Fresh Dead	
ALEWIFE	95	4	.	.	Fresh Dead	
ALEWIFE	104	6	.	.	Fresh Dead	
ALEWIFE	102	6	.	.	Fresh Dead	
ALEWIFE	115	9	.	.	Fresh Dead	
ALEWIFE	98	5	.	.	Fresh Dead	
ALEWIFE	74	2	.	.	Fresh Dead	
ALEWIFE	86	3	.	.	Fresh Dead	
ALEWIFE	82	3	.	.	Fresh Dead	
ALEWIFE	87	3	.	.	Fresh Dead	
ALEWIFE	85	3	.	.	Fresh Dead	
ALEWIFE	80	2	.	.	Fresh Dead	
ALEWIFE	75	2	.	.	Fresh Dead	
ALEWIFE	84	3	.	.	Fresh Dead	
ALEWIFE	99	5	.	.	Fresh Dead	
ALEWIFE	100	6	.	.	Fresh Dead	
ALEWIFE	80	3	.	.	Fresh Dead	
ALEWIFE	107	6	.	.	Fresh Dead	
ALEWIFE	95	4	.	.	Fresh Dead	
ALEWIFE	74	2	.	.	Fresh Dead	
ALEWIFE	77	2	.	.	Fresh Dead	
ALEWIFE	74	2	.	.	Fresh Dead	
ALEWIFE	78	2	.	.	Fresh Dead	
ALEWIFE	90	4	.	.	Fresh Dead	
ALEWIFE	75	2	.	.	Fresh Dead	
ALEWIFE	95	4	.	.	Fresh Dead	
ALEWIFE	79	2	.	.	Fresh Dead	
ALEWIFE	72	2	.	.	Fresh Dead	
ALEWIFE	68	2	.	.	Fresh Dead	

ALEWIFE	83	3	.	.	Fresh Dead
ALEWIFE	100	5	.	.	Fresh Dead
ALEWIFE	79	2	.	.	Fresh Dead
ALEWIFE	74	2	.	.	Fresh Dead
ALEWIFE	77	2	.	.	Fresh Dead
ALEWIFE	88	3	.	.	Fresh Dead
ALEWIFE	72	2	.	.	Fresh Dead
ALEWIFE	83	3	.	.	Fresh Dead
ALEWIFE	72	2	.	.	Fresh Dead
ALEWIFE	87	3	.	.	Fresh Dead
ALEWIFE	88	3	.	.	Fresh Dead
ALEWIFE	74	2	.	.	Fresh Dead
ALEWIFE	115	8	.	.	Fresh Dead
ALEWIFE	81	3	.	.	Fresh Dead
ALEWIFE	.	.	1719	5500	Fresh Dead
ALEWIFE	.	.	1656	5300	Fresh Dead
ALEWIFE	.	.	1281	4100	Fresh Dead
ALEWIFE	.	.	938	3000	Fresh Dead
ALEWIFE	.	.	1500	4800	Fresh Dead
ALEWIFE	.	.	1531	4900	Fresh Dead
ALEWIFE	.	.	1781	5700	Fresh Dead
ALEWIFE	.	.	1656	5300	Fresh Dead
ALEWIFE	.	.	1625	5200	Fresh Dead
ALEWIFE	.	.	1531	4900	Fresh Dead
ALEWIFE	.	.	1719	5500	Fresh Dead
ALEWIFE	.	.	2156	6000	Fresh Dead
ALEWIFE	.	.	1875	6000	Fresh Dead
ALEWIFE	.	.	1750	4500	Fresh Dead
ALEWIFE	.	.	1781	4700	Fresh Dead
ALEWIFE	.	.	1438	4600	Fresh Dead
ALEWIFE	.	.	656	2100	Fresh Dead
ALEWIFE	.	.	1719	5500	Fresh Dead
ALEWIFE	.	.	1594	5100	Fresh Dead
ALEWIFE	.	.	1781	5700	Fresh Dead
ALEWIFE	.	.	1656	5300	Fresh Dead
ALEWIFE	.	.	1781	5700	Fresh Dead
ALEWIFE	.	.	1719	5500	Fresh Dead
ALEWIFE	.	.	1875	6000	Fresh Dead
ALEWIFE	.	.	1875	6000	Fresh Dead
ALEWIFE	.	.	1844	5900	Fresh Dead
ALEWIFE	.	.	1969	6300	Fresh Dead
ALEWIFE	.	.	1688	5400	Fresh Dead
ALEWIFE	.	.	1906	6100	Fresh Dead
ALEWIFE	.	.	1875	6000	Fresh Dead
ALEWIFE	.	.	1875	6000	Fresh Dead
ALEWIFE	.	.	1750	5600	Fresh Dead
ALEWIFE	.	.	1844	5900	Fresh Dead
ALEWIFE	.	.	1813	5800	Fresh Dead
ALEWIFE	.	.	1906	6100	Fresh Dead
ALEWIFE	.	.	1844	5900	Fresh Dead
ALEWIFE	.	.	1625	5200	Fresh Dead
ALEWIFE	.	.	1031	3300	Fresh Dead
ALEWIFE	.	.	1750	5600	Fresh Dead
ALEWIFE	.	.	1969	6300	Fresh Dead
ALEWIFE	.	.	2063	6600	Fresh Dead
ALEWIFE	.	.	2000	6400	Fresh Dead
ALEWIFE	.	.	1906	6100	Fresh Dead
ALEWIFE	.	.	1938	6200	Fresh Dead
ALEWIFE	.	.	1938	6200	Fresh Dead
ALEWIFE	.	.	1906	6100	Fresh Dead
ALEWIFE	.	.	2281	7300	Fresh Dead
ALEWIFE	.	.	2281	7300	Fresh Dead
ALEWIFE	.	.	1875	6000	Fresh Dead
ALEWIFE	.	.	2031	6500	Fresh Dead
ALEWIFE	.	.	1563	5000	Fresh Dead
ALEWIFE	.	.	1563	5000	Fresh Dead
ALEWIFE	.	.	2313	7400	Fresh Dead
ALEWIFE	.	.	1813	5800	Fresh Dead
ALEWIFE	.	.	1094	3500	Fresh Dead
ALEWIFE	.	.	1094	3500	Fresh Dead
ALEWIFE	.	.	1281	4100	Fresh Dead
ALEWIFE	.	.	1656	5300	Fresh Dead
ALEWIFE	.	.	1281	4100	Fresh Dead
ALEWIFE	.	.	1594	5100	Fresh Dead
ALEWIFE	.	.	1594	5100	Fresh Dead
ALEWIFE	.	.	1813	5800	Fresh Dead
ALEWIFE	.	.	1688	5400	Fresh Dead
ALEWIFE	.	.	1625	5200	Fresh Dead
ALEWIFE	.	.	1813	5800	Fresh Dead
ALEWIFE	.	.	1594	5100	Fresh Dead
ALEWIFE	.	.	2188	7000	Fresh Dead
ALEWIFE	.	.	1906	6100	Fresh Dead
ALEWIFE	.	.	1563	5000	Fresh Dead
ALEWIFE	.	.	1656	5300	Fresh Dead
ALEWIFE	.	.	2000	6400	Fresh Dead
ALEWIFE	.	.	1594	5100	Fresh Dead
ALEWIFE	.	.	1906	6100	Fresh Dead
ALEWIFE	.	.	1313	4200	Fresh Dead
ALEWIFE	.	.	1813	5800	Fresh Dead
ALEWIFE	.	.	1688	5400	Fresh Dead

ALEWIFE	.	.	1969	6300	Fresh Dead
ALEWIFE	.	.	1719	5500	Fresh Dead
ALEWIFE	.	.	2844	9100	Fresh Dead
ALEWIFE	.	.	1625	5200	Fresh Dead
ALEWIFE	.	.	1813	5800	Fresh Dead
ALEWIFE	.	.	1500	4800	Fresh Dead
ALEWIFE	.	.	2250	7200	Fresh Dead
ALEWIFE	.	.	1906	6100	Fresh Dead
ALEWIFE	.	.	1688	5400	Fresh Dead
ALEWIFE	.	.	1219	3900	Fresh Dead
ALEWIFE	.	.	1750	5600	Fresh Dead
ALEWIFE	.	.	1438	4600	Fresh Dead
ALEWIFE	.	.	1500	4800	Fresh Dead
ALEWIFE	.	.	1750	5600	Fresh Dead
ALEWIFE	.	.	1094	3500	Fresh Dead
ALEWIFE	.	.	1688	5400	Fresh Dead
ALEWIFE	.	.	1719	5500	Fresh Dead
ALEWIFE	.	.	1750	5600	Fresh Dead
ALEWIFE	.	.	1719	5500	Fresh Dead
ALEWIFE	.	.	1063	3400	Fresh Dead
ALEWIFE	.	.	1250	4000	Fresh Dead
ALEWIFE	.	.	1625	5200	Fresh Dead
ALEWIFE	.	.	813	2600	Fresh Dead
ALEWIFE	.	.	1500	4800	Fresh Dead
ALEWIFE	.	.	1531	4900	Fresh Dead
ALEWIFE	.	.	1438	4600	Fresh Dead
ALEWIFE	.	.	1688	5400	Fresh Dead
ALEWIFE	.	.	2844	9100	Fresh Dead
ALEWIFE	.	.	1438	4600	Fresh Dead
RAINBOW SMELT	127	8	.	.	Fresh Dead
RAINBOW SMELT	112	5	.	.	Fresh Dead
RAINBOW SMELT	136	10	.	.	Fresh Dead
RAINBOW SMELT	133	11	.	.	Fresh Dead
RAINBOW SMELT	112	6	.	.	Fresh Dead
RAINBOW SMELT	118	6	.	.	Fresh Dead
RAINBOW SMELT	130	7	.	.	Fresh Dead
RAINBOW SMELT	99	5	.	.	Fresh Dead
RAINBOW SMELT	126	8	.	.	Fresh Dead
RAINBOW SMELT	105	5	.	.	Fresh Dead
RAINBOW SMELT	103	4	.	.	Fresh Dead
RAINBOW SMELT	109	5	.	.	Fresh Dead
RAINBOW SMELT	115	6	.	.	Fresh Dead
RAINBOW SMELT	102	4	.	.	Fresh Dead
RAINBOW SMELT	125	8	.	.	Fresh Dead
RAINBOW SMELT	124	8	.	.	Fresh Dead
RAINBOW SMELT	111	5	.	.	Fresh Dead
RAINBOW SMELT	113	6	.	.	Fresh Dead
RAINBOW SMELT	112	7	.	.	Fresh Dead
RAINBOW SMELT	96	4	.	.	Fresh Dead
RAINBOW SMELT	124	9	.	.	Fresh Dead
RAINBOW SMELT	112	5	.	.	Fresh Dead
RAINBOW SMELT	168	17	.	.	Fresh Dead
RAINBOW SMELT	112	6	.	.	Fresh Dead
RAINBOW SMELT	126	9	.	.	Fresh Dead
RAINBOW SMELT	114	6	.	.	Fresh Dead
RAINBOW SMELT	115	7	.	.	Fresh Dead
RAINBOW SMELT	113	5	.	.	Fresh Dead
RAINBOW SMELT	116	6	.	.	Fresh Dead
RAINBOW SMELT	112	6	.	.	Fresh Dead
RAINBOW SMELT	78	2	.	.	Fresh Dead
RAINBOW SMELT	110	5	.	.	Fresh Dead
RAINBOW SMELT	112	5	.	.	Fresh Dead
RAINBOW SMELT	115	6	.	.	Fresh Dead
RAINBOW SMELT	111	6	.	.	Fresh Dead
RAINBOW SMELT	94	3	.	.	Fresh Dead
RAINBOW SMELT	121	7	.	.	Fresh Dead
RAINBOW SMELT	73	2	.	.	Fresh Dead
RAINBOW SMELT	138	8	.	.	Fresh Dead
RAINBOW SMELT	96	4	.	.	Fresh Dead
RAINBOW SMELT	107	7	.	.	Fresh Dead
RAINBOW SMELT	115	7	.	.	Fresh Dead
RAINBOW SMELT	121	6	.	.	Fresh Dead
RAINBOW SMELT	100	4	.	.	Fresh Dead
RAINBOW SMELT	119	7	.	.	Fresh Dead
RAINBOW SMELT	115	5	.	.	Fresh Dead
RAINBOW SMELT	110	5	.	.	Fresh Dead
RAINBOW SMELT	137	8	.	.	Fresh Dead
RAINBOW SMELT	113	6	.	.	Fresh Dead
RAINBOW SMELT	88	4	.	.	Fresh Dead
RAINBOW SMELT	120	7	.	.	Fresh Dead
RAINBOW SMELT	.	.	30	200	Fresh Dead
RAINBOW SMELT	.	.	37	255	Fresh Dead
RAINBOW SMELT	.	.	4	29	Fresh Dead
LONGNOSE SUCKER	451	700	.	.	Fresh Dead
THREESPINE STICKLEBACK	58	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	51	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	74	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	59	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	64	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	65	2	.	.	Fresh Dead

NINESPINE STICKLEBACK	74	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	72	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	63	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	60	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	89	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	71	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	85	4	.	.	Fresh Dead
MOTTLED SCULPIN	88	8	.	.	Fresh Dead
MOTTLED SCULPIN	64	4	.	.	Fresh Dead

SAMPLING PERIOD: 26-27JUN06 START DATE AND TIME: 26JUN06:10:02 END DATE AND TIME: 27JUN06:10:06
SAMPLING DURATION (hrs.): 24.07 CW VOLUME SAMPLED (gals x 10^6): 981.9200
INTAKE TEMPERATURES (F): MINIMUM= 57.8 MEAN= 58.7 MAXIMUM= 59.8
DISCHARGE TEMPERATURES (F): MINIMUM= 76.0 MEAN= 77.1 MAXIMUM= 78.4 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 25-27JUN06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 2937.6

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
ALEWIFE	77	2	.	.	Fresh Dead	
ALEWIFE	82	2	.	.	Fresh Dead	
ALEWIFE	71	2	.	.	Fresh Dead	
ALEWIFE	80	2	.	.	Fresh Dead	
ALEWIFE	81	2	.	.	Fresh Dead	
ALEWIFE	99	4	.	.	Fresh Dead	
ALEWIFE	60	1	.	.	Fresh Dead	
ALEWIFE	105	6	.	.	Fresh Dead	
ALEWIFE	98	5	.	.	Fresh Dead	
ALEWIFE	80	2	.	.	Fresh Dead	
ALEWIFE	65	1	.	.	Fresh Dead	
ALEWIFE	95	4	.	.	Fresh Dead	
ALEWIFE	95	3	.	.	Fresh Dead	
ALEWIFE	72	1	.	.	Fresh Dead	
ALEWIFE	84	3	.	.	Fresh Dead	
ALEWIFE	72	2	.	.	Fresh Dead	
ALEWIFE	72	2	.	.	Fresh Dead	
ALEWIFE	89	3	.	.	Fresh Dead	
ALEWIFE	81	2	.	.	Fresh Dead	
ALEWIFE	90	3	.	.	Fresh Dead	
ALEWIFE	70	2	.	.	Fresh Dead	
ALEWIFE	76	2	.	.	Fresh Dead	
ALEWIFE	92	3	.	.	Fresh Dead	
ALEWIFE	91	3	.	.	Fresh Dead	
ALEWIFE	76	2	.	.	Fresh Dead	
ALEWIFE	98	4	.	.	Fresh Dead	
ALEWIFE	98	5	.	.	Fresh Dead	
ALEWIFE	81	2	.	.	Fresh Dead	
ALEWIFE	85	3	.	.	Fresh Dead	
ALEWIFE	99	4	.	.	Fresh Dead	
ALEWIFE	70	1	.	.	Fresh Dead	
ALEWIFE	101	5	.	.	Fresh Dead	
ALEWIFE	96	4	.	.	Fresh Dead	
ALEWIFE	80	2	.	.	Fresh Dead	
ALEWIFE	104	5	.	.	Fresh Dead	
ALEWIFE	70	2	.	.	Fresh Dead	
ALEWIFE	81	2	.	.	Fresh Dead	
ALEWIFE	96	3	.	.	Fresh Dead	
ALEWIFE	83	2	.	.	Fresh Dead	
ALEWIFE	73	2	.	.	Fresh Dead	
ALEWIFE	86	3	.	.	Fresh Dead	
ALEWIFE	94	4	.	.	Fresh Dead	
ALEWIFE	74	2	.	.	Fresh Dead	
ALEWIFE	74	2	.	.	Fresh Dead	
ALEWIFE	80	2	.	.	Fresh Dead	
ALEWIFE	66	1	.	.	Fresh Dead	
ALEWIFE	68	1	.	.	Fresh Dead	
ALEWIFE	66	1	.	.	Fresh Dead	
ALEWIFE	64	1	.	.	Fresh Dead	
ALEWIFE	75	2	.	.	Fresh Dead	
ALEWIFE	.	.	50	129	Fresh Dead	
ALEWIFE	.	.	4038	10500	Fresh Dead	
ALEWIFE	.	.	3385	8800	Fresh Dead	
ALEWIFE	.	.	1577	4100	Fresh Dead	
ALEWIFE	.	.	1308	3400	Fresh Dead	
ALEWIFE	.	.	1423	3700	Fresh Dead	
ALEWIFE	.	.	1538	4000	Fresh Dead	
ALEWIFE	.	.	1577	4100	Fresh Dead	
ALEWIFE	.	.	1115	2900	Fresh Dead	
ALEWIFE	.	.	577	1500	Fresh Dead	
ALEWIFE	.	.	577	1500	Fresh Dead	
ALEWIFE	87	3	.	.	Fresh Dead	
RAINBOW SMELT	105	5	.	.	Fresh Dead	
RAINBOW SMELT	112	6	.	.	Fresh Dead	
RAINBOW SMELT	112	6	.	.	Fresh Dead	
RAINBOW SMELT	145	13	.	.	Fresh Dead	
RAINBOW SMELT	120	7	.	.	Fresh Dead	
RAINBOW SMELT	118	6	.	.	Fresh Dead	
RAINBOW SMELT	109	5	.	.	Fresh Dead	
RAINBOW SMELT	108	5	.	.	Fresh Dead	

RAINBOW SMELT	143	10	.	.	Fresh Dead
RAINBOW SMELT	108	4	.	.	Fresh Dead
RAINBOW SMELT	105	5	.	.	Fresh Dead
RAINBOW SMELT	54	1	.	.	Fresh Dead
RAINBOW SMELT	139	9	.	.	Fresh Dead
RAINBOW SMELT	121	6	.	.	Fresh Dead
RAINBOW SMELT	99	3	.	.	Fresh Dead
RAINBOW SMELT	137	11	.	.	Fresh Dead
RAINBOW SMELT	127	7	.	.	Fresh Dead
RAINBOW SMELT	125	6	.	.	Fresh Dead
RAINBOW SMELT	112	6	.	.	Fresh Dead
RAINBOW SMELT	116	7	.	.	Fresh Dead
RAINBOW SMELT	105	5	.	.	Fresh Dead
RAINBOW SMELT	111	4	.	.	Fresh Dead
RAINBOW SMELT	111	5	.	.	Fresh Dead
RAINBOW SMELT	104	4	.	.	Fresh Dead
RAINBOW SMELT	99	4	.	.	Fresh Dead
RAINBOW SMELT	121	5	.	.	Fresh Dead
RAINBOW SMELT	115	6	.	.	Fresh Dead
RAINBOW SMELT	103	3	.	.	Fresh Dead
RAINBOW SMELT	127	8	.	.	Fresh Dead
WHITE SUCKER	387	725	.	.	Live
THREESPINE STICKLEBACK	56	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	60	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	.	.	1	1	Fresh Dead
THREESPINE STICKLEBACK	45	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	60	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	55	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	64	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	61	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	59	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	56	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	58	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	58	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	56	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	49	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	58	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	61	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	57	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	56	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	62	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	51	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	52	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	55	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	53	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	58	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	57	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	54	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	60	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	51	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	74	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	68	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	60	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	71	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	72	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	74	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	73	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	60	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	80	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	66	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	66	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	77	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	77	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	79	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	85	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	72	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	71	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	70	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	72	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	86	4	.	.	Fresh Dead
NINESPINE STICKLEBACK	65	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	54	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	76	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	61	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	70	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	73	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	57	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	68	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	66	2	.	.	Fresh Dead
YELLOW PERCH	62	1	.	.	Fresh Dead
YELLOW PERCH	320	400	.	.	Fresh Dead
MOTTLED SCULPIN	52	2	.	.	Fresh Dead
MOTTLED SCULPIN	75	6	.	.	Fresh Dead
MOTTLED SCULPIN	56	2	.	.	Fresh Dead
MOTTLED SCULPIN	67	3	.	.	Fresh Dead
MOTTLED SCULPIN	68	4	.	.	Fresh Dead
MOTTLED SCULPIN	76	5	.	.	Fresh Dead
MOTTLED SCULPIN	69	4	.	.	Fresh Dead
MOTTLED SCULPIN	66	4	.	.	Fresh Dead
MOTTLED SCULPIN	68	5	.	.	Fresh Dead

MOTTLED SCULPIN	60	3	.	.	Fresh Dead
MOTTLED SCULPIN	62	4	.	.	Fresh Dead
MOTTLED SCULPIN	71	4	.	.	Fresh Dead
MOTTLED SCULPIN	61	3	.	.	Fresh Dead
MOTTLED SCULPIN	49	2	.	.	Fresh Dead
MOTTLED SCULPIN	57	2	.	.	Fresh Dead
SLIMY SCULPIN	84	7	.	.	Fresh Dead
SLIMY SCULPIN	65	3	.	.	Fresh Dead
SLIMY SCULPIN	89	10	.	.	Fresh Dead
SLIMY SCULPIN	95	14	.	.	Fresh Dead

SAMPLING PERIOD: 28-29JUN06 START DATE AND TIME: 28JUN06:10:00 END DATE AND TIME: 29JUN06:10:03
SAMPLING DURATION (hrs.): 24.05 CW VOLUME SAMPLED (gals x 10^6): 981.2400
INTAKE TEMPERATURES (F): MINIMUM= 57.3 MEAN= 59.0 MAXIMUM= 60.9
DISCHARGE TEMPERATURES (F): MINIMUM= 76.0 MEAN= 77.8 MAXIMUM= 79.9 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 28JUN-01JUL06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 3916.8

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GREAT LAKES CRAYFISH	48	3	.	.	Fresh Dead	
ALEWIFE	85	3	.	.	Fresh Dead	
ALEWIFE	109	6	.	.	Fresh Dead	
ALEWIFE	96	5	.	.	Fresh Dead	
ALEWIFE	122	8	.	.	Fresh Dead	
ALEWIFE	99	6	.	.	Fresh Dead	
ALEWIFE	100	5	.	.	Fresh Dead	
ALEWIFE	83	3	.	.	Fresh Dead	
ALEWIFE	84	3	.	.	Fresh Dead	
ALEWIFE	97	5	.	.	Fresh Dead	
ALEWIFE	102	5	.	.	Fresh Dead	
ALEWIFE	80	3	.	.	Fresh Dead	
ALEWIFE	76	2	.	.	Fresh Dead	
ALEWIFE	99	6	.	.	Fresh Dead	
ALEWIFE	111	8	.	.	Fresh Dead	
ALEWIFE	84	3	.	.	Fresh Dead	
ALEWIFE	83	2	.	.	Fresh Dead	
ALEWIFE	84	2	.	.	Fresh Dead	
ALEWIFE	80	2	.	.	Fresh Dead	
ALEWIFE	79	3	.	.	Fresh Dead	
ALEWIFE	81	2	.	.	Fresh Dead	
ALEWIFE	83	2	.	.	Fresh Dead	
ALEWIFE	93	4	.	.	Fresh Dead	
ALEWIFE	88	4	.	.	Fresh Dead	
ALEWIFE	105	6	.	.	Fresh Dead	
ALEWIFE	101	5	.	.	Fresh Dead	
ALEWIFE	86	3	.	.	Fresh Dead	
ALEWIFE	90	3	.	.	Fresh Dead	
ALEWIFE	85	3	.	.	Fresh Dead	
ALEWIFE	164	22	.	.	Fresh Dead	
ALEWIFE	112	8	.	.	Fresh Dead	
ALEWIFE	65	2	.	.	Fresh Dead	
ALEWIFE	76	2	.	.	Fresh Dead	
ALEWIFE	86	3	.	.	Fresh Dead	
ALEWIFE	85	3	.	.	Fresh Dead	
ALEWIFE	86	3	.	.	Fresh Dead	
ALEWIFE	77	2	.	.	Fresh Dead	
ALEWIFE	100	5	.	.	Fresh Dead	
ALEWIFE	82	3	.	.	Fresh Dead	
ALEWIFE	80	3	.	.	Fresh Dead	
ALEWIFE	83	2	.	.	Fresh Dead	
ALEWIFE	80	2	.	.	Fresh Dead	
ALEWIFE	76	2	.	.	Fresh Dead	
ALEWIFE	77	2	.	.	Fresh Dead	
ALEWIFE	93	4	.	.	Fresh Dead	
ALEWIFE	75	2	.	.	Fresh Dead	
ALEWIFE	108	7	.	.	Fresh Dead	
ALEWIFE	68	2	.	.	Fresh Dead	
ALEWIFE	94	4	.	.	Fresh Dead	
ALEWIFE	80	3	.	.	Fresh Dead	
ALEWIFE	76	2	.	.	Fresh Dead	
ALEWIFE	.	.	100	377	Fresh Dead	
ALEWIFE	.	.	1237	4700	Fresh Dead	
ALEWIFE	.	.	1158	4400	Fresh Dead	
ALEWIFE	.	.	1316	5000	Fresh Dead	
ALEWIFE	.	.	1316	5000	Fresh Dead	
ALEWIFE	.	.	684	2600	Fresh Dead	
ALEWIFE	.	.	1211	4600	Fresh Dead	
ALEWIFE	.	.	1250	4750	Fresh Dead	
ALEWIFE	.	.	53	200	Fresh Dead	
ALEWIFE	.	.	105	400	Fresh Dead	
ALEWIFE	.	.	1053	4000	Fresh Dead	
ALEWIFE	.	.	1132	4300	Fresh Dead	
ALEWIFE	.	.	789	3000	Fresh Dead	
ALEWIFE	.	.	658	2500	Fresh Dead	
RAINBOW SMELT	127	10	.	.	Fresh Dead	
RAINBOW SMELT	97	4	.	.	Fresh Dead	
RAINBOW SMELT	144	14	.	.	Fresh Dead	
RAINBOW SMELT	115	7	.	.	Fresh Dead	

RAINBOW SMELT	124	9	.	.	Fresh Dead
RAINBOW SMELT	120	9	.	.	Fresh Dead
RAINBOW SMELT	115	5	.	.	Fresh Dead
RAINBOW SMELT	121	8	.	.	Fresh Dead
RAINBOW SMELT	107	5	.	.	Fresh Dead
RAINBOW SMELT	109	5	.	.	Fresh Dead
RAINBOW SMELT	112	6	.	.	Fresh Dead
RAINBOW SMELT	103	4	.	.	Fresh Dead
RAINBOW SMELT	103	5	.	.	Fresh Dead
RAINBOW SMELT	119	7	.	.	Fresh Dead
RAINBOW SMELT	127	7	.	.	Fresh Dead
RAINBOW SMELT	113	7	.	.	Fresh Dead
RAINBOW SMELT	111	6	.	.	Fresh Dead
RAINBOW SMELT	96	4	.	.	Fresh Dead
BURBOT	575	1400	.	.	Fresh Dead
BURBOT	773	2800	.	.	Fresh Dead
THREESPINE STICKLEBACK	48	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	57	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	55	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	59	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	57	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	58	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	53	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	66	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	70	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	79	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	73	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	69	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	79	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	79	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	70	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	69	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	79	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	78	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	74	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	74	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	67	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	67	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	75	3	.	.	Fresh Dead
YELLOW PERCH	77	4	.	.	Fresh Dead
MOTTLED SCULPIN	82	7	.	.	Fresh Dead
MOTTLED SCULPIN	79	6	.	.	Fresh Dead
MOTTLED SCULPIN	77	5	.	.	Fresh Dead
MOTTLED SCULPIN	84	8	.	.	Fresh Dead
MOTTLED SCULPIN	72	5	.	.	Fresh Dead
MOTTLED SCULPIN	55	3	.	.	Fresh Dead
SLIMY SCULPIN	109	15	.	.	Fresh Dead
SLIMY SCULPIN	83	7	.	.	Fresh Dead

SAMPLING PERIOD: 03JUL06 START DATE AND TIME: 03JUL06:10:30 END DATE AND TIME: 03JUL06:18:40
SAMPLING DURATION (hrs.): 8.17 CW VOLUME SAMPLED (gals x 10^6): 333.2000
INTAKE TEMPERATURES (F): MINIMUM= 52.7 MEAN= 54.4 MAXIMUM= 56.2
DISCHARGE TEMPERATURES (F): MINIMUM= 71.7 MEAN= 73.6 MAXIMUM= 76.0 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 02-08JUL06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 6854.4

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GREAT LAKES CRAYFISH	50	4	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	43	2	.	.	Fresh Dead	
ALEWIFE	.	.	2171	7600	Fresh Dead	
ALEWIFE	.	.	2257	7900	Fresh Dead	
ALEWIFE	.	.	2657	9300	Fresh Dead	
ALEWIFE	.	.	2714	9500	Fresh Dead	
ALEWIFE	.	.	100	352	Fresh Dead	
ALEWIFE	96	5	.	.	Fresh Dead	
ALEWIFE	83	3	.	.	Fresh Dead	
ALEWIFE	77	2	.	.	Fresh Dead	
ALEWIFE	80	3	.	.	Fresh Dead	
ALEWIFE	78	2	.	.	Fresh Dead	
ALEWIFE	85	4	.	.	Fresh Dead	
ALEWIFE	79	2	.	.	Fresh Dead	
ALEWIFE	75	2	.	.	Fresh Dead	
ALEWIFE	68	2	.	.	Fresh Dead	
ALEWIFE	73	2	.	.	Fresh Dead	
ALEWIFE	79	2	.	.	Fresh Dead	
ALEWIFE	76	2	.	.	Fresh Dead	
ALEWIFE	68	2	.	.	Fresh Dead	
ALEWIFE	79	2	.	.	Fresh Dead	
ALEWIFE	72	2	.	.	Fresh Dead	
ALEWIFE	74	2	.	.	Fresh Dead	
ALEWIFE	80	3	.	.	Fresh Dead	
ALEWIFE	76	2	.	.	Fresh Dead	
ALEWIFE	78	3	.	.	Fresh Dead	
ALEWIFE	87	3	.	.	Fresh Dead	
ALEWIFE	88	3	.	.	Fresh Dead	
ALEWIFE	82	3	.	.	Fresh Dead	
ALEWIFE	88	3	.	.	Fresh Dead	
ALEWIFE	95	4	.	.	Fresh Dead	

ALEWIFE	83	3	.	.	Fresh Dead
ALEWIFE	91	4	.	.	Fresh Dead
ALEWIFE	91	4	.	.	Fresh Dead
ALEWIFE	84	3	.	.	Fresh Dead
ALEWIFE	85	3	.	.	Fresh Dead
ALEWIFE	85	3	.	.	Fresh Dead
ALEWIFE	101	4	.	.	Fresh Dead
ALEWIFE	87	3	.	.	Fresh Dead
ALEWIFE	90	3	.	.	Fresh Dead
ALEWIFE	89	3	.	.	Fresh Dead
ALEWIFE	91	4	.	.	Fresh Dead
ALEWIFE	87	3	.	.	Fresh Dead
ALEWIFE	86	3	.	.	Fresh Dead
ALEWIFE	89	4	.	.	Fresh Dead
ALEWIFE	94	4	.	.	Fresh Dead
ALEWIFE	98	4	.	.	Fresh Dead
ALEWIFE	95	4	.	.	Fresh Dead
ALEWIFE	101	5	.	.	Fresh Dead
ALEWIFE	100	5	.	.	Fresh Dead
ALEWIFE	106	7	.	.	Fresh Dead
ALEWIFE	98	6	.	.	Fresh Dead
ALEWIFE	108	7	.	.	Fresh Dead
ALEWIFE	110	7	.	.	Fresh Dead
ALEWIFE	108	8	.	.	Fresh Dead
ALEWIFE	127	11	.	.	Fresh Dead
ALEWIFE	.	.	2371	8300	Fresh Dead
ALEWIFE	.	.	2686	9400	Fresh Dead
ALEWIFE	.	.	2514	8800	Fresh Dead
ALEWIFE	.	.	2486	8700	Fresh Dead
ALEWIFE	.	.	1257	4400	Fresh Dead
RAINBOW SMELT	142	10	.	.	Fresh Dead
RAINBOW SMELT	112	5	.	.	Fresh Dead
RAINBOW SMELT	139	14	.	.	Fresh Dead
RAINBOW SMELT	124	9	.	.	Fresh Dead
RAINBOW SMELT	115	8	.	.	Fresh Dead
RAINBOW SMELT	119	8	.	.	Fresh Dead
RAINBOW SMELT	104	6	.	.	Fresh Dead
RAINBOW SMELT	121	8	.	.	Fresh Dead
NINESPINE STICKLEBACK	78	3	.	.	Fresh Dead

SAMPLING PERIOD: 05-06JUL06 START DATE AND TIME: 05JUL06:00:00 END DATE AND TIME: 06JUL06:00:00
SAMPLING DURATION (hrs.): 24.00 CW VOLUME SAMPLED (gals x 10^6): .
INTAKE TEMPERATURES (F): MINIMUM= . MEAN= . MAXIMUM= .
DISCHARGE TEMPERATURES (F): MINIMUM= . MEAN= . MAXIMUM= . MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: NO SAMPLE CW VOLUME (gals x 10^6) FOR EXTRAPOLATION PERIOD: .

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
NO SAMPLE	.	.	.	.		

SAMPLING PERIOD: 10-11JUL06 START DATE AND TIME: 10JUL06:10:30 END DATE AND TIME: 11JUL06:10:10
SAMPLING DURATION (hrs.): 23.67 CW VOLUME SAMPLED (gals x 10^6): 819.4000
INTAKE TEMPERATURES (F): MINIMUM= 51.4 MEAN= 52.6 MAXIMUM= 56.1
DISCHARGE TEMPERATURES (F): MINIMUM= 70.1 MEAN= 71.3 MAXIMUM= 74.6 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 09-11JUL06 CW VOLUME (gals x 10^6) FOR EXTRAPOLATION PERIOD: 2937.6

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GREAT LAKES CRAYFISH	47	4	.	.	Fresh Dead	
ALEWIFE	141	15	.	.	Fresh Dead	
ALEWIFE	95	3	.	.	Fresh Dead	
ALEWIFE	163	22	.	.	Fresh Dead	
ALEWIFE	99	5	.	.	Fresh Dead	
ALEWIFE	102	7	.	.	Fresh Dead	
ALEWIFE	106	6	.	.	Fresh Dead	
ALEWIFE	107	6	.	.	Fresh Dead	
ALEWIFE	95	4	.	.	Fresh Dead	
ALEWIFE	92	4	.	.	Fresh Dead	
ALEWIFE	110	9	.	.	Fresh Dead	
ALEWIFE	104	5	.	.	Fresh Dead	
ALEWIFE	97	4	.	.	Fresh Dead	
ALEWIFE	78	2	.	.	Fresh Dead	
ALEWIFE	108	5	.	.	Fresh Dead	
ALEWIFE	101	5	.	.	Fresh Dead	
ALEWIFE	109	6	.	.	Fresh Dead	
ALEWIFE	107	8	.	.	Fresh Dead	
ALEWIFE	96	5	.	.	Fresh Dead	
ALEWIFE	90	3	.	.	Fresh Dead	
ALEWIFE	106	5	.	.	Fresh Dead	
ALEWIFE	96	4	.	.	Fresh Dead	
ALEWIFE	90	4	.	.	Fresh Dead	
ALEWIFE	83	4	.	.	Fresh Dead	
ALEWIFE	113	7	.	.	Fresh Dead	
ALEWIFE	108	6	.	.	Fresh Dead	
ALEWIFE	83	3	.	.	Fresh Dead	
ALEWIFE	86	3	.	.	Fresh Dead	

ALEWIFE	84	2	.	.	Fresh Dead
ALEWIFE	85	3	.	.	Fresh Dead
ALEWIFE	75	2	.	.	Fresh Dead
ALEWIFE	81	2	.	.	Fresh Dead
ALEWIFE	80	2	.	.	Fresh Dead
ALEWIFE	96	5	.	.	Fresh Dead
ALEWIFE	84	3	.	.	Fresh Dead
ALEWIFE	91	3	.	.	Fresh Dead
ALEWIFE	74	2	.	.	Fresh Dead
ALEWIFE	76	3	.	.	Fresh Dead
ALEWIFE	91	4	.	.	Fresh Dead
ALEWIFE	77	2	.	.	Fresh Dead
ALEWIFE	105	6	.	.	Fresh Dead
ALEWIFE	103	6	.	.	Fresh Dead
ALEWIFE	94	4	.	.	Fresh Dead
ALEWIFE	83	2	.	.	Fresh Dead
ALEWIFE	70	1	.	.	Fresh Dead
ALEWIFE	72	2	.	.	Fresh Dead
ALEWIFE	90	3	.	.	Fresh Dead
ALEWIFE	76	2	.	.	Fresh Dead
ALEWIFE	71	2	.	.	Fresh Dead
ALEWIFE	85	3	.	.	Fresh Dead
ALEWIFE	109	7	.	.	Fresh Dead
ALEWIFE	.	.	100	308	Fresh Dead
ALEWIFE	.	.	2250	8100	Fresh Dead
ALEWIFE	.	.	1639	5900	Fresh Dead
ALEWIFE	.	.	1472	5300	Fresh Dead
ALEWIFE	.	.	1556	5600	Fresh Dead
ALEWIFE	.	.	861	3100	Fresh Dead
ALEWIFE	.	.	1694	6100	Fresh Dead
ALEWIFE	.	.	389	1400	Fresh Dead
ALEWIFE	.	.	1000	3600	Fresh Dead
ALEWIFE	.	.	694	2500	Fresh Dead
ALEWIFE	.	.	917	3300	Fresh Dead
ALEWIFE	.	.	1222	4400	Fresh Dead
ALEWIFE	.	.	1139	4100	Fresh Dead
ALEWIFE	.	.	1028	3700	Fresh Dead
ALEWIFE	.	.	1028	3700	Fresh Dead
ALEWIFE	.	.	861	3100	Fresh Dead
ALEWIFE	.	.	944	3400	Fresh Dead
ALEWIFE	.	.	833	3000	Fresh Dead
ALEWIFE	.	.	972	3500	Fresh Dead
ALEWIFE	.	.	1139	4100	Fresh Dead
ALEWIFE	.	.	972	3500	Fresh Dead
ALEWIFE	.	.	917	3300	Fresh Dead
ALEWIFE	.	.	833	3000	Fresh Dead
BLOATER	97	4	.	.	Fresh Dead
BLOATER	95	5	.	.	Fresh Dead
COHO SALMON	105	8	.	.	Fresh Dead
RAINBOW SMELT	123	8	.	.	Fresh Dead
RAINBOW SMELT	122	6	.	.	Fresh Dead
RAINBOW SMELT	104	5	.	.	Fresh Dead
RAINBOW SMELT	114	6	.	.	Fresh Dead
RAINBOW SMELT	119	7	.	.	Fresh Dead
RAINBOW SMELT	114	5	.	.	Fresh Dead
RAINBOW SMELT	130	8	.	.	Fresh Dead
RAINBOW SMELT	136	12	.	.	Fresh Dead
RAINBOW SMELT	138	9	.	.	Fresh Dead
RAINBOW SMELT	105	5	.	.	Fresh Dead
RAINBOW SMELT	123	5	.	.	Fresh Dead
RAINBOW SMELT	112	5	.	.	Fresh Dead
RAINBOW SMELT	112	5	.	.	Fresh Dead
RAINBOW SMELT	128	6	.	.	Fresh Dead
RAINBOW SMELT	131	7	.	.	Fresh Dead
RAINBOW SMELT	93	3	.	.	Fresh Dead
RAINBOW SMELT	125	9	.	.	Fresh Dead
RAINBOW SMELT	145	9	.	.	Fresh Dead
RAINBOW SMELT	114	7	.	.	Fresh Dead
RAINBOW SMELT	130	9	.	.	Fresh Dead
RAINBOW SMELT	152	13	.	.	Fresh Dead
RAINBOW SMELT	125	7	.	.	Fresh Dead
RAINBOW SMELT	115	6	.	.	Fresh Dead
RAINBOW SMELT	118	6	.	.	Fresh Dead
RAINBOW SMELT	90	2	.	.	Fresh Dead
RAINBOW SMELT	96	3	.	.	Fresh Dead
RAINBOW SMELT	97	3	.	.	Fresh Dead
RAINBOW SMELT	89	2	.	.	Fresh Dead
RAINBOW SMELT	89	3	.	.	Fresh Dead
RAINBOW SMELT	120	6	.	.	Fresh Dead
RAINBOW SMELT	119	5	.	.	Fresh Dead
RAINBOW SMELT	109	4	.	.	Fresh Dead
RAINBOW SMELT	103	3	.	.	Fresh Dead
RAINBOW SMELT	87	3	.	.	Fresh Dead
RAINBOW SMELT	105	6	.	.	Fresh Dead
RAINBOW SMELT	116	8	.	.	Fresh Dead
RAINBOW SMELT	128	5	.	.	Fresh Dead
RAINBOW SMELT	125	9	.	.	Fresh Dead
RAINBOW SMELT	109	6	.	.	Fresh Dead
RAINBOW SMELT	104	4	.	.	Fresh Dead
RAINBOW SMELT	108	5	.	.	Fresh Dead

RAINBOW SMELT	101	4	.	.	Fresh Dead
RAINBOW SMELT	101	5	.	.	Fresh Dead
RAINBOW SMELT	94	3	.	.	Fresh Dead
RAINBOW SMELT	96	4	.	.	Fresh Dead
RAINBOW SMELT	83	3	.	.	Fresh Dead
RAINBOW SMELT	84	2	.	.	Fresh Dead
RAINBOW SMELT	70	1	.	.	Fresh Dead
SPOTTAIL SHINER	108	9	.	.	Fresh Dead
LONGNOSE SUCKER	210	102	.	.	Fresh Dead
WHITE SUCKER	550	1650	.	.	Live
THREESPINE STICKLEBACK	54	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	58	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	56	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	57	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	60	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	56	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	58	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	59	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	60	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	67	3	.	.	Fresh Dead
THREESPINE STICKLEBACK	64	3	.	.	Fresh Dead
THREESPINE STICKLEBACK	56	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	61	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	68	3	.	.	Fresh Dead
THREESPINE STICKLEBACK	60	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	56	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	57	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	53	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	65	3	.	.	Fresh Dead
THREESPINE STICKLEBACK	60	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	60	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	55	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	64	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	79	4	.	.	Fresh Dead
NINESPINE STICKLEBACK	72	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	60	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	74	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	72	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	67	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	73	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	56	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	62	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	77	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	69	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	56	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	54	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	55	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	59	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	57	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	69	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	53	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	78	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	68	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	62	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	77	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	79	4	.	.	Fresh Dead
NINESPINE STICKLEBACK	74	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	63	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	81	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	71	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	64	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	57	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	58	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	57	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	79	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	78	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	82	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	72	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	63	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	70	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	62	2	.	.	Fresh Dead
YELLOW PERCH	282	242	.	.	Fresh Dead
MOTTLED SCULPIN	105	17	.	.	Fresh Dead
MOTTLED SCULPIN	81	7	.	.	Fresh Dead
MOTTLED SCULPIN	86	9	.	.	Fresh Dead
MOTTLED SCULPIN	77	5	.	.	Fresh Dead
MOTTLED SCULPIN	68	5	.	.	Fresh Dead
MOTTLED SCULPIN	71	7	.	.	Fresh Dead
SLIMY SCULPIN	76	4	.	.	Fresh Dead

SAMPLING PERIOD: 12-13JUL06 START DATE AND TIME: 12JUL06:10:10 END DATE AND TIME: 13JUL06:10:13
SAMPLING DURATION (hrs.): 24.05 CW VOLUME SAMPLED (gals x 10^6): 981.2400
INTAKE TEMPERATURES (F): MINIMUM= 57.2 MEAN= 59.7 MAXIMUM= 61.9
DISCHARGE TEMPERATURES (F): MINIMUM= 75.8 MEAN= 78.7 MAXIMUM= 81.2 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 12-15JUL06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 3916.8

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
ALEWIFE	108	6	.	.	Fresh Dead	
ALEWIFE	85	3	.	.	Fresh Dead	
ALEWIFE	98	5	.	.	Fresh Dead	
ALEWIFE	92	4	.	.	Fresh Dead	
ALEWIFE	80	3	.	.	Fresh Dead	
ALEWIFE	99	6	.	.	Fresh Dead	
ALEWIFE	102	5	.	.	Fresh Dead	
ALEWIFE	99	4	.	.	Fresh Dead	
ALEWIFE	100	5	.	.	Fresh Dead	
ALEWIFE	97	5	.	.	Fresh Dead	
ALEWIFE	98	4	.	.	Fresh Dead	
ALEWIFE	83	3	.	.	Fresh Dead	
ALEWIFE	79	2	.	.	Fresh Dead	
ALEWIFE	103	5	.	.	Fresh Dead	
ALEWIFE	102	6	.	.	Fresh Dead	
ALEWIFE	107	7	.	.	Fresh Dead	
ALEWIFE	115	7	.	.	Fresh Dead	
ALEWIFE	85	4	.	.	Fresh Dead	
ALEWIFE	96	5	.	.	Fresh Dead	
ALEWIFE	91	4	.	.	Fresh Dead	
ALEWIFE	92	4	.	.	Fresh Dead	
ALEWIFE	103	6	.	.	Fresh Dead	
ALEWIFE	89	4	.	.	Fresh Dead	
ALEWIFE	92	5	.	.	Fresh Dead	
ALEWIFE	98	5	.	.	Fresh Dead	
ALEWIFE	96	5	.	.	Fresh Dead	
ALEWIFE	106	7	.	.	Fresh Dead	
ALEWIFE	104	7	.	.	Fresh Dead	
ALEWIFE	111	7	.	.	Fresh Dead	
ALEWIFE	97	5	.	.	Fresh Dead	
ALEWIFE	82	3	.	.	Fresh Dead	
ALEWIFE	88	4	.	.	Fresh Dead	
ALEWIFE	83	3	.	.	Fresh Dead	
ALEWIFE	101	6	.	.	Fresh Dead	
ALEWIFE	82	3	.	.	Fresh Dead	
ALEWIFE	94	4	.	.	Fresh Dead	
ALEWIFE	96	4	.	.	Fresh Dead	
ALEWIFE	85	6	.	.	Fresh Dead	
ALEWIFE	102	6	.	.	Fresh Dead	
ALEWIFE	93	4	.	.	Fresh Dead	
ALEWIFE	74	3	.	.	Fresh Dead	
ALEWIFE	87	3	.	.	Fresh Dead	
ALEWIFE	76	3	.	.	Fresh Dead	
ALEWIFE	107	6	.	.	Fresh Dead	
ALEWIFE	80	3	.	.	Fresh Dead	
ALEWIFE	98	5	.	.	Fresh Dead	
ALEWIFE	102	6	.	.	Fresh Dead	
ALEWIFE	80	3	.	.	Fresh Dead	
ALEWIFE	92	4	.	.	Fresh Dead	
ALEWIFE	76	3	.	.	Fresh Dead	
ALEWIFE	.	.	100	381	Fresh Dead	
ALEWIFE	.	.	780	3200	Fresh Dead	
ALEWIFE	.	.	1537	6300	Fresh Dead	
ALEWIFE	.	.	44	180	Fresh Dead	
ALEWIFE	.	.	1024	4200	Fresh Dead	
ALEWIFE	.	.	1073	4400	Fresh Dead	
ALEWIFE	.	.	732	3000	Fresh Dead	
ALEWIFE	.	.	268	1100	Fresh Dead	
ALEWIFE	.	.	707	2900	Fresh Dead	
ALEWIFE	.	.	1000	4100	Fresh Dead	
ALEWIFE	.	.	561	2300	Fresh Dead	
ALEWIFE	.	.	463	1900	Fresh Dead	
ALEWIFE	.	.	463	1900	Fresh Dead	
RAINBOW SMELT	111	7	.	.	Fresh Dead	
RAINBOW SMELT	112	5	.	.	Fresh Dead	
RAINBOW SMELT	73	1	.	.	Fresh Dead	
RAINBOW SMELT	102	5	.	.	Fresh Dead	
RAINBOW SMELT	94	5	.	.	Fresh Dead	
RAINBOW SMELT	136	10	.	.	Fresh Dead	
RAINBOW SMELT	98	3	.	.	Fresh Dead	
RAINBOW SMELT	146	12	.	.	Fresh Dead	
RAINBOW SMELT	120	8	.	.	Fresh Dead	
RAINBOW SMELT	84	2	.	.	Fresh Dead	
RAINBOW SMELT	120	8	.	.	Fresh Dead	
LONGNOSE SUCKER	332	480	.	.	Fresh Dead	
LONGNOSE SUCKER	445	800	.	.	Fresh Dead	
BLACK BULLHEAD	259	250	.	.	Fresh Dead	
BURBOT	391	500	.	.	Fresh Dead	
THREESPINE STICKLEBACK	60	2	.	.	Fresh Dead	
THREESPINE STICKLEBACK	57	2	.	.	Fresh Dead	
THREESPINE STICKLEBACK	55	1	.	.	Fresh Dead	
THREESPINE STICKLEBACK	59	2	.	.	Fresh Dead	
THREESPINE STICKLEBACK	62	2	.	.	Fresh Dead	
NINESPINE STICKLEBACK	81	4	.	.	Fresh Dead	
NINESPINE STICKLEBACK	77	2	.	.	Fresh Dead	
NINESPINE STICKLEBACK	76	3	.	.	Fresh Dead	
NINESPINE STICKLEBACK	74	2	.	.	Fresh Dead	

NINESPINE STICKLEBACK	62	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	80	2	.	.	Fresh Dead
MOTTLED SCULPIN	72	4	.	.	Fresh Dead
MOTTLED SCULPIN	68	4	.	.	Fresh Dead
MOTTLED SCULPIN	59	3	.	.	Fresh Dead
MOTTLED SCULPIN	61	3	.	.	Fresh Dead
MOTTLED SCULPIN	76	6	.	.	Fresh Dead

SAMPLING PERIOD: 17-18JUL06 START DATE AND TIME: 17JUL06:10:14 END DATE AND TIME: 18JUL06:10:36
SAMPLING DURATION (hrs.): 24.37 CW VOLUME SAMPLED (gals x 10^6): 902.3600
INTAKE TEMPERATURES (F): MINIMUM= 50.1 MEAN= 53.6 MAXIMUM= 57.1
DISCHARGE TEMPERATURES (F): MINIMUM= 69.0 MEAN= 72.4 MAXIMUM= 75.1 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 16-18JUL06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 2937.6

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GREAT LAKES CRAYFISH	50	4	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	39	1	.	.	Fresh Dead	
ALEWIFE	102	5	.	.	Fresh Dead	
ALEWIFE	127	10	.	.	Fresh Dead	
ALEWIFE	73	3	.	.	Fresh Dead	
ALEWIFE	98	6	.	.	Fresh Dead	
ALEWIFE	94	4	.	.	Fresh Dead	
ALEWIFE	111	6	.	.	Fresh Dead	
ALEWIFE	79	2	.	.	Fresh Dead	
ALEWIFE	101	6	.	.	Fresh Dead	
ALEWIFE	95	5	.	.	Fresh Dead	
ALEWIFE	89	3	.	.	Fresh Dead	
ALEWIFE	90	4	.	.	Fresh Dead	
ALEWIFE	96	5	.	.	Fresh Dead	
ALEWIFE	81	2	.	.	Fresh Dead	
ALEWIFE	73	2	.	.	Fresh Dead	
ALEWIFE	104	6	.	.	Fresh Dead	
ALEWIFE	91	3	.	.	Fresh Dead	
ALEWIFE	76	3	.	.	Fresh Dead	
ALEWIFE	106	5	.	.	Fresh Dead	
ALEWIFE	87	4	.	.	Fresh Dead	
ALEWIFE	91	3	.	.	Fresh Dead	
ALEWIFE	97	5	.	.	Fresh Dead	
ALEWIFE	91	4	.	.	Fresh Dead	
ALEWIFE	98	5	.	.	Fresh Dead	
ALEWIFE	104	6	.	.	Fresh Dead	
ALEWIFE	82	3	.	.	Fresh Dead	
ALEWIFE	105	5	.	.	Fresh Dead	
ALEWIFE	80	2	.	.	Fresh Dead	
ALEWIFE	84	3	.	.	Fresh Dead	
ALEWIFE	115	8	.	.	Fresh Dead	
ALEWIFE	83	3	.	.	Fresh Dead	
ALEWIFE	82	4	.	.	Fresh Dead	
ALEWIFE	95	4	.	.	Fresh Dead	
ALEWIFE	105	6	.	.	Fresh Dead	
ALEWIFE	71	2	.	.	Fresh Dead	
ALEWIFE	101	6	.	.	Fresh Dead	
ALEWIFE	78	2	.	.	Fresh Dead	
ALEWIFE	71	1	.	.	Fresh Dead	
ALEWIFE	77	2	.	.	Fresh Dead	
ALEWIFE	82	2	.	.	Fresh Dead	
ALEWIFE	81	3	.	.	Fresh Dead	
ALEWIFE	172	27	.	.	Fresh Dead	
ALEWIFE	75	2	.	.	Fresh Dead	
ALEWIFE	71	2	.	.	Fresh Dead	
ALEWIFE	86	3	.	.	Fresh Dead	
ALEWIFE	76	2	.	.	Fresh Dead	
ALEWIFE	90	4	.	.	Fresh Dead	
ALEWIFE	68	2	.	.	Fresh Dead	
ALEWIFE	89	3	.	.	Fresh Dead	
ALEWIFE	75	2	.	.	Fresh Dead	
ALEWIFE	80	2	.	.	Fresh Dead	
ALEWIFE	.	.	100	374	Fresh Dead	
ALEWIFE	.	.	821	3200	Fresh Dead	
ALEWIFE	.	.	1026	4000	Fresh Dead	
ALEWIFE	.	.	1051	4100	Fresh Dead	
ALEWIFE	.	.	692	2700	Fresh Dead	
ALEWIFE	.	.	1077	4200	Fresh Dead	
ALEWIFE	.	.	590	2300	Fresh Dead	
ALEWIFE	.	.	513	2000	Fresh Dead	
ALEWIFE	.	.	2436	9500	Fresh Dead	
ALEWIFE	.	.	2821	11000	Fresh Dead	
ALEWIFE	.	.	2897	11300	Fresh Dead	
ALEWIFE	.	.	2846	11100	Fresh Dead	
ALEWIFE	.	.	2385	9300	Fresh Dead	
ALEWIFE	.	.	3077	12000	Fresh Dead	
ALEWIFE	.	.	3000	11700	Fresh Dead	
RAINBOW SMELT	113	4	.	.	Fresh Dead	
RAINBOW SMELT	97	3	.	.	Fresh Dead	
RAINBOW SMELT	113	6	.	.	Fresh Dead	
RAINBOW SMELT	100	4	.	.	Fresh Dead	
RAINBOW SMELT	117	5	.	.	Fresh Dead	

RAINBOW SMELT	106	4	.	.	Fresh Dead
RAINBOW SMELT	135	7	.	.	Fresh Dead
RAINBOW SMELT	132	6	.	.	Fresh Dead
RAINBOW SMELT	95	3	.	.	Fresh Dead
RAINBOW SMELT	95	4	.	.	Fresh Dead
RAINBOW SMELT	115	7	.	.	Fresh Dead
RAINBOW SMELT	127	6	.	.	Fresh Dead
RAINBOW SMELT	101	3	.	.	Fresh Dead
RAINBOW SMELT	143	9	.	.	Fresh Dead
RAINBOW SMELT	108	4	.	.	Fresh Dead
RAINBOW SMELT	136	7	.	.	Fresh Dead
RAINBOW SMELT	102	5	.	.	Fresh Dead
RAINBOW SMELT	121	6	.	.	Fresh Dead
RAINBOW SMELT	122	8	.	.	Fresh Dead
RAINBOW SMELT	135	7	.	.	Fresh Dead
RAINBOW SMELT	149	10	.	.	Fresh Dead
RAINBOW SMELT	148	9	.	.	Fresh Dead
RAINBOW SMELT	113	7	.	.	Fresh Dead
RAINBOW SMELT	88	3	.	.	Fresh Dead
RAINBOW SMELT	120	6	.	.	Fresh Dead
RAINBOW SMELT	99	4	.	.	Fresh Dead
RAINBOW SMELT	115	6	.	.	Fresh Dead
RAINBOW SMELT	120	6	.	.	Fresh Dead
RAINBOW SMELT	102	6	.	.	Fresh Dead
RAINBOW SMELT	66	1	.	.	Fresh Dead
RAINBOW SMELT	93	2	.	.	Fresh Dead
RAINBOW SMELT	128	7	.	.	Fresh Dead
RAINBOW SMELT	104	4	.	.	Fresh Dead
RAINBOW SMELT	119	5	.	.	Fresh Dead
RAINBOW SMELT	95	4	.	.	Fresh Dead
RAINBOW SMELT	118	6	.	.	Fresh Dead
RAINBOW SMELT	107	4	.	.	Fresh Dead
RAINBOW SMELT	94	3	.	.	Fresh Dead
RAINBOW SMELT	86	2	.	.	Fresh Dead
RAINBOW SMELT	92	3	.	.	Fresh Dead
RAINBOW SMELT	84	2	.	.	Fresh Dead
RAINBOW SMELT	86	2	.	.	Fresh Dead
RAINBOW SMELT	120	4	.	.	Fresh Dead
RAINBOW SMELT	108	4	.	.	Fresh Dead
RAINBOW SMELT	70	1	.	.	Fresh Dead
RAINBOW SMELT	112	4	.	.	Fresh Dead
RAINBOW SMELT	83	2	.	.	Fresh Dead
RAINBOW SMELT	115	7	.	.	Fresh Dead
RAINBOW SMELT	85	2	.	.	Fresh Dead
RAINBOW SMELT	91	2	.	.	Fresh Dead
RAINBOW SMELT	114	4	.	.	Fresh Dead
RAINBOW SMELT	120	5	.	.	Fresh Dead
RAINBOW SMELT	.	.	97	407	Fresh Dead
SPOTTAIL SHINER	102	7	.	.	Fresh Dead
LONGNOSE SUCKER	270	163	.	.	Fresh Dead
THREESPINE STICKLEBACK	58	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	66	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	60	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	57	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	62	3	.	.	Fresh Dead
THREESPINE STICKLEBACK	59	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	59	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	55	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	56	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	54	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	62	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	55	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	57	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	54	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	55	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	63	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	67	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	65	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	76	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	71	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	82	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	57	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	66	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	75	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	65	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	78	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	82	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	66	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	63	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	47	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	66	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	68	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	69	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	69	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	72	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	65	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	63	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	69	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	77	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	65	2	.	.	Fresh Dead

NINESPINE STICKLEBACK	78	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	59	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	53	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	57	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	65	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	61	2	.	.	Fresh Dead
YELLOW PERCH	64	2	.	.	Fresh Dead
MOTTLED SCULPIN	94	11	.	.	Fresh Dead
MOTTLED SCULPIN	68	3	.	.	Fresh Dead
MOTTLED SCULPIN	48	2	.	.	Fresh Dead
SLIMY SCULPIN	82	7	.	.	Fresh Dead

SAMPLING PERIOD: 19-20JUL06 START DATE AND TIME: 19JUL06:10:19 END DATE AND TIME: 20JUL06:10:07
SAMPLING DURATION (hrs.): 23.80 CW VOLUME SAMPLED (gals x 10^6): 971.0400
INTAKE TEMPERATURES (F): MINIMUM= 49.6 MEAN= 53.0 MAXIMUM= 57.9
DISCHARGE TEMPERATURES (F): MINIMUM= 68.3 MEAN= 72.3 MAXIMUM= 79.4 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 19-22JUL06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 3916.8

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GREAT LAKES CRAYFISH	44	3	.	.	Fresh Dead	
ALEWIFE	112	6	.	.	Fresh Dead	
ALEWIFE	88	4	.	.	Fresh Dead	
ALEWIFE	112	7	.	.	Fresh Dead	
ALEWIFE	104	7	.	.	Fresh Dead	
ALEWIFE	71	2	.	.	Fresh Dead	
ALEWIFE	80	3	.	.	Fresh Dead	
ALEWIFE	79	2	.	.	Fresh Dead	
ALEWIFE	104	5	.	.	Fresh Dead	
ALEWIFE	92	4	.	.	Fresh Dead	
ALEWIFE	87	3	.	.	Fresh Dead	
ALEWIFE	74	2	.	.	Fresh Dead	
ALEWIFE	108	6	.	.	Fresh Dead	
ALEWIFE	102	6	.	.	Fresh Dead	
ALEWIFE	85	3	.	.	Fresh Dead	
ALEWIFE	113	8	.	.	Fresh Dead	
ALEWIFE	94	4	.	.	Fresh Dead	
ALEWIFE	78	2	.	.	Fresh Dead	
ALEWIFE	106	6	.	.	Fresh Dead	
ALEWIFE	73	2	.	.	Fresh Dead	
ALEWIFE	85	4	.	.	Fresh Dead	
ALEWIFE	77	3	.	.	Fresh Dead	
ALEWIFE	65	1	.	.	Fresh Dead	
ALEWIFE	104	5	.	.	Fresh Dead	
ALEWIFE	90	3	.	.	Fresh Dead	
ALEWIFE	79	3	.	.	Fresh Dead	
ALEWIFE	97	4	.	.	Fresh Dead	
ALEWIFE	93	4	.	.	Fresh Dead	
ALEWIFE	72	2	.	.	Fresh Dead	
ALEWIFE	108	6	.	.	Fresh Dead	
ALEWIFE	119	8	.	.	Fresh Dead	
ALEWIFE	101	6	.	.	Fresh Dead	
ALEWIFE	105	5	.	.	Fresh Dead	
ALEWIFE	79	2	.	.	Fresh Dead	
ALEWIFE	94	5	.	.	Fresh Dead	
ALEWIFE	74	2	.	.	Fresh Dead	
ALEWIFE	94	4	.	.	Fresh Dead	
ALEWIFE	90	3	.	.	Fresh Dead	
ALEWIFE	114	9	.	.	Fresh Dead	
ALEWIFE	94	4	.	.	Fresh Dead	
ALEWIFE	75	2	.	.	Fresh Dead	
ALEWIFE	89	4	.	.	Fresh Dead	
ALEWIFE	90	4	.	.	Fresh Dead	
ALEWIFE	93	4	.	.	Fresh Dead	
ALEWIFE	80	2	.	.	Fresh Dead	
ALEWIFE	96	5	.	.	Fresh Dead	
ALEWIFE	80	3	.	.	Fresh Dead	
ALEWIFE	82	3	.	.	Fresh Dead	
ALEWIFE	89	3	.	.	Fresh Dead	
ALEWIFE	95	4	.	.	Fresh Dead	
ALEWIFE	93	4	.	.	Fresh Dead	
ALEWIFE	.	.	100	325	Fresh Dead	
ALEWIFE	.	.	1743	6100	Fresh Dead	
ALEWIFE	.	.	657	2300	Fresh Dead	
ALEWIFE	.	.	1000	3500	Fresh Dead	
ALEWIFE	.	.	1486	5200	Fresh Dead	
ALEWIFE	.	.	686	2400	Fresh Dead	
ALEWIFE	.	.	2314	8100	Fresh Dead	
ALEWIFE	.	.	1771	6200	Fresh Dead	
ALEWIFE	.	.	1629	5700	Fresh Dead	
ALEWIFE	.	.	1086	3800	Fresh Dead	
ALEWIFE	.	.	3437	12030	Fresh Dead	
ALEWIFE	.	.	3143	11000	Fresh Dead	
ALEWIFE	.	.	143	500	Fresh Dead	
ALEWIFE	.	.	1743	6100	Fresh Dead	
ALEWIFE	.	.	1714	6000	Fresh Dead	
ALEWIFE	.	.	2543	8900	Fresh Dead	
ALEWIFE	.	.	3143	11000	Fresh Dead	

ALEWIFE	.	.	2000	7000	Fresh Dead
RAINBOW SMELT	114	7	.	.	Fresh Dead
RAINBOW SMELT	140	13	.	.	Fresh Dead
RAINBOW SMELT	158	12	.	.	Fresh Dead
RAINBOW SMELT	93	3	.	.	Fresh Dead
RAINBOW SMELT	142	7	.	.	Fresh Dead
RAINBOW SMELT	101	5	.	.	Fresh Dead
RAINBOW SMELT	126	6	.	.	Fresh Dead
RAINBOW SMELT	128	5	.	.	Fresh Dead
RAINBOW SMELT	109	4	.	.	Fresh Dead
RAINBOW SMELT	107	3	.	.	Fresh Dead
RAINBOW SMELT	136	9	.	.	Fresh Dead
RAINBOW SMELT	108	5	.	.	Fresh Dead
RAINBOW SMELT	115	4	.	.	Fresh Dead
RAINBOW SMELT	125	5	.	.	Fresh Dead
RAINBOW SMELT	104	5	.	.	Fresh Dead
RAINBOW SMELT	119	7	.	.	Fresh Dead
RAINBOW SMELT	170	20	.	.	Fresh Dead
RAINBOW SMELT	112	4	.	.	Fresh Dead
RAINBOW SMELT	113	6	.	.	Fresh Dead
RAINBOW SMELT	140	7	.	.	Fresh Dead
RAINBOW SMELT	99	4	.	.	Fresh Dead
RAINBOW SMELT	113	6	.	.	Fresh Dead
RAINBOW SMELT	100	3	.	.	Fresh Dead
RAINBOW SMELT	100	4	.	.	Fresh Dead
RAINBOW SMELT	101	5	.	.	Fresh Dead
RAINBOW SMELT	159	15	.	.	Fresh Dead
RAINBOW SMELT	122	7	.	.	Fresh Dead
RAINBOW SMELT	131	10	.	.	Fresh Dead
RAINBOW SMELT	66	1	.	.	Fresh Dead
RAINBOW SMELT	92	3	.	.	Fresh Dead
RAINBOW SMELT	94	3	.	.	Fresh Dead
RAINBOW SMELT	111	5	.	.	Fresh Dead
RAINBOW SMELT	155	12	.	.	Fresh Dead
SPOTTAIL SHINER	116	14	.	.	Fresh Dead
SPOTTAIL SHINER	111	11	.	.	Fresh Dead
LONGNOSE SUCKER	231	115	.	.	Fresh Dead
LONGNOSE SUCKER	226	115	.	.	Fresh Dead
LONGNOSE SUCKER	225	110	.	.	Fresh Dead
WHITE SUCKER	504	1100	.	.	Fresh Dead
BLACK BULLHEAD	210	154	.	.	Fresh Dead
THREESPINE STICKLEBACK	56	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	68	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	83	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	65	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	73	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	69	3	.	.	Fresh Dead
MOTTLED SCULPIN	71	5	.	.	Fresh Dead
MOTTLED SCULPIN	83	7	.	.	Fresh Dead
MOTTLED SCULPIN	95	12	.	.	Fresh Dead
MOTTLED SCULPIN	82	7	.	.	Fresh Dead
MOTTLED SCULPIN	88	9	.	.	Fresh Dead
MOTTLED SCULPIN	82	8	.	.	Fresh Dead
MOTTLED SCULPIN	74	6	.	.	Fresh Dead
MOTTLED SCULPIN	75	5	.	.	Fresh Dead
MOTTLED SCULPIN	81	6	.	.	Fresh Dead
MOTTLED SCULPIN	74	5	.	.	Fresh Dead
MOTTLED SCULPIN	66	4	.	.	Fresh Dead

SAMPLING PERIOD: 24-25JUL06 START DATE AND TIME: 24JUL06:10:16 END DATE AND TIME: 25JUL06:10:15
SAMPLING DURATION (hrs.): 23.98 CW VOLUME SAMPLED (gals x 10^6): 978.5200
INTAKE TEMPERATURES (F): MINIMUM= 56.8 MEAN= 58.4 MAXIMUM= 59.7
DISCHARGE TEMPERATURES (F): MINIMUM= 75.8 MEAN= 77.8 MAXIMUM= 79.7 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 23-25JUL06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 2937.6

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GREAT LAKES CRAYFISH	59	6	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	50	4	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	42	3	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	50	4	.	.	Fresh Dead	
ALEWIFE	124	9	.	.	Fresh Dead	
ALEWIFE	80	3	.	.	Fresh Dead	
ALEWIFE	102	5	.	.	Fresh Dead	
ALEWIFE	81	3	.	.	Fresh Dead	
ALEWIFE	113	6	.	.	Fresh Dead	
ALEWIFE	87	3	.	.	Fresh Dead	
ALEWIFE	80	2	.	.	Fresh Dead	
ALEWIFE	84	3	.	.	Fresh Dead	
ALEWIFE	100	6	.	.	Fresh Dead	
ALEWIFE	73	2	.	.	Fresh Dead	
ALEWIFE	82	3	.	.	Fresh Dead	
ALEWIFE	76	2	.	.	Fresh Dead	
ALEWIFE	86	3	.	.	Fresh Dead	
ALEWIFE	79	2	.	.	Fresh Dead	
ALEWIFE	85	3	.	.	Fresh Dead	
ALEWIFE	75	2	.	.	Fresh Dead	
ALEWIFE	116	7	.	.	Fresh Dead	

ALEWIFE	67	1	.	.	Fresh Dead
ALEWIFE	95	4	.	.	Fresh Dead
ALEWIFE	165	25	.	.	Fresh Dead
ALEWIFE	85	3	.	.	Fresh Dead
ALEWIFE	86	3	.	.	Fresh Dead
ALEWIFE	90	3	.	.	Fresh Dead
ALEWIFE	92	4	.	.	Fresh Dead
ALEWIFE	92	4	.	.	Fresh Dead
ALEWIFE	93	4	.	.	Fresh Dead
ALEWIFE	81	3	.	.	Fresh Dead
ALEWIFE	85	3	.	.	Fresh Dead
ALEWIFE	90	3	.	.	Fresh Dead
ALEWIFE	97	5	.	.	Fresh Dead
ALEWIFE	78	2	.	.	Fresh Dead
ALEWIFE	63	1	.	.	Fresh Dead
ALEWIFE	80	2	.	.	Fresh Dead
ALEWIFE	95	4	.	.	Fresh Dead
ALEWIFE	100	5	.	.	Fresh Dead
ALEWIFE	90	3	.	.	Fresh Dead
ALEWIFE	94	3	.	.	Fresh Dead
ALEWIFE	118	9	.	.	Fresh Dead
ALEWIFE	93	4	.	.	Fresh Dead
ALEWIFE	97	5	.	.	Fresh Dead
ALEWIFE	109	8	.	.	Fresh Dead
ALEWIFE	100	5	.	.	Fresh Dead
ALEWIFE	102	6	.	.	Fresh Dead
ALEWIFE	120	10	.	.	Fresh Dead
ALEWIFE	66	2	.	.	Fresh Dead
ALEWIFE	123	9	.	.	Fresh Dead
ALEWIFE	75	2	.	.	Fresh Dead
ALEWIFE	86	3	.	.	Fresh Dead
ALEWIFE	80	3	.	.	Fresh Dead
ALEWIFE	73	2	.	.	Fresh Dead
ALEWIFE	.	.	100	355	Fresh Dead
ALEWIFE	.	.	368	1400	Fresh Dead
ALEWIFE	.	.	1158	4400	Fresh Dead
ALEWIFE	.	.	1184	4500	Fresh Dead
ALEWIFE	.	.	289	1100	Fresh Dead
ALEWIFE	.	.	2289	8700	Fresh Dead
ALEWIFE	.	.	1632	6200	Fresh Dead
ALEWIFE	.	.	974	3700	Fresh Dead
BLOATER	78	5	.	.	Fresh Dead
RAINBOW SMELT	116	4	.	.	Fresh Dead
RAINBOW SMELT	122	8	.	.	Fresh Dead
RAINBOW SMELT	119	4	.	.	Fresh Dead
RAINBOW SMELT	121	6	.	.	Fresh Dead
RAINBOW SMELT	105	3	.	.	Fresh Dead
RAINBOW SMELT	113	3	.	.	Fresh Dead
RAINBOW SMELT	114	4	.	.	Fresh Dead
RAINBOW SMELT	116	4	.	.	Fresh Dead
LONGNOSE SUCKER	285	220	.	.	Fresh Dead
LONGNOSE SUCKER	402	800	.	.	Fresh Dead
WHITE SUCKER	514	1400	.	.	Fresh Dead
WHITE SUCKER	535	1400	.	.	Fresh Dead
BLACK BULLHEAD	216	178	.	.	Fresh Dead
BURBOT	387	500	.	.	Fresh Dead
THREESPINE STICKLEBACK	55	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	57	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	58	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	57	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	55	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	65	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	75	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	56	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	74	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	66	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	58	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	62	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	71	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	73	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	70	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	75	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	63	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	79	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	70	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	65	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	64	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	78	3	.	.	Fresh Dead
YELLOW PERCH	251	168	.	.	Fresh Dead
MOTTLED SCULPIN	64	3	.	.	Fresh Dead
MOTTLED SCULPIN	61	3	.	.	Fresh Dead
MOTTLED SCULPIN	65	3	.	.	Fresh Dead
MOTTLED SCULPIN	61	3	.	.	Fresh Dead
MOTTLED SCULPIN	52	2	.	.	Fresh Dead
SLIMY SCULPIN	80	6	.	.	Fresh Dead

SAMPLING PERIOD: 26-27JUL06 START DATE AND TIME: 26JUL06:10:40 END DATE AND TIME: 27JUL06:10:30
SAMPLING DURATION (hrs.): 23.83 CW VOLUME SAMPLED (gals x 10^6): 972.4000
INTAKE TEMPERATURES (F): MINIMUM= 57.3 MEAN= 58.9 MAXIMUM= 62.2
DISCHARGE TEMPERATURES (F): MINIMUM= 76.3 MEAN= 78.2 MAXIMUM= 81.2 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 26-29JUL06 CW VOLUME (gals x 10^6) FOR EXTRAPOLATION PERIOD: 3916.8

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GREAT LAKES CRAYFISH	.	.	1	.	Fresh Dead	
ALEWIFE	91	4	.	.	Fresh Dead	
ALEWIFE	78	2	.	.	Fresh Dead	
ALEWIFE	74	2	.	.	Fresh Dead	
ALEWIFE	84	3	.	.	Fresh Dead	
ALEWIFE	75	2	.	.	Fresh Dead	
ALEWIFE	86	4	.	.	Fresh Dead	
ALEWIFE	77	3	.	.	Fresh Dead	
ALEWIFE	82	2	.	.	Fresh Dead	
ALEWIFE	77	2	.	.	Fresh Dead	
ALEWIFE	75	2	.	.	Fresh Dead	
ALEWIFE	79	2	.	.	Fresh Dead	
ALEWIFE	79	2	.	.	Fresh Dead	
ALEWIFE	73	2	.	.	Fresh Dead	
ALEWIFE	80	2	.	.	Fresh Dead	
ALEWIFE	81	3	.	.	Fresh Dead	
ALEWIFE	71	2	.	.	Fresh Dead	
ALEWIFE	78	2	.	.	Fresh Dead	
ALEWIFE	78	2	.	.	Fresh Dead	
ALEWIFE	74	2	.	.	Fresh Dead	
ALEWIFE	80	3	.	.	Fresh Dead	
ALEWIFE	86	3	.	.	Fresh Dead	
ALEWIFE	89	3	.	.	Fresh Dead	
ALEWIFE	97	4	.	.	Fresh Dead	
ALEWIFE	90	4	.	.	Fresh Dead	
ALEWIFE	94	4	.	.	Fresh Dead	
ALEWIFE	87	3	.	.	Fresh Dead	
ALEWIFE	93	4	.	.	Fresh Dead	
ALEWIFE	87	3	.	.	Fresh Dead	
ALEWIFE	91	4	.	.	Fresh Dead	
ALEWIFE	93	4	.	.	Fresh Dead	
ALEWIFE	87	4	.	.	Fresh Dead	
ALEWIFE	95	4	.	.	Fresh Dead	
ALEWIFE	99	5	.	.	Fresh Dead	
ALEWIFE	94	4	.	.	Fresh Dead	
ALEWIFE	96	4	.	.	Fresh Dead	
ALEWIFE	97	5	.	.	Fresh Dead	
ALEWIFE	93	4	.	.	Fresh Dead	
ALEWIFE	104	6	.	.	Fresh Dead	
ALEWIFE	100	5	.	.	Fresh Dead	
ALEWIFE	99	5	.	.	Fresh Dead	
ALEWIFE	107	6	.	.	Fresh Dead	
ALEWIFE	106	6	.	.	Fresh Dead	
ALEWIFE	103	5	.	.	Fresh Dead	
ALEWIFE	104	6	.	.	Fresh Dead	
ALEWIFE	111	8	.	.	Fresh Dead	
ALEWIFE	110	7	.	.	Fresh Dead	
ALEWIFE	111	7	.	.	Fresh Dead	
ALEWIFE	112	6	.	.	Fresh Dead	
ALEWIFE	112	6	.	.	Fresh Dead	
ALEWIFE	126	10	.	.	Fresh Dead	
ALEWIFE	.	.	100	342	Fresh Dead	
ALEWIFE	.	.	139	500	Fresh Dead	
ALEWIFE	.	.	389	1400	Fresh Dead	
ALEWIFE	.	.	236	850	Fresh Dead	
ALEWIFE	.	.	1444	5200	Fresh Dead	
ALEWIFE	.	.	833	3000	Fresh Dead	
ALEWIFE	.	.	1778	6400	Fresh Dead	
ALEWIFE	.	.	833	3000	Fresh Dead	
ALEWIFE	.	.	611	2200	Fresh Dead	
RAINBOW SMELT	141	9	.	.	Fresh Dead	
RAINBOW SMELT	141	9	.	.	Fresh Dead	
RAINBOW SMELT	112	6	.	.	Fresh Dead	
RAINBOW SMELT	78	1	.	.	Fresh Dead	
RAINBOW SMELT	106	5	.	.	Fresh Dead	
COMMON CARP	200	96	.	.	Fresh Dead	
WHITE SUCKER	405	700	.	.	Fresh Dead	
WHITE SUCKER	504	1100	.	.	Fresh Dead	
THREESPINE STICKLEBACK	60	1	.	.	Fresh Dead	
THREESPINE STICKLEBACK	62	1	.	.	Fresh Dead	
NINESPINE STICKLEBACK	70	3	.	.	Fresh Dead	
NINESPINE STICKLEBACK	59	1	.	.	Fresh Dead	
NINESPINE STICKLEBACK	60	2	.	.	Fresh Dead	
YELLOW PERCH	342	500	.	.	Fresh Dead	
YELLOW PERCH	305	284	.	.	Fresh Dead	
MOTTLED SCULPIN	67	4	.	.	Fresh Dead	
MOTTLED SCULPIN	56	3	.	.	Fresh Dead	
MOTTLED SCULPIN	69	3	.	.	Fresh Dead	

SAMPLING PERIOD: 31JUL-01AUG06 START DATE AND TIME: 31JUL06:10:16 END DATE AND TIME: 01AUG06:10:00
SAMPLING DURATION (hrs.): 23.73 CW VOLUME SAMPLED (gals x 10^6): 968.3200
INTAKE TEMPERATURES (F): MINIMUM= 49.2 MEAN= 50.5 MAXIMUM= 52.6
DISCHARGE TEMPERATURES (F): MINIMUM= 69.5 MEAN= 71.3 MAXIMUM= 75.0 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 30JUL-01AUG06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 2937.6

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GREAT LAKES CRAYFISH	58	6	.	.	Fresh Dead	
ALEWIFE	98	5	.	.	Fresh Dead	
ALEWIFE	121	8	.	.	Fresh Dead	
ALEWIFE	120	27	.	.	Fresh Dead	
ALEWIFE	108	7	.	.	Fresh Dead	
ALEWIFE	101	6	.	.	Fresh Dead	
ALEWIFE	127	10	.	.	Fresh Dead	
ALEWIFE	182	30	.	.	Fresh Dead	
ALEWIFE	90	4	.	.	Fresh Dead	
ALEWIFE	78	2	.	.	Fresh Dead	
ALEWIFE	113	10	.	.	Fresh Dead	
ALEWIFE	121	7	.	.	Fresh Dead	
ALEWIFE	155	19	.	.	Fresh Dead	
ALEWIFE	96	4	.	.	Fresh Dead	
ALEWIFE	102	7	.	.	Fresh Dead	
ALEWIFE	92	5	.	.	Fresh Dead	
ALEWIFE	105	6	.	.	Fresh Dead	
ALEWIFE	163	21	.	.	Fresh Dead	
ALEWIFE	102	5	.	.	Fresh Dead	
ALEWIFE	97	4	.	.	Fresh Dead	
ALEWIFE	117	10	.	.	Fresh Dead	
ALEWIFE	112	7	.	.	Fresh Dead	
ALEWIFE	99	5	.	.	Fresh Dead	
ALEWIFE	110	6	.	.	Fresh Dead	
ALEWIFE	96	5	.	.	Fresh Dead	
ALEWIFE	99	5	.	.	Fresh Dead	
ALEWIFE	90	4	.	.	Fresh Dead	
ALEWIFE	98	5	.	.	Fresh Dead	
ALEWIFE	78	2	.	.	Fresh Dead	
ALEWIFE	99	5	.	.	Fresh Dead	
ALEWIFE	83	3	.	.	Fresh Dead	
ALEWIFE	87	3	.	.	Fresh Dead	
ALEWIFE	92	4	.	.	Fresh Dead	
ALEWIFE	97	5	.	.	Fresh Dead	
ALEWIFE	82	2	.	.	Fresh Dead	
ALEWIFE	80	3	.	.	Fresh Dead	
ALEWIFE	83	3	.	.	Fresh Dead	
ALEWIFE	72	2	.	.	Fresh Dead	
ALEWIFE	77	3	.	.	Fresh Dead	
ALEWIFE	97	4	.	.	Fresh Dead	
ALEWIFE	84	3	.	.	Fresh Dead	
ALEWIFE	85	3	.	.	Fresh Dead	
ALEWIFE	78	3	.	.	Fresh Dead	
ALEWIFE	71	2	.	.	Fresh Dead	
ALEWIFE	85	3	.	.	Fresh Dead	
ALEWIFE	79	3	.	.	Fresh Dead	
ALEWIFE	80	3	.	.	Fresh Dead	
ALEWIFE	76	2	.	.	Fresh Dead	
ALEWIFE	71	2	.	.	Fresh Dead	
ALEWIFE	77	3	.	.	Fresh Dead	
ALEWIFE	71	2	.	.	Fresh Dead	
ALEWIFE	.	.	64	195	Fresh Dead	
ALEWIFE	.	.	100	382	Fresh Dead	
ALEWIFE	.	.	257	900	Fresh Dead	
ALEWIFE	.	.	943	3300	Fresh Dead	
ALEWIFE	.	.	800	2800	Fresh Dead	
ALEWIFE	.	.	1143	4000	Fresh Dead	
ALEWIFE	.	.	1571	5500	Fresh Dead	
ALEWIFE	.	.	600	2100	Fresh Dead	
ALEWIFE	.	.	171	600	Fresh Dead	
ALEWIFE	.	.	343	1200	Fresh Dead	
ALEWIFE	.	.	371	1300	Fresh Dead	
RAINBOW SMELT	120	6	.	.	Fresh Dead	
RAINBOW SMELT	104	3	.	.	Fresh Dead	
RAINBOW SMELT	110	3	.	.	Fresh Dead	
RAINBOW SMELT	125	6	.	.	Fresh Dead	
RAINBOW SMELT	116	4	.	.	Fresh Dead	
RAINBOW SMELT	108	4	.	.	Fresh Dead	
RAINBOW SMELT	112	3	.	.	Fresh Dead	
RAINBOW SMELT	86	2	.	.	Fresh Dead	
RAINBOW SMELT	85	2	.	.	Fresh Dead	
RAINBOW SMELT	54	1	.	.	Fresh Dead	
RAINBOW SMELT	134	7	.	.	Fresh Dead	
RAINBOW SMELT	141	6	.	.	Fresh Dead	
RAINBOW SMELT	124	8	.	.	Fresh Dead	
RAINBOW SMELT	105	5	.	.	Fresh Dead	
RAINBOW SMELT	136	8	.	.	Fresh Dead	
RAINBOW SMELT	97	4	.	.	Fresh Dead	
RAINBOW SMELT	121	5	.	.	Fresh Dead	
RAINBOW SMELT	108	6	.	.	Fresh Dead	
RAINBOW SMELT	96	5	.	.	Fresh Dead	

RAINBOW SMELT	134	9	.	.	Fresh Dead
RAINBOW SMELT	110	5	.	.	Fresh Dead
RAINBOW SMELT	.	.	1	4	Fresh Dead
SPOTTAIL SHINER	109	12	.	.	Fresh Dead
LONGNOSE SUCKER	293	240	.	.	Fresh Dead
THREESPINE STICKLEBACK	60	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	49	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	71	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	62	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	75	3	.	.	Fresh Dead
MOTTLED SCULPIN	100	13	.	.	Fresh Dead
MOTTLED SCULPIN	61	3	.	.	Fresh Dead
MOTTLED SCULPIN	80	5	.	.	Fresh Dead
MOTTLED SCULPIN	57	3	.	.	Fresh Dead
MOTTLED SCULPIN	57	3	.	.	Fresh Dead
MOTTLED SCULPIN	61	4	.	.	Fresh Dead

SAMPLING PERIOD: 02-03AUG06 START DATE AND TIME: 02AUG06:10:10 END DATE AND TIME: 03AUG06:10:30
SAMPLING DURATION (hrs.): 24.33 CW VOLUME SAMPLED (gals x 10^6): 863.6000
INTAKE TEMPERATURES (F): MINIMUM= 51.1 MEAN= 59.3 MAXIMUM= 64.9
DISCHARGE TEMPERATURES (F): MINIMUM= 71.4 MEAN= 79.1 MAXIMUM= 85.1 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 02-05AUG06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 3916.8

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GREAT LAKES CRAYFISH	53	5	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	47	3	.	.	Fresh Dead	
ALEWIFE	170	26	.	.	Fresh Dead	
ALEWIFE	101	5	.	.	Fresh Dead	
ALEWIFE	115	8	.	.	Fresh Dead	
ALEWIFE	110	8	.	.	Fresh Dead	
ALEWIFE	128	9	.	.	Fresh Dead	
ALEWIFE	101	5	.	.	Fresh Dead	
ALEWIFE	94	5	.	.	Fresh Dead	
ALEWIFE	103	6	.	.	Fresh Dead	
ALEWIFE	95	4	.	.	Fresh Dead	
ALEWIFE	100	6	.	.	Fresh Dead	
ALEWIFE	102	6	.	.	Fresh Dead	
ALEWIFE	119	9	.	.	Fresh Dead	
ALEWIFE	87	4	.	.	Fresh Dead	
ALEWIFE	86	3	.	.	Fresh Dead	
ALEWIFE	97	5	.	.	Fresh Dead	
ALEWIFE	106	6	.	.	Fresh Dead	
ALEWIFE	108	7	.	.	Fresh Dead	
ALEWIFE	103	5	.	.	Fresh Dead	
ALEWIFE	102	5	.	.	Fresh Dead	
ALEWIFE	82	3	.	.	Fresh Dead	
ALEWIFE	108	7	.	.	Fresh Dead	
ALEWIFE	108	6	.	.	Fresh Dead	
ALEWIFE	94	4	.	.	Fresh Dead	
ALEWIFE	91	4	.	.	Fresh Dead	
ALEWIFE	77	2	.	.	Fresh Dead	
ALEWIFE	100	5	.	.	Fresh Dead	
ALEWIFE	99	6	.	.	Fresh Dead	
ALEWIFE	82	3	.	.	Fresh Dead	
ALEWIFE	81	3	.	.	Fresh Dead	
ALEWIFE	87	4	.	.	Fresh Dead	
ALEWIFE	82	3	.	.	Fresh Dead	
ALEWIFE	78	2	.	.	Fresh Dead	
ALEWIFE	154	17	.	.	Fresh Dead	
ALEWIFE	102	5	.	.	Fresh Dead	
ALEWIFE	92	5	.	.	Fresh Dead	
ALEWIFE	101	6	.	.	Fresh Dead	
ALEWIFE	68	2	.	.	Fresh Dead	
ALEWIFE	87	3	.	.	Fresh Dead	
ALEWIFE	70	2	.	.	Fresh Dead	
ALEWIFE	99	4	.	.	Fresh Dead	
ALEWIFE	83	4	.	.	Fresh Dead	
ALEWIFE	77	2	.	.	Fresh Dead	
ALEWIFE	95	5	.	.	Fresh Dead	
ALEWIFE	76	3	.	.	Fresh Dead	
ALEWIFE	101	5	.	.	Fresh Dead	
ALEWIFE	87	4	.	.	Fresh Dead	
ALEWIFE	79	3	.	.	Fresh Dead	
ALEWIFE	84	3	.	.	Fresh Dead	
ALEWIFE	181	28	.	.	Fresh Dead	
ALEWIFE	113	7	.	.	Fresh Dead	
ALEWIFE	.	.	22	82	Fresh Dead	
ALEWIFE	.	.	44	211	Fresh Dead	
ALEWIFE	.	.	604	3200	Fresh Dead	
ALEWIFE	.	.	189	1000	Fresh Dead	
ALEWIFE	.	.	415	2200	Fresh Dead	
ALEWIFE	.	.	491	2600	Fresh Dead	
ALEWIFE	.	.	75	400	Fresh Dead	
CHINOOK SALMON	151	32	.	.	Fresh Dead	
CHINOOK SALMON	133	17	.	.	Fresh Dead	
BROWN TROUT	313	400	.	.	Fresh Dead	
RAINBOW SMELT	120	6	.	.	Fresh Dead	

RAINBOW SMELT	105	4	.	.	Fresh Dead
RAINBOW SMELT	75	1	.	.	Fresh Dead
RAINBOW SMELT	120	7	.	.	Fresh Dead
RAINBOW SMELT	105	4	.	.	Fresh Dead
RAINBOW SMELT	82	2	.	.	Fresh Dead
RAINBOW SMELT	62	1	.	.	Fresh Dead
RAINBOW SMELT	105	4	.	.	Fresh Dead
RAINBOW SMELT	97	4	.	.	Fresh Dead
RAINBOW SMELT	128	6	.	.	Fresh Dead
RAINBOW SMELT	100	5	.	.	Fresh Dead
RAINBOW SMELT	71	2	.	.	Fresh Dead
WHITE SUCKER	435	900	.	.	Fresh Dead
WHITE SUCKER	459	900	.	.	Fresh Dead
BURBOT	597	1500	.	.	Fresh Dead
THREESPINE STICKLEBACK	60	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	63	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	64	3	.	.	Fresh Dead
THREESPINE STICKLEBACK	55	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	56	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	46	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	56	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	56	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	52	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	55	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	61	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	66	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	68	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	65	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	56	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	62	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	68	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	64	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	70	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	60	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	76	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	70	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	67	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	66	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	77	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	75	3	.	.	Fresh Dead
NINESPINE STICKLEBACK	59	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	60	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	67	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	58	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	64	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	61	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	68	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	68	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	66	3	.	.	Fresh Dead
YELLOW PERCH	90	7	.	.	Fresh Dead
YELLOW PERCH	90	7	.	.	Fresh Dead
YELLOW PERCH	81	5	.	.	Fresh Dead
YELLOW PERCH	58	2	.	.	Fresh Dead
YELLOW PERCH	71	4	.	.	Fresh Dead
YELLOW PERCH	66	3	.	.	Fresh Dead
YELLOW PERCH	75	4	.	.	Fresh Dead
MOTTLED SCULPIN	94	11	.	.	Fresh Dead
MOTTLED SCULPIN	90	10	.	.	Fresh Dead
MOTTLED SCULPIN	61	3	.	.	Fresh Dead
MOTTLED SCULPIN	55	2	.	.	Fresh Dead
MOTTLED SCULPIN	52	2	.	.	Fresh Dead

SAMPLING PERIOD: 07-08AUG06 START DATE AND TIME: 07AUG06:10:40 END DATE AND TIME: 08AUG06:02:45
SAMPLING DURATION (hrs.): 16.08 CW VOLUME SAMPLED (gals x 10^6): 656.2000
INTAKE TEMPERATURES (F): MINIMUM= 66.7 MEAN= 68.2 MAXIMUM= 69.8
DISCHARGE TEMPERATURES (F): MINIMUM= 85.6 MEAN= 88.7 MAXIMUM= 91.6 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 06-08AUG06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 2937.6

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GREAT LAKES CRAYFISH	50	5	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	39	2	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	46	3	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	46	3	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	49	4	.	.	Fresh Dead	
ALEWIFE	195	32	.	.	Fresh Dead	
ALEWIFE	155	15	.	.	Fresh Dead	
ALEWIFE	116	8	.	.	Fresh Dead	
ALEWIFE	89	3	.	.	Fresh Dead	
ALEWIFE	152	22	.	.	Fresh Dead	
ALEWIFE	81	3	.	.	Fresh Dead	
ALEWIFE	162	19	.	.	Fresh Dead	
ALEWIFE	95	4	.	.	Fresh Dead	
ALEWIFE	81	3	.	.	Fresh Dead	
ALEWIFE	94	5	.	.	Fresh Dead	
ALEWIFE	96	12	.	.	Fresh Dead	
ALEWIFE	166	21	.	.	Fresh Dead	
ALEWIFE	112	7	.	.	Fresh Dead	

ALEWIFE	148	17	.	.	Fresh Dead
ALEWIFE	91	4	.	.	Fresh Dead
ALEWIFE	82	3	.	.	Fresh Dead
ALEWIFE	99	5	.	.	Fresh Dead
ALEWIFE	131	19	.	.	Fresh Dead
ALEWIFE	70	2	.	.	Fresh Dead
ALEWIFE	81	3	.	.	Fresh Dead
ALEWIFE	98	5	.	.	Fresh Dead
ALEWIFE	80	3	.	.	Fresh Dead
ALEWIFE	83	3	.	.	Fresh Dead
ALEWIFE	96	5	.	.	Fresh Dead
ALEWIFE	79	2	.	.	Fresh Dead
ALEWIFE	167	21	.	.	Fresh Dead
ALEWIFE	101	6	.	.	Fresh Dead
ALEWIFE	111	7	.	.	Fresh Dead
ALEWIFE	67	2	.	.	Fresh Dead
ALEWIFE	93	4	.	.	Fresh Dead
ALEWIFE	114	8	.	.	Fresh Dead
ALEWIFE	182	26	.	.	Fresh Dead
ALEWIFE	105	7	.	.	Fresh Dead
ALEWIFE	118	10	.	.	Fresh Dead
ALEWIFE	97	5	.	.	Fresh Dead
ALEWIFE	140	16	.	.	Fresh Dead
ALEWIFE	107	6	.	.	Fresh Dead
ALEWIFE	72	3	.	.	Fresh Dead
ALEWIFE	88	3	.	.	Fresh Dead
ALEWIFE	74	3	.	.	Fresh Dead
ALEWIFE	84	3	.	.	Fresh Dead
ALEWIFE	77	3	.	.	Fresh Dead
ALEWIFE	80	4	.	.	Fresh Dead
ALEWIFE	107	7	.	.	Fresh Dead
ALEWIFE	80	3	.	.	Fresh Dead
ALEWIFE	109	6	.	.	Fresh Dead
ALEWIFE	95	5	.	.	Fresh Dead
ALEWIFE	100	5	.	.	Fresh Dead
ALEWIFE	75	3	.	.	Fresh Dead
ALEWIFE	114	9	.	.	Fresh Dead
ALEWIFE	.	.	100	865	Fresh Dead
ALEWIFE	.	.	90	650	Fresh Dead
ALEWIFE	.	.	89	445	Fresh Dead
SPOTTAIL SHINER	98	9	.	.	Fresh Dead
SPOTTAIL SHINER	126	20	.	.	Fresh Dead
LONGNOSE SUCKER	249	156	.	.	Fresh Dead
LONGNOSE SUCKER	470	850	.	.	Fresh Dead
WHITE SUCKER	451	1000	.	.	Fresh Dead
BURBOT	615	1150	.	.	Fresh Dead
NINESPINE STICKLEBACK	56	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	61	2	.	.	Fresh Dead
YELLOW PERCH	73	4	.	.	Fresh Dead
MOTTLED SCULPIN	75	6	.	.	Fresh Dead
MOTTLED SCULPIN	66	3	.	.	Fresh Dead

SAMPLING PERIOD: 09-10AUG06 START DATE AND TIME: 09AUG06:10:25 END DATE AND TIME: 10AUG06:10:15
SAMPLING DURATION (hrs.): 23.83 CW VOLUME SAMPLED (gals x 10^6): 972.4000
INTAKE TEMPERATURES (F): MINIMUM= 68.6 MEAN= 69.9 MAXIMUM= 71.4
DISCHARGE TEMPERATURES (F): MINIMUM= 88.8 MEAN= 90.6 MAXIMUM= 93.3 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 09-12AUG06 CW VOLUME (gals x 10^6) FOR EXTRAPOLATION PERIOD: 3916.8

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GREAT LAKES CRAYFISH	37	2	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	41	3	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	44	3	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	46	4	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	38	2	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	45	3	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	42	3	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	43	3	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	35	2	.	.	Fresh Dead	
ALEWIFE	84	4	.	.	Fresh Dead	
ALEWIFE	79	3	.	.	Fresh Dead	
ALEWIFE	143	22	.	.	Fresh Dead	
ALEWIFE	91	3	.	.	Fresh Dead	
ALEWIFE	76	2	.	.	Fresh Dead	
ALEWIFE	100	6	.	.	Fresh Dead	
ALEWIFE	155	17	.	.	Fresh Dead	
ALEWIFE	139	14	.	.	Fresh Dead	
ALEWIFE	160	18	.	.	Fresh Dead	
ALEWIFE	94	5	.	.	Fresh Dead	
ALEWIFE	94	4	.	.	Fresh Dead	
ALEWIFE	102	6	.	.	Fresh Dead	
ALEWIFE	80	2	.	.	Fresh Dead	
ALEWIFE	76	2	.	.	Fresh Dead	
ALEWIFE	83	3	.	.	Fresh Dead	
ALEWIFE	159	19	.	.	Fresh Dead	
ALEWIFE	125	9	.	.	Fresh Dead	
ALEWIFE	156	15	.	.	Fresh Dead	
ALEWIFE	104	6	.	.	Fresh Dead	

ALEWIFE	100	5	.	.	Fresh Dead
ALEWIFE	115	7	.	.	Fresh Dead
ALEWIFE	77	2	.	.	Fresh Dead
ALEWIFE	92	4	.	.	Fresh Dead
ALEWIFE	76	3	.	.	Fresh Dead
ALEWIFE	100	5	.	.	Fresh Dead
ALEWIFE	111	8	.	.	Fresh Dead
ALEWIFE	97	5	.	.	Fresh Dead
ALEWIFE	79	3	.	.	Fresh Dead
ALEWIFE	.	.	2	3	Fresh Dead
ALEWIFE	162	18	.	.	Fresh Dead
ALEWIFE	100	5	.	.	Fresh Dead
ALEWIFE	116	7	.	.	Fresh Dead
ALEWIFE	119	6	.	.	Fresh Dead
ALEWIFE	79	3	.	.	Fresh Dead
ALEWIFE	119	7	.	.	Fresh Dead
ALEWIFE	104	7	.	.	Fresh Dead
ALEWIFE	156	19	.	.	Fresh Dead
ALEWIFE	83	3	.	.	Fresh Dead
ALEWIFE	105	6	.	.	Fresh Dead
ALEWIFE	100	6	.	.	Fresh Dead
ALEWIFE	104	6	.	.	Fresh Dead
ALEWIFE	115	9	.	.	Fresh Dead
ALEWIFE	102	5	.	.	Fresh Dead
ALEWIFE	85	4	.	.	Fresh Dead
ALEWIFE	186	33	.	.	Fresh Dead
ALEWIFE	110	7	.	.	Fresh Dead
ALEWIFE	88	4	.	.	Fresh Dead
ALEWIFE	86	3	.	.	Fresh Dead
ALEWIFE	100	6	.	.	Fresh Dead
ALEWIFE	92	4	.	.	Fresh Dead
ALEWIFE	.	.	66	275	Fresh Dead
ALEWIFE	.	.	117	500	Fresh Dead
ALEWIFE	.	.	50	350	Fresh Dead
ALEWIFE	.	.	38	197	Fresh Dead
ALEWIFE	.	.	38	210	Fresh Dead
ALEWIFE	.	.	7	36	Fresh Dead
ROUND WHITEFISH	435	450	.	.	Fresh Dead
SPOTTAIL SHINER	88	8	.	.	Fresh Dead
LONGNOSE SUCKER	254	150	.	.	Fresh Dead
WHITE SUCKER	446	1000	.	.	Fresh Dead
WHITE SUCKER	474	1200	.	.	Fresh Dead
WHITE SUCKER	454	1070	.	.	Fresh Dead
WHITE SUCKER	430	720	.	.	Fresh Dead
WHITE SUCKER	423	820	.	.	Fresh Dead
WHITE SUCKER	415	890	.	.	Fresh Dead
BURBOT	368	282	.	.	Fresh Dead
BURBOT	130	14	.	.	Fresh Dead
BURBOT	432	640	.	.	Fresh Dead
NINESPINE STICKLEBACK	68	2	.	.	Fresh Dead
YELLOW PERCH	76	5	.	.	Fresh Dead
YELLOW PERCH	105	12	.	.	Fresh Dead
YELLOW PERCH	197	80	.	.	Fresh Dead
YELLOW PERCH	301	400	.	.	Fresh Dead
YELLOW PERCH	85	7	.	.	Fresh Dead
YELLOW PERCH	93	9	.	.	Fresh Dead
YELLOW PERCH	81	5	.	.	Fresh Dead
YELLOW PERCH	306	370	.	.	Fresh Dead
YELLOW PERCH	260	186	.	.	Fresh Dead
MOTTLED SCULPIN	76	7	.	.	Fresh Dead
MOTTLED SCULPIN	79	7	.	.	Fresh Dead
MOTTLED SCULPIN	61	3	.	.	Fresh Dead
MOTTLED SCULPIN	72	5	.	.	Fresh Dead
MOTTLED SCULPIN	79	9	.	.	Fresh Dead
MOTTLED SCULPIN	67	4	.	.	Fresh Dead
MOTTLED SCULPIN	59	3	.	.	Fresh Dead
MOTTLED SCULPIN	56	3	.	.	Fresh Dead
MOTTLED SCULPIN	71	6	.	.	Fresh Dead
MOTTLED SCULPIN	60	3	.	.	Fresh Dead
MOTTLED SCULPIN	67	4	.	.	Fresh Dead
MOTTLED SCULPIN	52	2	.	.	Fresh Dead

SAMPLING PERIOD: 14-15AUG06 START DATE AND TIME: 14AUG06:10:18 END DATE AND TIME: 15AUG06:10:20
SAMPLING DURATION (hrs.): 24.03 CW VOLUME SAMPLED (gals x 10^6): 980.5600
INTAKE TEMPERATURES (F): MINIMUM= 67.0 MEAN= 69.2 MAXIMUM= 70.8
DISCHARGE TEMPERATURES (F): MINIMUM= 85.3 MEAN= 88.8 MAXIMUM= 90.2 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 13-15AUG06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 2937.6

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GREAT LAKES CRAYFISH	55	4	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	48	4	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	46	3	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	40	2	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	40	2	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	47	4	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	54	5	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	48	4	.	.	Fresh Dead	

GREAT LAKES CRAYFISH	46	3	.	.	Fresh Dead
GREAT LAKES CRAYFISH	52	5	.	.	Fresh Dead
GREAT LAKES CRAYFISH	49	4	.	.	Fresh Dead
GREAT LAKES CRAYFISH	56	5	.	.	Fresh Dead
GREAT LAKES CRAYFISH	57	5	.	.	Fresh Dead
GREAT LAKES CRAYFISH	42	2	.	.	Fresh Dead
GREAT LAKES CRAYFISH	45	3	.	.	Fresh Dead
GREAT LAKES CRAYFISH	41	2	.	.	Fresh Dead
GREAT LAKES CRAYFISH	38	2	.	.	Fresh Dead
GREAT LAKES CRAYFISH	54	5	.	.	Fresh Dead
GREAT LAKES CRAYFISH	46	3	.	.	Fresh Dead
GREAT LAKES CRAYFISH	40	2	.	.	Fresh Dead
GREAT LAKES CRAYFISH	46	3	.	.	Fresh Dead
ALEWIFE	134	12	.	.	Fresh Dead
ALEWIFE	163	18	.	.	Fresh Dead
ALEWIFE	175	25	.	.	Fresh Dead
ALEWIFE	138	15	.	.	Fresh Dead
ALEWIFE	161	21	.	.	Fresh Dead
ALEWIFE	129	11	.	.	Fresh Dead
ALEWIFE	149	15	.	.	Fresh Dead
ALEWIFE	162	16	.	.	Fresh Dead
ALEWIFE	116	7	.	.	Fresh Dead
ALEWIFE	119	10	.	.	Fresh Dead
ALEWIFE	110	8	.	.	Fresh Dead
ALEWIFE	158	16	.	.	Fresh Dead
ALEWIFE	97	4	.	.	Fresh Dead
ALEWIFE	92	4	.	.	Fresh Dead
ALEWIFE	109	6	.	.	Fresh Dead
ALEWIFE	89	3	.	.	Fresh Dead
ALEWIFE	97	5	.	.	Fresh Dead
ALEWIFE	86	4	.	.	Fresh Dead
ALEWIFE	85	4	.	.	Fresh Dead
ALEWIFE	85	4	.	.	Fresh Dead
ALEWIFE	133	10	.	.	Fresh Dead
ALEWIFE	110	8	.	.	Fresh Dead
ALEWIFE	143	17	.	.	Fresh Dead
ALEWIFE	180	22	.	.	Fresh Dead
ALEWIFE	158	16	.	.	Fresh Dead
ALEWIFE	120	10	.	.	Fresh Dead
ALEWIFE	157	16	.	.	Fresh Dead
ALEWIFE	162	17	.	.	Fresh Dead
ALEWIFE	129	9	.	.	Fresh Dead
ALEWIFE	86	4	.	.	Fresh Dead
ALEWIFE	84	4	.	.	Fresh Dead
ALEWIFE	117	8	.	.	Fresh Dead
ALEWIFE	144	13	.	.	Fresh Dead
ALEWIFE	116	8	.	.	Fresh Dead
ALEWIFE	125	10	.	.	Fresh Dead
ALEWIFE	100	5	.	.	Fresh Dead
ALEWIFE	115	8	.	.	Fresh Dead
ALEWIFE	121	9	.	.	Fresh Dead
ALEWIFE	79	3	.	.	Fresh Dead
ALEWIFE	92	5	.	.	Fresh Dead
ALEWIFE	122	10	.	.	Fresh Dead
ALEWIFE	75	3	.	.	Fresh Dead
ALEWIFE	101	6	.	.	Fresh Dead
ALEWIFE	111	7	.	.	Fresh Dead
ALEWIFE	81	3	.	.	Fresh Dead
ALEWIFE	148	13	.	.	Fresh Dead
ALEWIFE	87	4	.	.	Fresh Dead
ALEWIFE	84	4	.	.	Fresh Dead
ALEWIFE	103	6	.	.	Fresh Dead
ALEWIFE	95	4	.	.	Fresh Dead
ALEWIFE	.	.	54	110	Fresh Dead
ALEWIFE	.	.	100	590	Fresh Dead
ALEWIFE	.	.	30	135	Fresh Dead
ALEWIFE	.	.	88	600	Fresh Dead
ALEWIFE	.	.	36	235	Fresh Dead
LAKE TROUT	713	4100	.	.	Fresh Dead
RAINBOW SMELT	92	2	.	.	Fresh Dead
RAINBOW SMELT	128	6	.	.	Fresh Dead
SPOTTAIL SHINER	111	12	.	.	Fresh Dead
SPOTTAIL SHINER	100	12	.	.	Fresh Dead
SPOTTAIL SHINER	97	9	.	.	Fresh Dead
SPOTTAIL SHINER	71	3	.	.	Fresh Dead
LONGNOSE DACE	134	20	.	.	Fresh Dead
LONGNOSE DACE	123	18	.	.	Fresh Dead
LONGNOSE DACE	90	7	.	.	Fresh Dead
LONGNOSE DACE	80	4	.	.	Fresh Dead
LONGNOSE DACE	102	11	.	.	Fresh Dead
LONGNOSE SUCKER	466	1070	.	.	Fresh Dead
LONGNOSE SUCKER	286	221	.	.	Fresh Dead
LONGNOSE SUCKER	278	244	.	.	Fresh Dead
LONGNOSE SUCKER	280	208	.	.	Fresh Dead
LONGNOSE SUCKER	602	1750	.	.	Fresh Dead
LONGNOSE SUCKER	298	265	.	.	Fresh Dead
LONGNOSE SUCKER	247	150	.	.	Fresh Dead
WHITE SUCKER	554	1830	.	.	Fresh Dead
WHITE SUCKER	378	550	.	.	Fresh Dead
WHITE SUCKER	475	1340	.	.	Fresh Dead

WHITE SUCKER	389	600	.	.	Fresh Dead
WHITE SUCKER	554	1900	.	.	Fresh Dead
WHITE SUCKER	518	1490	.	.	Fresh Dead
WHITE SUCKER	515	1400	.	.	Fresh Dead
WHITE SUCKER	427	900	.	.	Fresh Dead
WHITE SUCKER	458	1100	.	.	Fresh Dead
WHITE SUCKER	434	1000	.	.	Fresh Dead
WHITE SUCKER	523	1550	.	.	Fresh Dead
WHITE SUCKER	465	1200	.	.	Fresh Dead
WHITE SUCKER	454	1200	.	.	Fresh Dead
WHITE SUCKER	568	1700	.	.	Fresh Dead
WHITE SUCKER	439	950	.	.	Fresh Dead
WHITE SUCKER	456	1050	.	.	Fresh Dead
BLUEGILL	55	2	.	.	Fresh Dead
YELLOW PERCH	276	268	.	.	Fresh Dead
YELLOW PERCH	87	7	.	.	Fresh Dead
MOTTLED SCULPIN	68	6	.	.	Fresh Dead
MOTTLED SCULPIN	82	6	.	.	Fresh Dead
MOTTLED SCULPIN	95	15	.	.	Fresh Dead
MOTTLED SCULPIN	57	3	.	.	Fresh Dead
MOTTLED SCULPIN	66	4	.	.	Fresh Dead
MOTTLED SCULPIN	82	10	.	.	Fresh Dead
MOTTLED SCULPIN	81	9	.	.	Fresh Dead
MOTTLED SCULPIN	72	5	.	.	Fresh Dead
MOTTLED SCULPIN	64	5	.	.	Fresh Dead
MOTTLED SCULPIN	68	4	.	.	Fresh Dead
MOTTLED SCULPIN	63	3	.	.	Fresh Dead
MOTTLED SCULPIN	63	4	.	.	Fresh Dead
MOTTLED SCULPIN	72	5	.	.	Fresh Dead
MOTTLED SCULPIN	55	3	.	.	Fresh Dead
MOTTLED SCULPIN	56	3	.	.	Fresh Dead
MOTTLED SCULPIN	57	3	.	.	Fresh Dead
MOTTLED SCULPIN	59	2	.	.	Fresh Dead
MOTTLED SCULPIN	61	4	.	.	Fresh Dead
MOTTLED SCULPIN	58	2	.	.	Fresh Dead

SAMPLING PERIOD: 16-17AUG06 START DATE AND TIME: 16AUG06:10:05 END DATE AND TIME: 17AUG06:10:25
SAMPLING DURATION (hrs.): 24.33 CW VOLUME SAMPLED (gals x 10^6): 992.8000
INTAKE TEMPERATURES (F): MINIMUM= 62.9 MEAN= 66.0 MAXIMUM= 70.3
DISCHARGE TEMPERATURES (F): MINIMUM= 82.3 MEAN= 86.4 MAXIMUM= 91.6 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 16-19AUG06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 3916.8

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GREAT LAKES CRAYFISH	58	6	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	43	2	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	44	3	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	40	2	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	53	6	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	47	3	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	50	5	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	49	4	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	41	2	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	49	5	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	49	4	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	42	3	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	42	2	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	45	3	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	51	5	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	47	3	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	50	4	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	46	4	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	47	4	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	49	4	.	.	Fresh Dead	
ALEWIFE	111	8	.	.	Fresh Dead	
ALEWIFE	168	21	.	.	Fresh Dead	
ALEWIFE	137	14	.	.	Fresh Dead	
ALEWIFE	113	8	.	.	Fresh Dead	
ALEWIFE	91	5	.	.	Fresh Dead	
ALEWIFE	115	9	.	.	Fresh Dead	
ALEWIFE	88	4	.	.	Fresh Dead	
ALEWIFE	119	10	.	.	Fresh Dead	
ALEWIFE	117	9	.	.	Fresh Dead	
ALEWIFE	168	19	.	.	Fresh Dead	
ALEWIFE	116	10	.	.	Fresh Dead	
ALEWIFE	88	4	.	.	Fresh Dead	
ALEWIFE	160	17	.	.	Fresh Dead	
ALEWIFE	142	13	.	.	Fresh Dead	
ALEWIFE	141	14	.	.	Fresh Dead	
ALEWIFE	92	4	.	.	Fresh Dead	
ALEWIFE	91	6	.	.	Fresh Dead	
ALEWIFE	116	8	.	.	Fresh Dead	
ALEWIFE	108	7	.	.	Fresh Dead	
ALEWIFE	112	7	.	.	Fresh Dead	
ALEWIFE	94	5	.	.	Fresh Dead	
ALEWIFE	110	9	.	.	Fresh Dead	
ALEWIFE	103	6	.	.	Fresh Dead	
ALEWIFE	98	6	.	.	Fresh Dead	

ALEWIFE	145	15	.	.	Fresh Dead
ALEWIFE	91	4	.	.	Fresh Dead
ALEWIFE	105	7	.	.	Fresh Dead
ALEWIFE	101	6	.	.	Fresh Dead
ALEWIFE	118	11	.	.	Fresh Dead
ALEWIFE	127	11	.	.	Fresh Dead
ALEWIFE	106	7	.	.	Fresh Dead
ALEWIFE	73	3	.	.	Fresh Dead
ALEWIFE	80	4	.	.	Fresh Dead
ALEWIFE	187	29	.	.	Fresh Dead
ALEWIFE	109	8	.	.	Fresh Dead
ALEWIFE	92	6	.	.	Fresh Dead
ALEWIFE	104	6	.	.	Fresh Dead
ALEWIFE	89	4	.	.	Fresh Dead
ALEWIFE	99	5	.	.	Fresh Dead
ALEWIFE	81	3	.	.	Fresh Dead
ALEWIFE	116	10	.	.	Fresh Dead
ALEWIFE	78	3	.	.	Fresh Dead
ALEWIFE	107	6	.	.	Fresh Dead
ALEWIFE	103	6	.	.	Fresh Dead
ALEWIFE	160	17	.	.	Fresh Dead
ALEWIFE	98	8	.	.	Fresh Dead
ALEWIFE	135	12	.	.	Fresh Dead
ALEWIFE	76	3	.	.	Fresh Dead
ALEWIFE	110	8	.	.	Fresh Dead
ALEWIFE	129	10	.	.	Fresh Dead
ALEWIFE	.	.	51	440	Fresh Dead
ALEWIFE	.	.	355	3050	Fresh Dead
ALEWIFE	.	.	14	123	Fresh Dead
ROUND WHITEFISH	428	600	.	.	Fresh Dead
BROWN TROUT	668	4650	.	.	Fresh Dead
RAINBOW SMELT	114	5	.	.	Fresh Dead
RAINBOW SMELT	90	2	.	.	Fresh Dead
SPOTTAIL SHINER	104	12	.	.	Fresh Dead
LONGNOSE DACE	115	15	.	.	Fresh Dead
LONGNOSE DACE	125	18	.	.	Fresh Dead
LONGNOSE DACE	110	12	.	.	Fresh Dead
LONGNOSE DACE	109	13	.	.	Fresh Dead
LONGNOSE DACE	91	7	.	.	Fresh Dead
LONGNOSE SUCKER	258	144	.	.	Fresh Dead
LONGNOSE SUCKER	303	265	.	.	Fresh Dead
WHITE SUCKER	516	1300	.	.	Fresh Dead
WHITE SUCKER	515	1350	.	.	Fresh Dead
WHITE SUCKER	454	1190	.	.	Fresh Dead
WHITE SUCKER	457	1550	.	.	Fresh Dead
WHITE SUCKER	328	410	.	.	Fresh Dead
WHITE SUCKER	512	1180	.	.	Fresh Dead
WHITE SUCKER	415	780	.	.	Fresh Dead
WHITE SUCKER	438	860	.	.	Fresh Dead
WHITE SUCKER	434	915	.	.	Fresh Dead
WHITE SUCKER	470	1020	.	.	Fresh Dead
WHITE SUCKER	534	1570	.	.	Fresh Dead
WHITE SUCKER	196	80	.	.	Fresh Dead
WHITE SUCKER	180	55	.	.	Fresh Dead
WHITE SUCKER	242	155	.	.	Fresh Dead
WHITE SUCKER	555	1750	.	.	Fresh Dead
WHITE SUCKER	456	1200	.	.	Fresh Dead
WHITE SUCKER	448	1050	.	.	Fresh Dead
WHITE SUCKER	407	650	.	.	Fresh Dead
WHITE SUCKER	529	1700	.	.	Fresh Dead
WHITE SUCKER	455	950	.	.	Fresh Dead
WHITE SUCKER	524	1600	.	.	Fresh Dead
WHITE SUCKER	407	850	.	.	Fresh Dead
WHITE SUCKER	473	1200	.	.	Fresh Dead
WHITE SUCKER	427	800	.	.	Fresh Dead
WHITE SUCKER	443	1100	.	.	Fresh Dead
WHITE SUCKER	486	1250	.	.	Fresh Dead
WHITE SUCKER	498	1400	.	.	Fresh Dead
WHITE SUCKER	454	1000	.	.	Fresh Dead
THREESPINE STICKLEBACK	62	2	.	.	Fresh Dead
YELLOW PERCH	96	10	.	.	Fresh Dead
YELLOW PERCH	336	650	.	.	Fresh Dead
YELLOW PERCH	264	205	.	.	Fresh Dead
MOTTLED SCULPIN	83	8	.	.	Fresh Dead
MOTTLED SCULPIN	122	26	.	.	Fresh Dead
MOTTLED SCULPIN	82	10	.	.	Fresh Dead
MOTTLED SCULPIN	74	7	.	.	Fresh Dead
MOTTLED SCULPIN	85	11	.	.	Fresh Dead
MOTTLED SCULPIN	74	5	.	.	Fresh Dead
MOTTLED SCULPIN	65	4	.	.	Fresh Dead
MOTTLED SCULPIN	69	5	.	.	Fresh Dead
MOTTLED SCULPIN	72	7	.	.	Fresh Dead
MOTTLED SCULPIN	71	6	.	.	Fresh Dead
MOTTLED SCULPIN	72	7	.	.	Fresh Dead
MOTTLED SCULPIN	65	5	.	.	Fresh Dead
MOTTLED SCULPIN	55	2	.	.	Fresh Dead
MOTTLED SCULPIN	62	4	.	.	Fresh Dead
MOTTLED SCULPIN	58	4	.	.	Fresh Dead

SAMPLING PERIOD: 21-22AUG06 START DATE AND TIME: 21AUG06:10:05 END DATE AND TIME: 22AUG06:10:15
SAMPLING DURATION (hrs.): 24.17 CW VOLUME SAMPLED (gals x 10^6): 986.0000
INTAKE TEMPERATURES (F): MINIMUM= 68.7 MEAN= 69.6 MAXIMUM= 70.4
DISCHARGE TEMPERATURES (F): MINIMUM= 88.4 MEAN= 89.5 MAXIMUM= 90.9 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 20-22AUG06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 2937.6

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GREAT LAKES CRAYFISH	49	5	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	45	3	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	51	4	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	53	5	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	50	4	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	43	3	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	52	5	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	53	4	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	46	3	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	42	3	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	48	4	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	46	4	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	47	4	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	44	3	.	.	Fresh Dead	
ALEWIFE	124	9	.	.	Fresh Dead	
ALEWIFE	80	4	.	.	Fresh Dead	
ALEWIFE	115	9	.	.	Fresh Dead	
ALEWIFE	147	18	.	.	Fresh Dead	
ALEWIFE	136	13	.	.	Fresh Dead	
ALEWIFE	105	7	.	.	Fresh Dead	
ALEWIFE	73	3	.	.	Fresh Dead	
ALEWIFE	147	16	.	.	Fresh Dead	
ALEWIFE	83	4	.	.	Fresh Dead	
ALEWIFE	91	5	.	.	Fresh Dead	
ALEWIFE	86	5	.	.	Fresh Dead	
ALEWIFE	74	3	.	.	Fresh Dead	
ALEWIFE	84	3	.	.	Fresh Dead	
ALEWIFE	148	14	.	.	Fresh Dead	
ALEWIFE	153	15	.	.	Fresh Dead	
ALEWIFE	101	7	.	.	Fresh Dead	
ALEWIFE	76	3	.	.	Fresh Dead	
ALEWIFE	101	6	.	.	Fresh Dead	
ALEWIFE	79	3	.	.	Fresh Dead	
ALEWIFE	78	4	.	.	Fresh Dead	
ALEWIFE	102	5	.	.	Fresh Dead	
ALEWIFE	127	9	.	.	Fresh Dead	
ALEWIFE	91	4	.	.	Fresh Dead	
ALEWIFE	91	6	.	.	Fresh Dead	
ALEWIFE	75	3	.	.	Fresh Dead	
ALEWIFE	81	4	.	.	Fresh Dead	
ALEWIFE	111	8	.	.	Fresh Dead	
ALEWIFE	113	7	.	.	Fresh Dead	
ALEWIFE	89	5	.	.	Fresh Dead	
ALEWIFE	118	11	.	.	Fresh Dead	
ALEWIFE	97	5	.	.	Fresh Dead	
ALEWIFE	72	2	.	.	Fresh Dead	
ALEWIFE	149	15	.	.	Fresh Dead	
ALEWIFE	128	19	.	.	Fresh Dead	
ALEWIFE	103	6	.	.	Fresh Dead	
ALEWIFE	160	17	.	.	Fresh Dead	
ALEWIFE	98	5	.	.	Fresh Dead	
ALEWIFE	149	14	.	.	Fresh Dead	
ALEWIFE	141	14	.	.	Fresh Dead	
ALEWIFE	167	23	.	.	Fresh Dead	
ALEWIFE	165	22	.	.	Fresh Dead	
ALEWIFE	105	6	.	.	Fresh Dead	
ALEWIFE	79	3	.	.	Fresh Dead	
ALEWIFE	102	9	.	.	Fresh Dead	
ALEWIFE	93	4	.	.	Fresh Dead	
ALEWIFE	105	8	.	.	Fresh Dead	
ALEWIFE	158	16	.	.	Fresh Dead	
ALEWIFE	70	2	.	.	Fresh Dead	
ALEWIFE	73	2	.	.	Fresh Dead	
ALEWIFE	88	4	.	.	Fresh Dead	
ALEWIFE	104	6	.	.	Fresh Dead	
ALEWIFE	69	2	.	.	Fresh Dead	
BROWN TROUT	713	5012	.	.	Fresh Dead	
SPOTTAIL SHINER	75	4	.	.	Fresh Dead	
LONGNOSE DACE	124	20	.	.	Fresh Dead	
LONGNOSE DACE	97	8	.	.	Fresh Dead	
LONGNOSE DACE	115	12	.	.	Fresh Dead	
LONGNOSE DACE	100	9	.	.	Fresh Dead	
LONGNOSE DACE	110	12	.	.	Fresh Dead	
WHITE SUCKER	342	500	.	.	Live	
WHITE SUCKER	528	1600	.	.	Fresh Dead	
WHITE SUCKER	422	950	.	.	Live	
WHITE SUCKER	86	3	.	.	Fresh Dead	
WHITE SUCKER	427	950	.	.	Fresh Dead	
WHITE SUCKER	458	1110	.	.	Fresh Dead	
WHITE SUCKER	534	1580	.	.	Fresh Dead	
BLACK BULLHEAD	259	294	.	.	Fresh Dead	

BURBOT	336	219	.	.	Fresh Dead	
MOTTLED SCULPIN	66	5	.	.	Fresh Dead	
MOTTLED SCULPIN	60	2	.	.	Fresh Dead	
MOTTLED SCULPIN	75	5	.	.	Fresh Dead	

SAMPLING PERIOD: 23-24AUG06 START DATE AND TIME: 23AUG06:10:00 END DATE AND TIME: 24AUG06:10:02
SAMPLING DURATION (hrs.): 24.03 CW VOLUME SAMPLED (gals x 10^6): 980.5600
INTAKE TEMPERATURES (F): MINIMUM= 68.6 MEAN= 69.6 MAXIMUM= 72.3
DISCHARGE TEMPERATURES (F): MINIMUM= 88.3 MEAN= 90.0 MAXIMUM= 92.5 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 23-26AUG06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 3916.8

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GREAT LAKES CRAYFISH	53	5	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	58	5	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	42	2	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	50	5	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	39	3	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	46	4	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	49	5	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	47	3	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	46	3	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	44	2	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	47	4	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	44	3	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	51	4	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	45	3	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	39	2	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	43	3	.	.	Fresh Dead	
ALEWIFE	141	14	.	.	Fresh Dead	
ALEWIFE	130	12	.	.	Fresh Dead	
ALEWIFE	102	7	.	.	Fresh Dead	
ALEWIFE	104	7	.	.	Fresh Dead	
ALEWIFE	140	12	.	.	Fresh Dead	
ALEWIFE	100	5	.	.	Fresh Dead	
ALEWIFE	132	13	.	.	Fresh Dead	
ALEWIFE	.	.	6	60	Fresh Dead	
ALEWIFE	156	16	.	.	Fresh Dead	
ALEWIFE	160	18	.	.	Fresh Dead	
ALEWIFE	125	9	.	.	Fresh Dead	
ALEWIFE	71	2	.	.	Fresh Dead	
ALEWIFE	164	43	.	.	Fresh Dead	
ALEWIFE	111	9	.	.	Fresh Dead	
ALEWIFE	93	5	.	.	Fresh Dead	
ALEWIFE	103	8	.	.	Fresh Dead	
ALEWIFE	72	2	.	.	Fresh Dead	
ALEWIFE	76	2	.	.	Fresh Dead	
ALEWIFE	75	3	.	.	Fresh Dead	
ALEWIFE	168	17	.	.	Fresh Dead	
ALEWIFE	172	26	.	.	Fresh Dead	
ALEWIFE	111	10	.	.	Fresh Dead	
ALEWIFE	157	24	.	.	Fresh Dead	
ALEWIFE	90	5	.	.	Fresh Dead	
ALEWIFE	89	5	.	.	Fresh Dead	
ALEWIFE	72	2	.	.	Fresh Dead	
ALEWIFE	92	4	.	.	Fresh Dead	
ALEWIFE	118	8	.	.	Fresh Dead	
ALEWIFE	111	6	.	.	Fresh Dead	
ALEWIFE	90	6	.	.	Fresh Dead	
ALEWIFE	94	7	.	.	Fresh Dead	
ALEWIFE	137	12	.	.	Fresh Dead	
ALEWIFE	.	.	2	16	Fresh Dead	
ALEWIFE	125	10	.	.	Fresh Dead	
ALEWIFE	29	1	.	.	Fresh Dead	
LONGNOSE SUCKER	269	210	.	.	Fresh Dead	
LONGNOSE SUCKER	461	950	.	.	Fresh Dead	
LONGNOSE SUCKER	330	550	.	.	Fresh Dead	
WHITE SUCKER	490	1450	.	.	Fresh Dead	
WHITE SUCKER	441	800	.	.	Fresh Dead	
WHITE SUCKER	264	190	.	.	Fresh Dead	
WHITE SUCKER	512	1230	.	.	Fresh Dead	
WHITE SUCKER	426	980	.	.	Fresh Dead	
WHITE SUCKER	532	1540	.	.	Fresh Dead	
WHITE SUCKER	534	1510	.	.	Fresh Dead	
THREESPINE STICKLEBACK	66	2	.	.	Fresh Dead	
NINESPINE STICKLEBACK	61	2	.	.	Fresh Dead	
ROUND GOBY	87	9	.	.	Fresh Dead	
MOTTLED SCULPIN	58	2	.	.	Fresh Dead	
MOTTLED SCULPIN	108	16	.	.	Fresh Dead	
MOTTLED SCULPIN	73	6	.	.	Fresh Dead	
MOTTLED SCULPIN	79	7	.	.	Fresh Dead	
MOTTLED SCULPIN	72	5	.	.	Fresh Dead	
MOTTLED SCULPIN	81	9	.	.	Fresh Dead	
MOTTLED SCULPIN	71	5	.	.	Fresh Dead	
MOTTLED SCULPIN	67	4	.	.	Fresh Dead	
MOTTLED SCULPIN	73	6	.	.	Fresh Dead	
MOTTLED SCULPIN	66	4	.	.	Fresh Dead	
MOTTLED SCULPIN	67	4	.	.	Fresh Dead	

MOTTLED SCULPIN	70	5	.	.	Fresh Dead	
MOTTLED SCULPIN	55	2	.	.	Fresh Dead	

SAMPLING PERIOD: 28-29AUG06 START DATE AND TIME: 28AUG06:10:15 END DATE AND TIME: 29AUG06:10:15
SAMPLING DURATION (hrs.): 24.00 CW VOLUME SAMPLED (gals x 10^6): 979.2000
INTAKE TEMPERATURES (F): MINIMUM= 70.4 MEAN= 71.2 MAXIMUM= 72.2
DISCHARGE TEMPERATURES (F): MINIMUM= 90.1 MEAN= 91.0 MAXIMUM= 92.0 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 27-29AUG06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 2937.6

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GREAT LAKES CRAYFISH	43	3	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	56	6	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	60	7	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	51	5	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	51	4	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	52	4	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	49	3	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	46	3	.	.	Fresh Dead	
ALEWIFE	180	32	.	.	Fresh Dead	
ALEWIFE	122	9	.	.	Fresh Dead	
ALEWIFE	145	14	.	.	Fresh Dead	
ALEWIFE	160	20	.	.	Fresh Dead	
ALEWIFE	168	20	.	.	Fresh Dead	
ALEWIFE	145	30	.	.	Fresh Dead	
ALEWIFE	167	19	.	.	Fresh Dead	
ALEWIFE	116	15	.	.	Fresh Dead	
ALEWIFE	92	6	.	.	Fresh Dead	
ALEWIFE	146	11	.	.	Fresh Dead	
ALEWIFE	87	4	.	.	Fresh Dead	
ALEWIFE	148	11	.	.	Fresh Dead	
ALEWIFE	76	3	.	.	Fresh Dead	
ALEWIFE	107	8	.	.	Fresh Dead	
ALEWIFE	101	9	.	.	Fresh Dead	
ALEWIFE	92	5	.	.	Fresh Dead	
ALEWIFE	89	5	.	.	Fresh Dead	
ALEWIFE	85	4	.	.	Fresh Dead	
ALEWIFE	79	4	.	.	Fresh Dead	
ALEWIFE	84	3	.	.	Fresh Dead	
ALEWIFE	75	3	.	.	Fresh Dead	
ALEWIFE	67	2	.	.	Fresh Dead	
ALEWIFE	.	.	4	11	Fresh Dead	
GIZZARD SHAD	100	8	.	.	Fresh Dead	
GIZZARD SHAD	114	10	.	.	Fresh Dead	
GIZZARD SHAD	122	13	.	.	Fresh Dead	
GIZZARD SHAD	83	4	.	.	Fresh Dead	
GIZZARD SHAD	112	11	.	.	Fresh Dead	
GIZZARD SHAD	95	6	.	.	Fresh Dead	
GIZZARD SHAD	105	9	.	.	Fresh Dead	
GIZZARD SHAD	97	6	.	.	Fresh Dead	
GIZZARD SHAD	111	11	.	.	Fresh Dead	
GIZZARD SHAD	86	5	.	.	Fresh Dead	
GIZZARD SHAD	58	1	.	.	Fresh Dead	
GIZZARD SHAD	.	.	3	14	Fresh Dead	
RAINBOW SMELT	131	10	.	.	Fresh Dead	
SPOTTAIL SHINER	79	5	.	.	Fresh Dead	
SPOTTAIL SHINER	86	4	.	.	Fresh Dead	
SPOTTAIL SHINER	75	6	.	.	Fresh Dead	
LONGNOSE SUCKER	399	700	.	.	Fresh Dead	
LONGNOSE SUCKER	241	170	.	.	Fresh Dead	
LONGNOSE SUCKER	263	165	.	.	Fresh Dead	
WHITE SUCKER	316	400	.	.	Fresh Dead	
WHITE SUCKER	493	1000	.	.	Fresh Dead	
WHITE SUCKER	490	1400	.	.	Fresh Dead	
WHITE SUCKER	544	1700	.	.	Fresh Dead	
WHITE SUCKER	455	950	.	.	Fresh Dead	
NINESPINE STICKLEBACK	75	2	.	.	Fresh Dead	
YELLOW PERCH	137	33	.	.	Fresh Dead	
YELLOW PERCH	118	19	.	.	Fresh Dead	
YELLOW PERCH	132	24	.	.	Fresh Dead	
MOTTLED SCULPIN	82	5	.	.	Fresh Dead	
MOTTLED SCULPIN	91	4	.	.	Fresh Dead	
MOTTLED SCULPIN	70	5	.	.	Fresh Dead	
MOTTLED SCULPIN	74	7	.	.	Fresh Dead	
MOTTLED SCULPIN	88	9	.	.	Fresh Dead	
MOTTLED SCULPIN	74	5	.	.	Fresh Dead	
MOTTLED SCULPIN	67	5	.	.	Fresh Dead	
MOTTLED SCULPIN	61	3	.	.	Fresh Dead	
MOTTLED SCULPIN	71	6	.	.	Fresh Dead	
MOTTLED SCULPIN	64	4	.	.	Fresh Dead	

SAMPLING PERIOD: 30-31AUG06 START DATE AND TIME: 30AUG06:10:05 END DATE AND TIME: 31AUG06:10:08
SAMPLING DURATION (hrs.): 24.05 CW VOLUME SAMPLED (gals x 10^6): 981.2400
INTAKE TEMPERATURES (F): MINIMUM= 69.2 MEAN= 70.3 MAXIMUM= 74.3
DISCHARGE TEMPERATURES (F): MINIMUM= 88.8 MEAN= 90.3 MAXIMUM= 93.9 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 30AUG-02SEP06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 3916.8

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GREAT LAKES CRAYFISH	42	2	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	58	4	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	45	3	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	35	1	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	54	5	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	47	4	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	53	5	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	40	2	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	45	3	.	.	Fresh Dead	
ALEWIFE	65	2	.	.	Fresh Dead	
ALEWIFE	68	2	.	.	Fresh Dead	
ALEWIFE	70	3	.	.	Fresh Dead	
ALEWIFE	72	3	.	.	Fresh Dead	
ALEWIFE	75	3	.	.	Fresh Dead	
ALEWIFE	87	4	.	.	Fresh Dead	
ALEWIFE	91	4	.	.	Fresh Dead	
ALEWIFE	80	4	.	.	Fresh Dead	
ALEWIFE	90	6	.	.	Fresh Dead	
ALEWIFE	89	6	.	.	Fresh Dead	
ALEWIFE	92	7	.	.	Fresh Dead	
ALEWIFE	104	10	.	.	Fresh Dead	
ALEWIFE	100	10	.	.	Fresh Dead	
ALEWIFE	107	11	.	.	Fresh Dead	
ALEWIFE	.	.	1	4	Fresh Dead	
ALEWIFE	52	1	.	.	Fresh Dead	
ALEWIFE	74	3	.	.	Fresh Dead	
ALEWIFE	74	3	.	.	Fresh Dead	
ALEWIFE	81	4	.	.	Fresh Dead	
ALEWIFE	82	5	.	.	Fresh Dead	
ALEWIFE	91	7	.	.	Fresh Dead	
ALEWIFE	96	7	.	.	Fresh Dead	
ALEWIFE	88	7	.	.	Fresh Dead	
ALEWIFE	100	9	.	.	Fresh Dead	
ALEWIFE	103	9	.	.	Fresh Dead	
ALEWIFE	58	2	.	.	Fresh Dead	
ALEWIFE	88	5	.	.	Fresh Dead	
ALEWIFE	104	8	.	.	Fresh Dead	
ALEWIFE	67	3	.	.	Fresh Dead	
ALEWIFE	99	9	.	.	Fresh Dead	
ALEWIFE	85	5	.	.	Fresh Dead	
ALEWIFE	46	1	.	.	Fresh Dead	
ALEWIFE	151	35	.	.	Fresh Dead	
ALEWIFE	75	3	.	.	Fresh Dead	
ALEWIFE	73	3	.	.	Fresh Dead	
ALEWIFE	86	5	.	.	Fresh Dead	
ALEWIFE	94	7	.	.	Fresh Dead	
ALEWIFE	96	8	.	.	Fresh Dead	
ALEWIFE	151	30	.	.	Fresh Dead	
ALEWIFE	102	8	.	.	Fresh Dead	
ALEWIFE	121	15	.	.	Fresh Dead	
ALEWIFE	85	5	.	.	Fresh Dead	
ALEWIFE	56	1	.	.	Fresh Dead	
ALEWIFE	47	1	.	.	Fresh Dead	
ALEWIFE	152	14	.	.	Fresh Dead	
ALEWIFE	103	9	.	.	Fresh Dead	
ALEWIFE	111	12	.	.	Fresh Dead	
ALEWIFE	96	8	.	.	Fresh Dead	
ALEWIFE	72	3	.	.	Fresh Dead	
ALEWIFE	140	21	.	.	Fresh Dead	
ALEWIFE	94	6	.	.	Fresh Dead	
ALEWIFE	83	5	.	.	Fresh Dead	
ALEWIFE	90	5	.	.	Fresh Dead	
ALEWIFE	91	5	.	.	Fresh Dead	
ALEWIFE	87	5	.	.	Fresh Dead	
ALEWIFE	93	6	.	.	Fresh Dead	
ALEWIFE	47	1	.	.	Fresh Dead	
ALEWIFE	.	.	4	36	Fresh Dead	
ALEWIFE	.	.	4	34	Fresh Dead	
ALEWIFE	.	.	12	125	Fresh Dead	
GIZZARD SHAD	115	10	.	.	Fresh Dead	
GIZZARD SHAD	70	2	.	.	Fresh Dead	
GIZZARD SHAD	73	3	.	.	Fresh Dead	
GIZZARD SHAD	110	10	.	.	Fresh Dead	
GIZZARD SHAD	99	8	.	.	Fresh Dead	
GIZZARD SHAD	100	6	.	.	Fresh Dead	
CHINOOK SALMON	162	38	.	.	Fresh Dead	
RAINBOW SMELT	109	6	.	.	Fresh Dead	
RAINBOW SMELT	129	8	.	.	Fresh Dead	
RAINBOW SMELT	107	6	.	.	Fresh Dead	
RAINBOW SMELT	91	4	.	.	Fresh Dead	
RAINBOW SMELT	77	2	.	.	Fresh Dead	
RAINBOW SMELT	103	6	.	.	Fresh Dead	
RAINBOW SMELT	126	6	.	.	Fresh Dead	
RAINBOW SMELT	123	9	.	.	Fresh Dead	
RAINBOW SMELT	34	1	.	.	Fresh Dead	
RAINBOW SMELT	39	1	.	.	Fresh Dead	
RAINBOW SMELT	38	1	.	.	Fresh Dead	

SPOTTAIL SHINER	90	6	.	.	Fresh Dead
SPOTTAIL SHINER	90	8	.	.	Fresh Dead
SPOTTAIL SHINER	112	11	.	.	Fresh Dead
SPOTTAIL SHINER	78	5	.	.	Fresh Dead
SPOTTAIL SHINER	84	5	.	.	Fresh Dead
SPOTTAIL SHINER	93	6	.	.	Fresh Dead
SPOTTAIL SHINER	76	4	.	.	Fresh Dead
SPOTTAIL SHINER	82	5	.	.	Fresh Dead
SPOTTAIL SHINER	83	6	.	.	Fresh Dead
SPOTTAIL SHINER	74	4	.	.	Fresh Dead
SPOTTAIL SHINER	77	4	.	.	Fresh Dead
SPOTTAIL SHINER	88	6	.	.	Fresh Dead
SPOTTAIL SHINER	83	5	.	.	Fresh Dead
SPOTTAIL SHINER	87	6	.	.	Fresh Dead
SPOTTAIL SHINER	85	5	.	.	Fresh Dead
SPOTTAIL SHINER	81	4	.	.	Fresh Dead
SPOTTAIL SHINER	89	6	.	.	Fresh Dead
SPOTTAIL SHINER	83	5	.	.	Fresh Dead
SPOTTAIL SHINER	86	6	.	.	Fresh Dead
SPOTTAIL SHINER	78	5	.	.	Fresh Dead
SPOTTAIL SHINER	87	6	.	.	Fresh Dead
SPOTTAIL SHINER	86	6	.	.	Fresh Dead
SPOTTAIL SHINER	76	5	.	.	Fresh Dead
SPOTTAIL SHINER	84	6	.	.	Fresh Dead
SPOTTAIL SHINER	86	6	.	.	Fresh Dead
SPOTTAIL SHINER	65	2	.	.	Fresh Dead
SPOTTAIL SHINER	74	4	.	.	Fresh Dead
SPOTTAIL SHINER	86	5	.	.	Fresh Dead
SPOTTAIL SHINER	77	4	.	.	Fresh Dead
SPOTTAIL SHINER	82	4	.	.	Fresh Dead
SPOTTAIL SHINER	80	5	.	.	Fresh Dead
SPOTTAIL SHINER	90	7	.	.	Fresh Dead
SPOTTAIL SHINER	84	6	.	.	Fresh Dead
LONGNOSE DACE	114	17	.	.	Fresh Dead
LONGNOSE DACE	95	9	.	.	Fresh Dead
LONGNOSE DACE	72	4	.	.	Fresh Dead
LONGNOSE DACE	109	16	.	.	Fresh Dead
LONGNOSE DACE	97	9	.	.	Fresh Dead
LONGNOSE DACE	113	18	.	.	Fresh Dead
LONGNOSE DACE	81	7	.	.	Fresh Dead
LONGNOSE DACE	85	7	.	.	Fresh Dead
LONGNOSE DACE	111	14	.	.	Fresh Dead
LONGNOSE SUCKER	272	170	.	.	Fresh Dead
LONGNOSE SUCKER	245	130	.	.	Fresh Dead
WHITE SUCKER	452	900	.	.	Fresh Dead
WHITE SUCKER	493	900	.	.	Fresh Dead
WHITE SUCKER	266	205	.	.	Fresh Dead
WHITE SUCKER	200	84	.	.	Fresh Dead
WHITE SUCKER	425	900	.	.	Fresh Dead
WHITE SUCKER	425	700	.	.	Live
WHITE SUCKER	541	1150	.	.	Live
WHITE SUCKER	436	1000	.	.	Fresh Dead
WHITE SUCKER	484	1350	.	.	Live
TROUT-PERCH	115	13	.	.	Fresh Dead
THREESPINE STICKLEBACK	60	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	60	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	61	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	59	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	70	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	67	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	67	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	61	1	.	.	Fresh Dead
NINESPINE STICKLEBACK	66	2	.	.	Fresh Dead
BLUEGILL	75	9	.	.	Fresh Dead
YELLOW PERCH	98	10	.	.	Fresh Dead
YELLOW PERCH	110	14	.	.	Fresh Dead
YELLOW PERCH	111	14	.	.	Fresh Dead
YELLOW PERCH	123	20	.	.	Fresh Dead
YELLOW PERCH	130	26	.	.	Fresh Dead
YELLOW PERCH	106	12	.	.	Fresh Dead
YELLOW PERCH	106	13	.	.	Fresh Dead
YELLOW PERCH	102	11	.	.	Fresh Dead
YELLOW PERCH	111	15	.	.	Fresh Dead
YELLOW PERCH	115	15	.	.	Fresh Dead
YELLOW PERCH	125	20	.	.	Fresh Dead
YELLOW PERCH	134	26	.	.	Fresh Dead
YELLOW PERCH	134	26	.	.	Fresh Dead
YELLOW PERCH	129	23	.	.	Fresh Dead
YELLOW PERCH	141	28	.	.	Fresh Dead
YELLOW PERCH	100	10	.	.	Fresh Dead
YELLOW PERCH	109	14	.	.	Fresh Dead
YELLOW PERCH	137	26	.	.	Fresh Dead
YELLOW PERCH	120	18	.	.	Fresh Dead
YELLOW PERCH	155	45	.	.	Fresh Dead
YELLOW PERCH	133	23	.	.	Fresh Dead
YELLOW PERCH	123	18	.	.	Fresh Dead
YELLOW PERCH	118	17	.	.	Fresh Dead
YELLOW PERCH	117	17	.	.	Fresh Dead
YELLOW PERCH	106	17	.	.	Fresh Dead
YELLOW PERCH	116	16	.	.	Fresh Dead

YELLOW PERCH	112	15	.	.	Fresh Dead
YELLOW PERCH	130	26	.	.	Fresh Dead
YELLOW PERCH	119	17	.	.	Fresh Dead
YELLOW PERCH	121	18	.	.	Fresh Dead
YELLOW PERCH	108	12	.	.	Live
YELLOW PERCH	115	16	.	.	Fresh Dead
YELLOW PERCH	144	35	.	.	Fresh Dead
YELLOW PERCH	95	9	.	.	Fresh Dead
YELLOW PERCH	108	13	.	.	Fresh Dead
YELLOW PERCH	57	2	.	.	Fresh Dead
YELLOW PERCH	97	8	.	.	Fresh Dead
ROUND GOBY	65	3	.	.	Fresh Dead
MOTTLED SCULPIN	67	5	.	.	Fresh Dead
MOTTLED SCULPIN	74	7	.	.	Fresh Dead
MOTTLED SCULPIN	62	3	.	.	Fresh Dead
MOTTLED SCULPIN	77	8	.	.	Fresh Dead
MOTTLED SCULPIN	76	7	.	.	Fresh Dead
MOTTLED SCULPIN	83	8	.	.	Fresh Dead
MOTTLED SCULPIN	78	10	.	.	Fresh Dead
MOTTLED SCULPIN	62	4	.	.	Fresh Dead
MOTTLED SCULPIN	84	11	.	.	Fresh Dead
MOTTLED SCULPIN	76	7	.	.	Fresh Dead
MOTTLED SCULPIN	64	3	.	.	Fresh Dead
MOTTLED SCULPIN	64	4	.	.	Fresh Dead
MOTTLED SCULPIN	77	7	.	.	Fresh Dead
MOTTLED SCULPIN	78	7	.	.	Fresh Dead
MOTTLED SCULPIN	86	8	.	.	Fresh Dead
MOTTLED SCULPIN	93	11	.	.	Fresh Dead
MOTTLED SCULPIN	70	6	.	.	Fresh Dead
MOTTLED SCULPIN	91	9	.	.	Fresh Dead
MOTTLED SCULPIN	88	10	.	.	Fresh Dead
MOTTLED SCULPIN	72	5	.	.	Fresh Dead
MOTTLED SCULPIN	90	13	.	.	Fresh Dead
MOTTLED SCULPIN	74	7	.	.	Fresh Dead
MOTTLED SCULPIN	80	7	.	.	Fresh Dead
MOTTLED SCULPIN	88	12	.	.	Fresh Dead
MOTTLED SCULPIN	58	3	.	.	Fresh Dead
MOTTLED SCULPIN	77	7	.	.	Fresh Dead
MOTTLED SCULPIN	75	7	.	.	Fresh Dead
MOTTLED SCULPIN	65	4	.	.	Fresh Dead
MOTTLED SCULPIN	71	6	.	.	Fresh Dead
MOTTLED SCULPIN	76	7	.	.	Fresh Dead
MOTTLED SCULPIN	73	5	.	.	Fresh Dead
MOTTLED SCULPIN	59	2	.	.	Fresh Dead
MOTTLED SCULPIN	65	4	.	.	Fresh Dead
MOTTLED SCULPIN	78	8	.	.	Fresh Dead
MOTTLED SCULPIN	55	3	.	.	Fresh Dead
MOTTLED SCULPIN	64	4	.	.	Fresh Dead
MOTTLED SCULPIN	71	5	.	.	Fresh Dead
MOTTLED SCULPIN	87	10	.	.	Fresh Dead
MOTTLED SCULPIN	88	10	.	.	Fresh Dead
MOTTLED SCULPIN	96	12	.	.	Fresh Dead
MOTTLED SCULPIN	58	3	.	.	Fresh Dead
MOTTLED SCULPIN	63	4	.	.	Fresh Dead
MOTTLED SCULPIN	75	6	.	.	Fresh Dead
MOTTLED SCULPIN	67	5	.	.	Fresh Dead
MOTTLED SCULPIN	81	8	.	.	Fresh Dead
MOTTLED SCULPIN	65	6	.	.	Fresh Dead
MOTTLED SCULPIN	75	6	.	.	Fresh Dead
MOTTLED SCULPIN	65	4	.	.	Fresh Dead
MOTTLED SCULPIN	85	11	.	.	Fresh Dead
MOTTLED SCULPIN	76	8	.	.	Fresh Dead
MOTTLED SCULPIN	.	.	4	16	Fresh Dead
MOTTLED SCULPIN	.	.	4	17	Fresh Dead
MOTTLED SCULPIN	.	.	1	3	Fresh Dead
MOTTLED SCULPIN	.	.	6	34	Fresh Dead
MOTTLED SCULPIN	.	.	4	25	Fresh Dead
MOTTLED SCULPIN	.	.	5	48	Fresh Dead
MOTTLED SCULPIN	.	.	5	37	Fresh Dead
SLIMY SCULPIN	64	4	.	.	Fresh Dead
SLIMY SCULPIN	55	3	.	.	Fresh Dead
SLIMY SCULPIN	68	6	.	.	Fresh Dead
SLIMY SCULPIN	56	3	.	.	Fresh Dead
SLIMY SCULPIN	67	5	.	.	Fresh Dead

SAMPLING PERIOD: 04-05SEP06 START DATE AND TIME: 04SEP06:10:40 END DATE AND TIME: 05SEP06:10:30
SAMPLING DURATION (hrs.): 23.83 CW VOLUME SAMPLED (gals x 10^6): 972.4000
INTAKE TEMPERATURES (F): MINIMUM= 69.2 MEAN= 69.6 MAXIMUM= 70.7
DISCHARGE TEMPERATURES (F): MINIMUM= 88.7 MEAN= 89.9 MAXIMUM= 92.6 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 03-05SEP06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 2937.6

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GREAT LAKES CRAYFISH	55	5	.	.	Fresh Dead	
ALEWIFE	105	11	.	.	Fresh Dead	
ALEWIFE	168	17	.	.	Fresh Dead	
ALEWIFE	96	7	.	.	Fresh Dead	
ALEWIFE	77	3	.	.	Fresh Dead	

ALEWIFE	69	3	.	.	Fresh Dead
ALEWIFE	132	21	.	.	Fresh Dead
ALEWIFE	148	30	.	.	Fresh Dead
ALEWIFE	171	22	.	.	Fresh Dead
ALEWIFE	175	20	.	.	Fresh Dead
ALEWIFE	119	16	.	.	Fresh Dead
ALEWIFE	76	3	.	.	Fresh Dead
ROUND WHITEFISH	445	1150	.	.	Fresh Dead
SPOTTAIL SHINER	127	18	.	.	Fresh Dead
SPOTTAIL SHINER	122	16	.	.	Fresh Dead
SPOTTAIL SHINER	115	12	.	.	Fresh Dead
SPOTTAIL SHINER	82	5	.	.	Fresh Dead
SPOTTAIL SHINER	64	3	.	.	Fresh Dead
LONGNOSE DACE	124	17	.	.	Fresh Dead
LONGNOSE DACE	95	6	.	.	Fresh Dead
LONGNOSE DACE	108	14	.	.	Fresh Dead
LONGNOSE DACE	78	3	.	.	Fresh Dead
LONGNOSE SUCKER	285	289	.	.	Fresh Dead
LONGNOSE SUCKER	292	238	.	.	Fresh Dead
LONGNOSE SUCKER	241	180	.	.	Fresh Dead
WHITE SUCKER	525	1850	.	.	Fresh Dead
WHITE SUCKER	336	520	.	.	Fresh Dead
WHITE SUCKER	467	1120	.	.	Fresh Dead
WHITE SUCKER	460	960	.	.	Fresh Dead
WHITE SUCKER	492	1250	.	.	Fresh Dead
WHITE SUCKER	425	910	.	.	Fresh Dead
WHITE SUCKER	473	1270	.	.	Fresh Dead
WHITE SUCKER	444	1150	.	.	Fresh Dead
WHITE SUCKER	454	1160	.	.	Fresh Dead
WHITE SUCKER	521	1900	.	.	Fresh Dead
WHITE SUCKER	563	2100	.	.	Fresh Dead
WHITE SUCKER	453	1110	.	.	Fresh Dead
WHITE SUCKER	385	820	.	.	Fresh Dead
WHITE SUCKER	480	1250	.	.	Fresh Dead
WHITE SUCKER	456	1110	.	.	Fresh Dead
WHITE SUCKER	492	1200	.	.	Fresh Dead
WHITE SUCKER	436	1050	.	.	Fresh Dead
WHITE SUCKER	503	1520	.	.	Fresh Dead
WHITE SUCKER	480	1220	.	.	Fresh Dead
WHITE SUCKER	424	920	.	.	Fresh Dead
WHITE SUCKER	472	1200	.	.	Fresh Dead
WHITE SUCKER	444	920	.	.	Fresh Dead
WHITE SUCKER	466	1130	.	.	Fresh Dead
WHITE SUCKER	314	450	.	.	Fresh Dead
WHITE SUCKER	479	1270	.	.	Fresh Dead
WHITE SUCKER	558	2000	.	.	Fresh Dead
WHITE SUCKER	447	1180	.	.	Fresh Dead
WHITE SUCKER	452	1090	.	.	Fresh Dead
WHITE SUCKER	448	1010	.	.	Fresh Dead
WHITE SUCKER	177	80	.	.	Fresh Dead
WHITE SUCKER	224	140	.	.	Fresh Dead
BLACK BULLHEAD	221	179	.	.	Fresh Dead
BLACK BULLHEAD	235	220	.	.	Fresh Dead
BLACK BULLHEAD	268	310	.	.	Fresh Dead
BLACK BULLHEAD	235	244	.	.	Fresh Dead
BURBOT	785	2410	.	.	Fresh Dead
YELLOW PERCH	123	21	.	.	Fresh Dead
YELLOW PERCH	289	282	.	.	Fresh Dead
YELLOW PERCH	259	211	.	.	Fresh Dead
MOTTLED SCULPIN	73	6	.	.	Fresh Dead
MOTTLED SCULPIN	82	9	.	.	Fresh Dead
MOTTLED SCULPIN	89	11	.	.	Fresh Dead
MOTTLED SCULPIN	72	6	.	.	Fresh Dead
MOTTLED SCULPIN	76	6	.	.	Fresh Dead
MOTTLED SCULPIN	62	4	.	.	Fresh Dead
MOTTLED SCULPIN	58	3	.	.	Fresh Dead

SAMPLING PERIOD: 06-07SEP06 START DATE AND TIME: 06SEP06:10:27 END DATE AND TIME: 07SEP06:10:15
SAMPLING DURATION (hrs.): 23.80 CW VOLUME SAMPLED (gals x 10^6): 971.0400
INTAKE TEMPERATURES (F): MINIMUM= 69.5 MEAN= 70.2 MAXIMUM= 72.0
DISCHARGE TEMPERATURES (F): MINIMUM= 89.0 MEAN= 90.1 MAXIMUM= 91.5 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 06-09SEP06 CW VOLUME (gals x 10^6) FOR EXTRAPOLATION PERIOD: 3916.8

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GREAT LAKES CRAYFISH	53	5	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	46	4	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	44	4	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	44	3	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	51	4	.	.	Fresh Dead	
ALEWIFE	180	53	.	.	Fresh Dead	
ALEWIFE	48	1	.	.	Fresh Dead	
ALEWIFE	50	1	.	.	Fresh Dead	
ALEWIFE	45	1	.	.	Fresh Dead	
ALEWIFE	42	1	.	.	Fresh Dead	
ALEWIFE	57	2	.	.	Fresh Dead	
ALEWIFE	45	1	.	.	Fresh Dead	
ALEWIFE	46	1	.	.	Fresh Dead	

ALEWIFE	125	15	.	.	Fresh Dead
ALEWIFE	106	8	.	.	Fresh Dead
ALEWIFE	104	13	.	.	Fresh Dead
CHINOOK SALMON	172	65	.	.	Fresh Dead
RAINBOW SMELT	127	9	.	.	Fresh Dead
SPOTTAIL SHINER	117	16	.	.	Fresh Dead
SPOTTAIL SHINER	96	9	.	.	Fresh Dead
SPOTTAIL SHINER	84	6	.	.	Fresh Dead
SPOTTAIL SHINER	92	7	.	.	Fresh Dead
SPOTTAIL SHINER	93	8	.	.	Fresh Dead
SPOTTAIL SHINER	78	4	.	.	Fresh Dead
SPOTTAIL SHINER	68	3	.	.	Fresh Dead
LONGNOSE SUCKER	251	170	.	.	Fresh Dead
LONGNOSE SUCKER	424	850	.	.	Fresh Dead
LONGNOSE SUCKER	241	200	.	.	Fresh Dead
LONGNOSE SUCKER	225	250	.	.	Fresh Dead
WHITE SUCKER	425	950	.	.	Fresh Dead
WHITE SUCKER	413	900	.	.	Fresh Dead
WHITE SUCKER	490	1400	.	.	Fresh Dead
WHITE SUCKER	232	130	.	.	Fresh Dead
WHITE SUCKER	465	1200	.	.	Fresh Dead
WHITE SUCKER	447	1100	.	.	Fresh Dead
WHITE SUCKER	448	1200	.	.	Fresh Dead
WHITE SUCKER	424	1050	.	.	Fresh Dead
WHITE SUCKER	264	250	.	.	Fresh Dead
WHITE SUCKER	162	40	.	.	Fresh Dead
WHITE SUCKER	584	2000	.	.	Fresh Dead
WHITE SUCKER	558	1810	.	.	Fresh Dead
WHITE SUCKER	514	1480	.	.	Live
WHITE SUCKER	479	1200	.	.	Fresh Dead
WHITE SUCKER	455	1200	.	.	Fresh Dead
WHITE SUCKER	381	700	.	.	Fresh Dead
WHITE SUCKER	437	1000	.	.	Fresh Dead
WHITE SUCKER	382	690	.	.	Fresh Dead
WHITE SUCKER	328	460	.	.	Fresh Dead
BLACK BULLHEAD	265	305	.	.	Fresh Dead
NINESPINE STICKLEBACK	79	3	.	.	Fresh Dead
YELLOW PERCH	123	18	.	.	Fresh Dead
YELLOW PERCH	51	2	.	.	Fresh Dead
MOTTLED SCULPIN	74	6	.	.	Fresh Dead
MOTTLED SCULPIN	72	5	.	.	Fresh Dead
MOTTLED SCULPIN	60	3	.	.	Fresh Dead
MOTTLED SCULPIN	86	10	.	.	Fresh Dead
MOTTLED SCULPIN	74	6	.	.	Fresh Dead
MOTTLED SCULPIN	70	6	.	.	Fresh Dead
MOTTLED SCULPIN	71	5	.	.	Fresh Dead
MOTTLED SCULPIN	69	5	.	.	Fresh Dead
MOTTLED SCULPIN	83	9	.	.	Fresh Dead
MOTTLED SCULPIN	68	5	.	.	Fresh Dead
MOTTLED SCULPIN	71	5	.	.	Fresh Dead
MOTTLED SCULPIN	76	7	.	.	Fresh Dead
MOTTLED SCULPIN	76	6	.	.	Fresh Dead
MOTTLED SCULPIN	71	6	.	.	Fresh Dead
MOTTLED SCULPIN	63	3	.	.	Fresh Dead
MOTTLED SCULPIN	67	4	.	.	Fresh Dead
MOTTLED SCULPIN	66	3	.	.	Fresh Dead
MOTTLED SCULPIN	59	3	.	.	Fresh Dead
MOTTLED SCULPIN	72	6	.	.	Fresh Dead
MOTTLED SCULPIN	68	4	.	.	Fresh Dead
SLIMY SCULPIN	75	6	.	.	Fresh Dead
SLIMY SCULPIN	68	5	.	.	Fresh Dead
SLIMY SCULPIN	86	7	.	.	Fresh Dead
SLIMY SCULPIN	56	2	.	.	Fresh Dead
SLIMY SCULPIN	63	4	.	.	Fresh Dead
SLIMY SCULPIN	70	4	.	.	Fresh Dead

SAMPLING PERIOD: 11-12SEP06 START DATE AND TIME: 11SEP06:10:05 END DATE AND TIME: 12SEP06:10:10
SAMPLING DURATION (hrs.): 24.08 CW VOLUME SAMPLED (gals x 10^6): 799.0000
INTAKE TEMPERATURES (F): MINIMUM= 62.8 MEAN= 64.5 MAXIMUM= 69.3
DISCHARGE TEMPERATURES (F): MINIMUM= 82.1 MEAN= 84.0 MAXIMUM= 88.0 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 10-12SEP06 CW VOLUME (gals x 10^6) FOR EXTRAPOLATION PERIOD: 2937.6

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GREAT LAKES CRAYFISH	38	2	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	52	3	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	57	7	.	.	Fresh Dead	
ALEWIFE	173	24	.	.	Fresh Dead	
ALEWIFE	144	28	.	.	Fresh Dead	
ALEWIFE	104	10	.	.	Fresh Dead	
ALEWIFE	111	14	.	.	Fresh Dead	
ALEWIFE	115	11	.	.	Fresh Dead	
ALEWIFE	128	18	.	.	Fresh Dead	
ALEWIFE	143	25	.	.	Fresh Dead	
ALEWIFE	130	20	.	.	Fresh Dead	
ALEWIFE	98	9	.	.	Fresh Dead	
ALEWIFE	126	21	.	.	Fresh Dead	
ALEWIFE	116	15	.	.	Fresh Dead	

ALEWIFE	107	12	.	.	Fresh Dead
ALEWIFE	114	13	.	.	Fresh Dead
ALEWIFE	70	3	.	.	Fresh Dead
ALEWIFE	127	18	.	.	Fresh Dead
ALEWIFE	99	9	.	.	Fresh Dead
ALEWIFE	126	17	.	.	Fresh Dead
ALEWIFE	86	5	.	.	Fresh Dead
ALEWIFE	92	8	.	.	Fresh Dead
ALEWIFE	129	21	.	.	Fresh Dead
ALEWIFE	66	5	.	.	Fresh Dead
ALEWIFE	120	16	.	.	Fresh Dead
ALEWIFE	94	8	.	.	Fresh Dead
ALEWIFE	132	19	.	.	Fresh Dead
ALEWIFE	106	11	.	.	Fresh Dead
ALEWIFE	98	9	.	.	Fresh Dead
ALEWIFE	122	18	.	.	Fresh Dead
ALEWIFE	127	19	.	.	Fresh Dead
ALEWIFE	99	9	.	.	Fresh Dead
ALEWIFE	118	17	.	.	Fresh Dead
ALEWIFE	118	16	.	.	Fresh Dead
ALEWIFE	125	15	.	.	Fresh Dead
ALEWIFE	96	8	.	.	Fresh Dead
ALEWIFE	100	10	.	.	Fresh Dead
ALEWIFE	106	11	.	.	Fresh Dead
ALEWIFE	122	17	.	.	Fresh Dead
ALEWIFE	120	15	.	.	Fresh Dead
ALEWIFE	103	7	.	.	Fresh Dead
ALEWIFE	134	22	.	.	Fresh Dead
ALEWIFE	90	7	.	.	Fresh Dead
ALEWIFE	85	5	.	.	Fresh Dead
ALEWIFE	61	2	.	.	Fresh Dead
ALEWIFE	151	32	.	.	Fresh Dead
ALEWIFE	136	29	.	.	Fresh Dead
ALEWIFE	101	8	.	.	Fresh Dead
ALEWIFE	99	6	.	.	Fresh Dead
ALEWIFE	114	12	.	.	Fresh Dead
ALEWIFE	126	18	.	.	Fresh Dead
ALEWIFE	107	12	.	.	Fresh Dead
ALEWIFE	125	17	.	.	Fresh Dead
ALEWIFE	98	9	.	.	Fresh Dead
ALEWIFE	97	8	.	.	Fresh Dead
ALEWIFE	132	21	.	.	Fresh Dead
ALEWIFE	113	13	.	.	Fresh Dead
ALEWIFE	105	10	.	.	Fresh Dead
ALEWIFE	126	18	.	.	Fresh Dead
ALEWIFE	91	7	.	.	Fresh Dead
ALEWIFE	138	21	.	.	Fresh Dead
ALEWIFE	106	9	.	.	Fresh Dead
GIZZARD SHAD	.	.	2	.	Fresh Dead
BLOATER	100	8	.	.	Fresh Dead
BLOATER	79	5	.	.	Fresh Dead
BLOATER	85	5	.	.	Fresh Dead
BLOATER	73	4	.	.	Fresh Dead
BLOATER	78	4	.	.	Fresh Dead
ROUND WHITEFISH	430	700	.	.	Fresh Dead
ROUND WHITEFISH	441	600	.	.	Fresh Dead
RAINBOW SMELT	96	5	.	.	Fresh Dead
RAINBOW SMELT	108	7	.	.	Fresh Dead
RAINBOW SMELT	92	4	.	.	Fresh Dead
RAINBOW SMELT	72	2	.	.	Fresh Dead
RAINBOW SMELT	82	4	.	.	Fresh Dead
RAINBOW SMELT	83	3	.	.	Fresh Dead
RAINBOW SMELT	81	3	.	.	Fresh Dead
RAINBOW SMELT	80	3	.	.	Fresh Dead
RAINBOW SMELT	82	3	.	.	Fresh Dead
RAINBOW SMELT	96	5	.	.	Fresh Dead
RAINBOW SMELT	92	4	.	.	Fresh Dead
RAINBOW SMELT	117	8	.	.	Fresh Dead
RAINBOW SMELT	120	10	.	.	Fresh Dead
RAINBOW SMELT	82	3	.	.	Fresh Dead
RAINBOW SMELT	82	3	.	.	Fresh Dead
RAINBOW SMELT	136	13	.	.	Fresh Dead
RAINBOW SMELT	126	10	.	.	Fresh Dead
RAINBOW SMELT	145	17	.	.	Fresh Dead
RAINBOW SMELT	79	3	.	.	Fresh Dead
RAINBOW SMELT	76	2	.	.	Fresh Dead
RAINBOW SMELT	77	2	.	.	Fresh Dead
RAINBOW SMELT	73	2	.	.	Fresh Dead
RAINBOW SMELT	117	9	.	.	Fresh Dead
RAINBOW SMELT	125	10	.	.	Fresh Dead
RAINBOW SMELT	118	9	.	.	Fresh Dead
RAINBOW SMELT	100	5	.	.	Fresh Dead
RAINBOW SMELT	81	3	.	.	Fresh Dead
RAINBOW SMELT	105	6	.	.	Fresh Dead
RAINBOW SMELT	113	6	.	.	Fresh Dead
RAINBOW SMELT	77	2	.	.	Fresh Dead
RAINBOW SMELT	59	1	.	.	Fresh Dead
RAINBOW SMELT	95	5	.	.	Fresh Dead
RAINBOW SMELT	78	3	.	.	Fresh Dead
RAINBOW SMELT	92	4	.	.	Fresh Dead

RAINBOW SMELT	77	3	.	.	Fresh Dead
SPOTTAIL SHINER	71	3	.	.	Fresh Dead
SPOTTAIL SHINER	85	5	.	.	Fresh Dead
SPOTTAIL SHINER	93	7	.	.	Fresh Dead
SPOTTAIL SHINER	79	4	.	.	Fresh Dead
SPOTTAIL SHINER	104	11	.	.	Fresh Dead
SPOTTAIL SHINER	95	8	.	.	Fresh Dead
SPOTTAIL SHINER	77	4	.	.	Fresh Dead
SPOTTAIL SHINER	95	7	.	.	Fresh Dead
SPOTTAIL SHINER	121	17	.	.	Fresh Dead
SPOTTAIL SHINER	125	19	.	.	Fresh Dead
SPOTTAIL SHINER	76	4	.	.	Fresh Dead
SPOTTAIL SHINER	121	17	.	.	Fresh Dead
SPOTTAIL SHINER	68	2	.	.	Fresh Dead
SPOTTAIL SHINER	98	7	.	.	Fresh Dead
SPOTTAIL SHINER	100	10	.	.	Fresh Dead
SPOTTAIL SHINER	85	5	.	.	Fresh Dead
SPOTTAIL SHINER	78	4	.	.	Fresh Dead
LONGNOSE SUCKER	280	195	.	.	Fresh Dead
NINESPINE STICKLEBACK	70	2	.	.	Fresh Dead
MOTTLED SCULPIN	84	8	.	.	Fresh Dead
MOTTLED SCULPIN	80	7	.	.	Fresh Dead
MOTTLED SCULPIN	72	4	.	.	Fresh Dead
MOTTLED SCULPIN	80	7	.	.	Fresh Dead
MOTTLED SCULPIN	74	7	.	.	Fresh Dead
MOTTLED SCULPIN	72	6	.	.	Fresh Dead
MOTTLED SCULPIN	78	7	.	.	Fresh Dead
MOTTLED SCULPIN	77	7	.	.	Fresh Dead
MOTTLED SCULPIN	74	6	.	.	Fresh Dead
MOTTLED SCULPIN	73	6	.	.	Fresh Dead
MOTTLED SCULPIN	86	8	.	.	Fresh Dead
MOTTLED SCULPIN	74	6	.	.	Fresh Dead
MOTTLED SCULPIN	83	10	.	.	Fresh Dead
MOTTLED SCULPIN	85	9	.	.	Fresh Dead
MOTTLED SCULPIN	82	8	.	.	Fresh Dead
MOTTLED SCULPIN	78	7	.	.	Fresh Dead
MOTTLED SCULPIN	72	7	.	.	Fresh Dead
MOTTLED SCULPIN	86	7	.	.	Fresh Dead
MOTTLED SCULPIN	66	4	.	.	Fresh Dead
MOTTLED SCULPIN	61	3	.	.	Fresh Dead
MOTTLED SCULPIN	80	7	.	.	Fresh Dead
MOTTLED SCULPIN	67	4	.	.	Fresh Dead
MOTTLED SCULPIN	55	3	.	.	Fresh Dead
MOTTLED SCULPIN	66	4	.	.	Fresh Dead
MOTTLED SCULPIN	77	7	.	.	Fresh Dead
MOTTLED SCULPIN	78	7	.	.	Fresh Dead
MOTTLED SCULPIN	71	5	.	.	Fresh Dead
MOTTLED SCULPIN	71	5	.	.	Fresh Dead
MOTTLED SCULPIN	62	3	.	.	Fresh Dead
SLIMY SCULPIN	93	10	.	.	Fresh Dead
SLIMY SCULPIN	78	6	.	.	Fresh Dead
SLIMY SCULPIN	53	3	.	.	Fresh Dead
SLIMY SCULPIN	75	6	.	.	Fresh Dead

SAMPLING PERIOD: 13-14SEP06 START DATE AND TIME: 13SEP06:10:03 END DATE AND TIME: 14SEP06:10:26
SAMPLING DURATION (hrs.): 24.38 CW VOLUME SAMPLED (gals x 10^6): 994.8400
INTAKE TEMPERATURES (F): MINIMUM= 63.9 MEAN= 64.4 MAXIMUM= 65.2
DISCHARGE TEMPERATURES (F): MINIMUM= 83.3 MEAN= 83.9 MAXIMUM= 85.5 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 13-16SEP06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 3916.8

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
ALEWIFE	129	20	.	.	Fresh Dead	
ALEWIFE	89	6	.	.	Fresh Dead	
ALEWIFE	138	25	.	.	Fresh Dead	
ALEWIFE	136	25	.	.	Fresh Dead	
ALEWIFE	101	10	.	.	Fresh Dead	
ALEWIFE	102	9	.	.	Fresh Dead	
ALEWIFE	99	8	.	.	Fresh Dead	
ALEWIFE	94	9	.	.	Fresh Dead	
ALEWIFE	104	11	.	.	Fresh Dead	
ALEWIFE	96	10	.	.	Fresh Dead	
ALEWIFE	140	25	.	.	Fresh Dead	
ALEWIFE	89	6	.	.	Fresh Dead	
ALEWIFE	64	2	.	.	Fresh Dead	
ALEWIFE	108	7	.	.	Fresh Dead	
ALEWIFE	112	13	.	.	Fresh Dead	
ALEWIFE	164	31	.	.	Fresh Dead	
ALEWIFE	.	.	4	23	Fresh Dead	
ALEWIFE	144	27	.	.	Fresh Dead	
ALEWIFE	89	6	.	.	Fresh Dead	
ALEWIFE	125	17	.	.	Fresh Dead	
ALEWIFE	118	15	.	.	Fresh Dead	
ALEWIFE	101	9	.	.	Fresh Dead	
ALEWIFE	164	41	.	.	Fresh Dead	
ALEWIFE	136	24	.	.	Fresh Dead	
ALEWIFE	135	23	.	.	Fresh Dead	
ALEWIFE	123	19	.	.	Fresh Dead	

ALEWIFE	116	10	.	.	Fresh Dead
ALEWIFE	81	4	.	.	Fresh Dead
ALEWIFE	141	25	.	.	Fresh Dead
ALEWIFE	107	12	.	.	Fresh Dead
ALEWIFE	164	39	.	.	Fresh Dead
ALEWIFE	64	2	.	.	Fresh Dead
ALEWIFE	52	1	.	.	Fresh Dead
GIZZARD SHAD	65	3	.	.	Fresh Dead
GIZZARD SHAD	122	12	.	.	Fresh Dead
BLOATER	79	4	.	.	Fresh Dead
BLOATER	92	6	.	.	Fresh Dead
BLOATER	81	4	.	.	Fresh Dead
BLOATER	87	6	.	.	Fresh Dead
BLOATER	89	5	.	.	Fresh Dead
BLOATER	77	3	.	.	Fresh Dead
BLOATER	86	5	.	.	Fresh Dead
BLOATER	75	4	.	.	Fresh Dead
BLOATER	90	5	.	.	Fresh Dead
BLOATER	70	3	.	.	Fresh Dead
RAINBOW SMELT	133	14	.	.	Fresh Dead
RAINBOW SMELT	84	3	.	.	Fresh Dead
RAINBOW SMELT	89	4	.	.	Fresh Dead
RAINBOW SMELT	75	2	.	.	Fresh Dead
RAINBOW SMELT	119	9	.	.	Fresh Dead
RAINBOW SMELT	80	3	.	.	Fresh Dead
RAINBOW SMELT	65	2	.	.	Fresh Dead
RAINBOW SMELT	52	1	.	.	Fresh Dead
RAINBOW SMELT	73	2	.	.	Fresh Dead
RAINBOW SMELT	116	8	.	.	Fresh Dead
RAINBOW SMELT	76	3	.	.	Fresh Dead
RAINBOW SMELT	71	2	.	.	Fresh Dead
RAINBOW SMELT	78	4	.	.	Fresh Dead
RAINBOW SMELT	78	2	.	.	Fresh Dead
RAINBOW SMELT	93	5	.	.	Fresh Dead
RAINBOW SMELT	94	4	.	.	Fresh Dead
RAINBOW SMELT	78	3	.	.	Fresh Dead
RAINBOW SMELT	82	3	.	.	Fresh Dead
RAINBOW SMELT	76	2	.	.	Fresh Dead
RAINBOW SMELT	85	3	.	.	Fresh Dead
RAINBOW SMELT	127	11	.	.	Fresh Dead
RAINBOW SMELT	87	3	.	.	Fresh Dead
RAINBOW SMELT	114	6	.	.	Fresh Dead
RAINBOW SMELT	82	3	.	.	Fresh Dead
RAINBOW SMELT	75	1	.	.	Fresh Dead
SPOTTAIL SHINER	84	4	.	.	Fresh Dead
SPOTTAIL SHINER	88	5	.	.	Fresh Dead
SPOTTAIL SHINER	89	7	.	.	Fresh Dead
SPOTTAIL SHINER	84	5	.	.	Fresh Dead
SPOTTAIL SHINER	108	11	.	.	Fresh Dead
FATHEAD MINNOW	70	4	.	.	Fresh Dead
LONGNOSE DACE	95	8	.	.	Fresh Dead
LONGNOSE DACE	97	9	.	.	Fresh Dead
LONGNOSE DACE	84	7	.	.	Fresh Dead
LONGNOSE DACE	111	14	.	.	Fresh Dead
LONGNOSE SUCKER	339	400	.	.	Fresh Dead
WHITE SUCKER	486	1200	.	.	Fresh Dead
WHITE SUCKER	514	1450	.	.	Fresh Dead
WHITE SUCKER	225	110	.	.	Fresh Dead
WHITE SUCKER	522	1550	.	.	Live
WHITE SUCKER	225	134	.	.	Fresh Dead
CHANNEL CATFISH	163	52	.	.	Fresh Dead
BURBOT	137	22	.	.	Fresh Dead
THREESPINE STICKLEBACK	58	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	56	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	66	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	60	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	66	1	.	.	Fresh Dead
YELLOW PERCH	65	3	.	.	Fresh Dead
YELLOW PERCH	328	450	.	.	Live
MOTTLED SCULPIN	86	9	.	.	Fresh Dead
MOTTLED SCULPIN	72	6	.	.	Fresh Dead
MOTTLED SCULPIN	82	8	.	.	Fresh Dead
MOTTLED SCULPIN	79	6	.	.	Fresh Dead
MOTTLED SCULPIN	75	6	.	.	Fresh Dead
MOTTLED SCULPIN	75	6	.	.	Fresh Dead
MOTTLED SCULPIN	71	5	.	.	Fresh Dead
MOTTLED SCULPIN	74	7	.	.	Fresh Dead
MOTTLED SCULPIN	91	10	.	.	Fresh Dead
MOTTLED SCULPIN	78	6	.	.	Fresh Dead
MOTTLED SCULPIN	80	7	.	.	Fresh Dead
MOTTLED SCULPIN	95	8	.	.	Fresh Dead
MOTTLED SCULPIN	95	11	.	.	Fresh Dead
MOTTLED SCULPIN	84	8	.	.	Fresh Dead
MOTTLED SCULPIN	81	7	.	.	Fresh Dead
MOTTLED SCULPIN	70	6	.	.	Fresh Dead
MOTTLED SCULPIN	95	14	.	.	Fresh Dead
MOTTLED SCULPIN	85	8	.	.	Fresh Dead
MOTTLED SCULPIN	76	6	.	.	Fresh Dead
MOTTLED SCULPIN	76	7	.	.	Fresh Dead
MOTTLED SCULPIN	76	6	.	.	Fresh Dead

MOTTLED SCULPIN	79	6	.	.	Fresh Dead
MOTTLED SCULPIN	70	5	.	.	Fresh Dead
MOTTLED SCULPIN	73	5	.	.	Fresh Dead
MOTTLED SCULPIN	75	6	.	.	Fresh Dead
MOTTLED SCULPIN	80	7	.	.	Fresh Dead
MOTTLED SCULPIN	56	3	.	.	Fresh Dead
MOTTLED SCULPIN	85	8	.	.	Fresh Dead
MOTTLED SCULPIN	92	10	.	.	Fresh Dead
MOTTLED SCULPIN	65	4	.	.	Fresh Dead
MOTTLED SCULPIN	82	7	.	.	Fresh Dead
MOTTLED SCULPIN	70	4	.	.	Fresh Dead
MOTTLED SCULPIN	80	8	.	.	Fresh Dead
MOTTLED SCULPIN	68	4	.	.	Fresh Dead
MOTTLED SCULPIN	92	13	.	.	Fresh Dead
MOTTLED SCULPIN	81	7	.	.	Fresh Dead
MOTTLED SCULPIN	60	3	.	.	Fresh Dead
MOTTLED SCULPIN	82	8	.	.	Fresh Dead
MOTTLED SCULPIN	86	9	.	.	Fresh Dead
MOTTLED SCULPIN	75	6	.	.	Fresh Dead
SLIMY SCULPIN	86	8	.	.	Fresh Dead
SLIMY SCULPIN	91	9	.	.	Fresh Dead
SLIMY SCULPIN	63	3	.	.	Fresh Dead
SLIMY SCULPIN	60	3	.	.	Fresh Dead
SLIMY SCULPIN	73	5	.	.	Fresh Dead

SAMPLING PERIOD: 18-19SEP06 START DATE AND TIME: 18SEP06:10:16 END DATE AND TIME: 19SEP06:10:20
SAMPLING DURATION (hrs.): 24.07 CW VOLUME SAMPLED (gals x 10^6): 873.8000
INTAKE TEMPERATURES (F): MINIMUM= 45.8 MEAN= 49.4 MAXIMUM= 59.6
DISCHARGE TEMPERATURES (F): MINIMUM= 64.7 MEAN= 68.9 MAXIMUM= 80.8 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 17-19SEP06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 2937.6

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GREAT LAKES CRAYFISH	48	4	.	.	Fresh Dead	
ALEWIFE	96	8	.	.	Fresh Dead	
ALEWIFE	68	3	.	.	Fresh Dead	
ALEWIFE	53	1	.	.	Fresh Dead	
ALEWIFE	53	1	.	.	Fresh Dead	
ALEWIFE	64	2	.	.	Fresh Dead	
ALEWIFE	50	1	.	.	Fresh Dead	
ALEWIFE	157	19	.	.	Fresh Dead	
ALEWIFE	87	5	.	.	Fresh Dead	
ALEWIFE	159	20	.	.	Fresh Dead	
ALEWIFE	70	2	.	.	Fresh Dead	
ALEWIFE	58	2	.	.	Fresh Dead	
ALEWIFE	66	3	.	.	Fresh Dead	
ALEWIFE	60	2	.	.	Fresh Dead	
ALEWIFE	85	5	.	.	Fresh Dead	
ALEWIFE	81	4	.	.	Fresh Dead	
ALEWIFE	57	2	.	.	Fresh Dead	
ALEWIFE	75	3	.	.	Fresh Dead	
ALEWIFE	68	3	.	.	Fresh Dead	
ALEWIFE	62	2	.	.	Fresh Dead	
ALEWIFE	65	2	.	.	Fresh Dead	
ALEWIFE	56	1	.	.	Fresh Dead	
ALEWIFE	100	8	.	.	Fresh Dead	
ALEWIFE	68	3	.	.	Fresh Dead	
ALEWIFE	93	7	.	.	Fresh Dead	
ALEWIFE	70	3	.	.	Fresh Dead	
ALEWIFE	61	2	.	.	Fresh Dead	
ALEWIFE	76	3	.	.	Fresh Dead	
ALEWIFE	67	2	.	.	Fresh Dead	
ALEWIFE	66	2	.	.	Fresh Dead	
ALEWIFE	60	2	.	.	Fresh Dead	
ALEWIFE	81	4	.	.	Fresh Dead	
ALEWIFE	97	5	.	.	Fresh Dead	
ALEWIFE	64	2	.	.	Fresh Dead	
ALEWIFE	59	2	.	.	Fresh Dead	
ALEWIFE	61	2	.	.	Fresh Dead	
ALEWIFE	76	3	.	.	Fresh Dead	
ALEWIFE	68	3	.	.	Fresh Dead	
ALEWIFE	72	3	.	.	Fresh Dead	
ALEWIFE	60	2	.	.	Fresh Dead	
ALEWIFE	69	3	.	.	Fresh Dead	
ALEWIFE	85	5	.	.	Fresh Dead	
ALEWIFE	68	2	.	.	Fresh Dead	
ALEWIFE	65	2	.	.	Fresh Dead	
ALEWIFE	58	2	.	.	Fresh Dead	
ALEWIFE	54	1	.	.	Fresh Dead	
ALEWIFE	68	2	.	.	Fresh Dead	
ALEWIFE	57	1	.	.	Fresh Dead	
ALEWIFE	65	1	.	.	Fresh Dead	
ALEWIFE	70	2	.	.	Fresh Dead	
ALEWIFE	73	3	.	.	Fresh Dead	
ALEWIFE	.	.	81	225	Fresh Dead	
ALEWIFE	.	.	967	2900	Fresh Dead	
GIZZARD SHAD	118	14	.	.	Fresh Dead	
GIZZARD SHAD	111	11	.	.	Fresh Dead	

GIZZARD SHAD	111	11	.	.	Fresh Dead
GIZZARD SHAD	123	13	.	.	Fresh Dead
GIZZARD SHAD	113	12	.	.	Fresh Dead
GIZZARD SHAD	116	13	.	.	Fresh Dead
GIZZARD SHAD	251	158	.	.	Fresh Dead
GIZZARD SHAD	278	229	.	.	Fresh Dead
GIZZARD SHAD	301	284	.	.	Fresh Dead
BLOATER	77	3	.	.	Fresh Dead
BLOATER	121	13	.	.	Fresh Dead
BLOATER	82	5	.	.	Fresh Dead
BLOATER	80	4	.	.	Fresh Dead
BLOATER	77	4	.	.	Fresh Dead
BLOATER	78	4	.	.	Fresh Dead
RAINBOW SMELT	85	3	.	.	Fresh Dead
RAINBOW SMELT	132	12	.	.	Fresh Dead
RAINBOW SMELT	115	8	.	.	Fresh Dead
RAINBOW SMELT	91	4	.	.	Fresh Dead
RAINBOW SMELT	103	6	.	.	Fresh Dead
RAINBOW SMELT	111	7	.	.	Fresh Dead
RAINBOW SMELT	117	8	.	.	Fresh Dead
RAINBOW SMELT	129	10	.	.	Fresh Dead
RAINBOW SMELT	105	6	.	.	Fresh Dead
RAINBOW SMELT	127	9	.	.	Fresh Dead
RAINBOW SMELT	95	5	.	.	Fresh Dead
RAINBOW SMELT	82	3	.	.	Fresh Dead
RAINBOW SMELT	83	3	.	.	Fresh Dead
RAINBOW SMELT	93	4	.	.	Fresh Dead
RAINBOW SMELT	102	6	.	.	Fresh Dead
RAINBOW SMELT	116	8	.	.	Fresh Dead
RAINBOW SMELT	122	11	.	.	Fresh Dead
RAINBOW SMELT	91	4	.	.	Fresh Dead
RAINBOW SMELT	96	5	.	.	Fresh Dead
RAINBOW SMELT	94	4	.	.	Fresh Dead
RAINBOW SMELT	102	6	.	.	Fresh Dead
RAINBOW SMELT	111	7	.	.	Fresh Dead
RAINBOW SMELT	100	5	.	.	Fresh Dead
RAINBOW SMELT	94	5	.	.	Fresh Dead
RAINBOW SMELT	100	4	.	.	Fresh Dead
RAINBOW SMELT	114	8	.	.	Fresh Dead
RAINBOW SMELT	91	4	.	.	Fresh Dead
RAINBOW SMELT	74	2	.	.	Fresh Dead
RAINBOW SMELT	86	2	.	.	Fresh Dead
RAINBOW SMELT	93	4	.	.	Fresh Dead
RAINBOW SMELT	77	2	.	.	Fresh Dead
RAINBOW SMELT	84	3	.	.	Fresh Dead
RAINBOW SMELT	73	2	.	.	Fresh Dead
RAINBOW SMELT	85	3	.	.	Fresh Dead
RAINBOW SMELT	72	2	.	.	Fresh Dead
RAINBOW SMELT	66	2	.	.	Fresh Dead
RAINBOW SMELT	107	9	.	.	Fresh Dead
RAINBOW SMELT	91	4	.	.	Fresh Dead
RAINBOW SMELT	96	5	.	.	Fresh Dead
RAINBOW SMELT	105	7	.	.	Fresh Dead
RAINBOW SMELT	98	5	.	.	Fresh Dead
RAINBOW SMELT	125	12	.	.	Fresh Dead
RAINBOW SMELT	111	8	.	.	Fresh Dead
RAINBOW SMELT	83	3	.	.	Fresh Dead
RAINBOW SMELT	74	3	.	.	Fresh Dead
RAINBOW SMELT	94	5	.	.	Fresh Dead
RAINBOW SMELT	76	2	.	.	Fresh Dead
RAINBOW SMELT	90	4	.	.	Fresh Dead
RAINBOW SMELT	86	4	.	.	Fresh Dead
RAINBOW SMELT	81	2	.	.	Fresh Dead
RAINBOW SMELT	70	2	.	.	Fresh Dead
RAINBOW SMELT	.	.	60	222	Fresh Dead
RAINBOW SMELT	.	.	30	184	Fresh Dead
RAINBOW SMELT	44	1	.	.	Fresh Dead
RAINBOW SMELT	46	1	.	.	Fresh Dead
EMERALD SHINER	95	5	.	.	Fresh Dead
SPOTTAIL SHINER	87	6	.	.	Fresh Dead
SPOTTAIL SHINER	76	4	.	.	Fresh Dead
SPOTTAIL SHINER	115	14	.	.	Fresh Dead
SPOTTAIL SHINER	81	5	.	.	Fresh Dead
SPOTTAIL SHINER	82	4	.	.	Fresh Dead
SPOTTAIL SHINER	94	6	.	.	Fresh Dead
SPOTTAIL SHINER	95	7	.	.	Fresh Dead
SPOTTAIL SHINER	85	5	.	.	Fresh Dead
SPOTTAIL SHINER	76	4	.	.	Fresh Dead
SPOTTAIL SHINER	101	9	.	.	Fresh Dead
SPOTTAIL SHINER	97	8	.	.	Fresh Dead
SPOTTAIL SHINER	96	8	.	.	Fresh Dead
SPOTTAIL SHINER	86	5	.	.	Fresh Dead
SPOTTAIL SHINER	85	5	.	.	Fresh Dead
SPOTTAIL SHINER	80	5	.	.	Fresh Dead
SPOTTAIL SHINER	84	5	.	.	Fresh Dead
SPOTTAIL SHINER	97	7	.	.	Fresh Dead
SPOTTAIL SHINER	73	3	.	.	Fresh Dead
SPOTTAIL SHINER	79	4	.	.	Fresh Dead
SPOTTAIL SHINER	78	4	.	.	Fresh Dead
SPOTTAIL SHINER	76	4	.	.	Fresh Dead

SPOTTAIL SHINER	73	4	.	.	Fresh Dead
SPOTTAIL SHINER	91	6	.	.	Fresh Dead
SPOTTAIL SHINER	75	4	.	.	Fresh Dead
SPOTTAIL SHINER	89	6	.	.	Fresh Dead
SPOTTAIL SHINER	87	6	.	.	Fresh Dead
SPOTTAIL SHINER	103	9	.	.	Fresh Dead
SPOTTAIL SHINER	81	5	.	.	Fresh Dead
SPOTTAIL SHINER	92	5	.	.	Fresh Dead
SPOTTAIL SHINER	87	6	.	.	Fresh Dead
SPOTTAIL SHINER	90	5	.	.	Fresh Dead
SPOTTAIL SHINER	80	4	.	.	Fresh Dead
SPOTTAIL SHINER	85	5	.	.	Fresh Dead
SPOTTAIL SHINER	72	4	.	.	Fresh Dead
SPOTTAIL SHINER	90	5	.	.	Fresh Dead
SPOTTAIL SHINER	84	5	.	.	Fresh Dead
SPOTTAIL SHINER	78	4	.	.	Fresh Dead
SPOTTAIL SHINER	98	8	.	.	Fresh Dead
SPOTTAIL SHINER	83	5	.	.	Fresh Dead
SPOTTAIL SHINER	88	5	.	.	Fresh Dead
SPOTTAIL SHINER	115	10	.	.	Fresh Dead
SPOTTAIL SHINER	94	7	.	.	Fresh Dead
SPOTTAIL SHINER	99	7	.	.	Fresh Dead
SPOTTAIL SHINER	99	8	.	.	Fresh Dead
SPOTTAIL SHINER	84	5	.	.	Fresh Dead
SPOTTAIL SHINER	84	5	.	.	Fresh Dead
SPOTTAIL SHINER	72	3	.	.	Fresh Dead
SPOTTAIL SHINER	76	4	.	.	Fresh Dead
SPOTTAIL SHINER	73	4	.	.	Fresh Dead
SPOTTAIL SHINER	72	3	.	.	Fresh Dead
SPOTTAIL SHINER	98	8	.	.	Fresh Dead
SPOTTAIL SHINER	.	.	50	226	Fresh Dead
FATHEAD MINNOW	63	3	.	.	Fresh Dead
LONGNOSE DACE	95	7	.	.	Fresh Dead
LONGNOSE DACE	73	4	.	.	Fresh Dead
LONGNOSE DACE	78	5	.	.	Fresh Dead
LONGNOSE DACE	79	5	.	.	Fresh Dead
WHITE SUCKER	527	1800	.	.	Fresh Dead
WHITE SUCKER	363	575	.	.	Fresh Dead
WHITE SUCKER	404	400	.	.	Fresh Dead
WHITE SUCKER	338	600	.	.	Fresh Dead
WHITE SUCKER	365	610	.	.	Fresh Dead
BLACK BULLHEAD	172	69	.	.	Live
BLACK BULLHEAD	250	290	.	.	Fresh Dead
BLACK BULLHEAD	122	24	.	.	Fresh Dead
CHANNEL CATFISH	245	119	.	.	Live
BURBOT	380	295	.	.	Fresh Dead
BURBOT	445	620	.	.	Fresh Dead
BURBOT	344	230	.	.	Fresh Dead
NINESPINE STICKLEBACK	76	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	76	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	68	2	.	.	Fresh Dead
GREEN SUNFISH	56	3	.	.	Fresh Dead
PUMPKINSEED	108	28	.	.	Fresh Dead
PUMPKINSEED	109	28	.	.	Fresh Dead
BLUEGILL	94	15	.	.	Fresh Dead
UNID LEPOMIS	46	2	.	.	Fresh Dead
YELLOW PERCH	173	60	.	.	Fresh Dead
YELLOW PERCH	93	8	.	.	Fresh Dead
YELLOW PERCH	130	22	.	.	Fresh Dead
YELLOW PERCH	80	5	.	.	Fresh Dead
YELLOW PERCH	76	4	.	.	Fresh Dead
YELLOW PERCH	71	3	.	.	Fresh Dead
YELLOW PERCH	68	3	.	.	Fresh Dead
YELLOW PERCH	80	5	.	.	Fresh Dead
YELLOW PERCH	60	3	.	.	Fresh Dead
YELLOW PERCH	72	4	.	.	Fresh Dead
YELLOW PERCH	73	4	.	.	Fresh Dead
YELLOW PERCH	122	19	.	.	Fresh Dead
YELLOW PERCH	116	17	.	.	Fresh Dead
YELLOW PERCH	133	25	.	.	Fresh Dead
YELLOW PERCH	123	20	.	.	Fresh Dead
YELLOW PERCH	92	7	.	.	Fresh Dead
YELLOW PERCH	78	5	.	.	Fresh Dead
YELLOW PERCH	88	7	.	.	Fresh Dead
YELLOW PERCH	63	2	.	.	Fresh Dead
YELLOW PERCH	89	7	.	.	Fresh Dead
YELLOW PERCH	81	5	.	.	Fresh Dead
YELLOW PERCH	77	5	.	.	Fresh Dead
YELLOW PERCH	83	5	.	.	Fresh Dead
YELLOW PERCH	72	4	.	.	Fresh Dead
YELLOW PERCH	77	5	.	.	Fresh Dead
YELLOW PERCH	74	4	.	.	Fresh Dead
YELLOW PERCH	77	5	.	.	Fresh Dead
YELLOW PERCH	77	5	.	.	Fresh Dead
YELLOW PERCH	62	2	.	.	Fresh Dead
FRESHWATER DRUM	285	258	.	.	Fresh Dead
FRESHWATER DRUM	369	850	.	.	Fresh Dead
FRESHWATER DRUM	441	1120	.	.	Fresh Dead
FRESHWATER DRUM	290	252	.	.	Live
FRESHWATER DRUM	465	1400	.	.	Fresh Dead

FRESHWATER DRUM	423	1090	.	.	Live
FRESHWATER DRUM	219	122	.	.	Fresh Dead
MOTTLED SCULPIN	74	5	.	.	Fresh Dead
MOTTLED SCULPIN	69	6	.	.	Fresh Dead
MOTTLED SCULPIN	77	7	.	.	Fresh Dead
MOTTLED SCULPIN	75	5	.	.	Fresh Dead
MOTTLED SCULPIN	81	9	.	.	Fresh Dead
MOTTLED SCULPIN	78	7	.	.	Fresh Dead
MOTTLED SCULPIN	83	9	.	.	Fresh Dead
MOTTLED SCULPIN	59	4	.	.	Fresh Dead
MOTTLED SCULPIN	66	4	.	.	Fresh Dead
MOTTLED SCULPIN	64	3	.	.	Fresh Dead
MOTTLED SCULPIN	76	5	.	.	Fresh Dead
MOTTLED SCULPIN	68	5	.	.	Fresh Dead
MOTTLED SCULPIN	61	4	.	.	Fresh Dead
MOTTLED SCULPIN	68	4	.	.	Fresh Dead
MOTTLED SCULPIN	65	4	.	.	Fresh Dead
MOTTLED SCULPIN	63	4	.	.	Fresh Dead
MOTTLED SCULPIN	58	3	.	.	Fresh Dead
MOTTLED SCULPIN	67	4	.	.	Fresh Dead
MOTTLED SCULPIN	56	3	.	.	Fresh Dead

SAMPLING PERIOD: 20-21SEP06 START DATE AND TIME: 20SEP06:10:16 END DATE AND TIME: 21SEP06:10:10
SAMPLING DURATION (hrs.): 23.90 CW VOLUME SAMPLED (gals x 10^6): 793.4035
INTAKE TEMPERATURES (F): MINIMUM= 47.1 MEAN= 48.3 MAXIMUM= 49.8
DISCHARGE TEMPERATURES (F): MINIMUM= 66.7 MEAN= 73.3 MAXIMUM= 82.9 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 20-23SEP06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 3639.6

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GREAT LAKES CRAYFISH	55	5	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	45	4	.	.	Fresh Dead	
ALEWIFE	179	25	.	.	Fresh Dead	
ALEWIFE	178	30	.	.	Fresh Dead	
ALEWIFE	150	31	.	.	Fresh Dead	
ALEWIFE	157	15	.	.	Fresh Dead	
ALEWIFE	172	24	.	.	Fresh Dead	
ALEWIFE	127	18	.	.	Fresh Dead	
ALEWIFE	81	5	.	.	Fresh Dead	
ALEWIFE	75	4	.	.	Fresh Dead	
ALEWIFE	61	2	.	.	Fresh Dead	
ALEWIFE	63	2	.	.	Fresh Dead	
ALEWIFE	91	6	.	.	Fresh Dead	
ALEWIFE	74	3	.	.	Fresh Dead	
ALEWIFE	115	8	.	.	Fresh Dead	
ALEWIFE	58	2	.	.	Fresh Dead	
ALEWIFE	.	.	1	2	Fresh Dead	
ALEWIFE	177	28	.	.	Fresh Dead	
ALEWIFE	166	19	.	.	Fresh Dead	
ALEWIFE	152	28	.	.	Fresh Dead	
ALEWIFE	113	13	.	.	Fresh Dead	
ALEWIFE	106	10	.	.	Fresh Dead	
ALEWIFE	81	4	.	.	Fresh Dead	
ALEWIFE	97	7	.	.	Fresh Dead	
ALEWIFE	136	14	.	.	Fresh Dead	
ALEWIFE	130	15	.	.	Fresh Dead	
ALEWIFE	84	4	.	.	Fresh Dead	
ALEWIFE	67	2	.	.	Fresh Dead	
ALEWIFE	135	24	.	.	Fresh Dead	
ALEWIFE	143	15	.	.	Fresh Dead	
ALEWIFE	126	9	.	.	Fresh Dead	
ALEWIFE	82	3	.	.	Fresh Dead	
ALEWIFE	73	3	.	.	Fresh Dead	
ALEWIFE	159	15	.	.	Fresh Dead	
ALEWIFE	82	4	.	.	Fresh Dead	
ALEWIFE	79	3	.	.	Fresh Dead	
ALEWIFE	65	2	.	.	Fresh Dead	
ALEWIFE	87	5	.	.	Fresh Dead	
ALEWIFE	108	9	.	.	Fresh Dead	
ALEWIFE	71	2	.	.	Fresh Dead	
ALEWIFE	68	2	.	.	Fresh Dead	
ALEWIFE	74	3	.	.	Fresh Dead	
ALEWIFE	65	1	.	.	Fresh Dead	
ALEWIFE	81	3	.	.	Fresh Dead	
ALEWIFE	80	2	.	.	Fresh Dead	
ALEWIFE	79	2	.	.	Fresh Dead	
ALEWIFE	78	1	.	.	Fresh Dead	
ALEWIFE	147	16	.	.	Fresh Dead	
ALEWIFE	166	18	.	.	Fresh Dead	
ALEWIFE	148	14	.	.	Fresh Dead	
ALEWIFE	125	12	.	.	Fresh Dead	
ALEWIFE	74	3	.	.	Fresh Dead	
ALEWIFE	75	2	.	.	Fresh Dead	
ALEWIFE	57	1	.	.	Fresh Dead	
ALEWIFE	.	.	172	1700	Fresh Dead	
ALEWIFE	.	.	258	2800	Fresh Dead	
ALEWIFE	.	.	18	200	Fresh Dead	
BLOATER	81	4	.	.	Fresh Dead	

RAINBOW SMELT	87	4	.	.	Fresh Dead
RAINBOW SMELT	80	3	.	.	Fresh Dead
RAINBOW SMELT	73	2	.	.	Fresh Dead
RAINBOW SMELT	75	2	.	.	Fresh Dead
RAINBOW SMELT	87	3	.	.	Fresh Dead
RAINBOW SMELT	87	4	.	.	Fresh Dead
RAINBOW SMELT	98	6	.	.	Fresh Dead
RAINBOW SMELT	86	3	.	.	Fresh Dead
RAINBOW SMELT	78	2	.	.	Fresh Dead
RAINBOW SMELT	97	5	.	.	Fresh Dead
RAINBOW SMELT	87	4	.	.	Fresh Dead
RAINBOW SMELT	117	7	.	.	Fresh Dead
RAINBOW SMELT	99	5	.	.	Fresh Dead
RAINBOW SMELT	96	5	.	.	Fresh Dead
RAINBOW SMELT	89	3	.	.	Fresh Dead
RAINBOW SMELT	97	5	.	.	Fresh Dead
RAINBOW SMELT	79	2	.	.	Fresh Dead
RAINBOW SMELT	76	2	.	.	Fresh Dead
RAINBOW SMELT	91	4	.	.	Fresh Dead
RAINBOW SMELT	92	4	.	.	Fresh Dead
RAINBOW SMELT	83	3	.	.	Fresh Dead
RAINBOW SMELT	82	2	.	.	Fresh Dead
RAINBOW SMELT	118	7	.	.	Fresh Dead
RAINBOW SMELT	78	2	.	.	Fresh Dead
RAINBOW SMELT	119	9	.	.	Fresh Dead
RAINBOW SMELT	114	6	.	.	Fresh Dead
RAINBOW SMELT	97	4	.	.	Fresh Dead
RAINBOW SMELT	77	2	.	.	Fresh Dead
RAINBOW SMELT	78	1	.	.	Fresh Dead
RAINBOW SMELT	76	2	.	.	Fresh Dead
RAINBOW SMELT	88	4	.	.	Fresh Dead
SPOTTAIL SHINER	78	4	.	.	Fresh Dead
SPOTTAIL SHINER	99	8	.	.	Fresh Dead
SPOTTAIL SHINER	90	6	.	.	Fresh Dead
SPOTTAIL SHINER	89	5	.	.	Fresh Dead
SPOTTAIL SHINER	88	5	.	.	Fresh Dead
SPOTTAIL SHINER	100	8	.	.	Fresh Dead
SPOTTAIL SHINER	87	5	.	.	Fresh Dead
SPOTTAIL SHINER	90	6	.	.	Fresh Dead
SPOTTAIL SHINER	88	5	.	.	Fresh Dead
SPOTTAIL SHINER	108	10	.	.	Fresh Dead
SPOTTAIL SHINER	87	5	.	.	Fresh Dead
SPOTTAIL SHINER	74	4	.	.	Fresh Dead
SPOTTAIL SHINER	99	7	.	.	Fresh Dead
SPOTTAIL SHINER	.	.	1	3	Fresh Dead
SPOTTAIL SHINER	87	5	.	.	Fresh Dead
SPOTTAIL SHINER	120	13	.	.	Fresh Dead
SPOTTAIL SHINER	81	4	.	.	Fresh Dead
SPOTTAIL SHINER	90	5	.	.	Fresh Dead
SPOTTAIL SHINER	119	4	.	.	Fresh Dead
LONGNOSE DACE	122	22	.	.	Fresh Dead
LONGNOSE DACE	90	7	.	.	Fresh Dead
LONGNOSE DACE	83	8	.	.	Fresh Dead
LONGNOSE DACE	84	6	.	.	Fresh Dead
LONGNOSE DACE	77	6	.	.	Fresh Dead
WHITE SUCKER	221	134	.	.	Fresh Dead
BURBOT	480	950	.	.	Live
NINESPINE STICKLEBACK	62	1	.	.	Fresh Dead
PUMPKINSEED	109	30	.	.	Fresh Dead
SMALLMOUTH BASS	468	1100	.	.	Live
SMALLMOUTH BASS	93	10	.	.	Fresh Dead
YELLOW PERCH	69	3	.	.	Fresh Dead
YELLOW PERCH	57	2	.	.	Fresh Dead
YELLOW PERCH	80	5	.	.	Fresh Dead
YELLOW PERCH	74	4	.	.	Fresh Dead
YELLOW PERCH	68	2	.	.	Fresh Dead
YELLOW PERCH	70	3	.	.	Fresh Dead
MOTTLED SCULPIN	78	7	.	.	Fresh Dead
MOTTLED SCULPIN	75	6	.	.	Fresh Dead
MOTTLED SCULPIN	75	6	.	.	Fresh Dead
MOTTLED SCULPIN	66	3	.	.	Fresh Dead
MOTTLED SCULPIN	67	5	.	.	Fresh Dead
MOTTLED SCULPIN	63	3	.	.	Fresh Dead
MOTTLED SCULPIN	63	4	.	.	Live
MOTTLED SCULPIN	65	4	.	.	Live
MOTTLED SCULPIN	71	5	.	.	Fresh Dead
MOTTLED SCULPIN	69	6	.	.	Fresh Dead
MOTTLED SCULPIN	70	6	.	.	Fresh Dead
MOTTLED SCULPIN	72	4	.	.	Fresh Dead
MOTTLED SCULPIN	63	4	.	.	Fresh Dead

SAMPLING PERIOD: 25-26SEP06 START DATE AND TIME: 25SEP06:10:04 END DATE AND TIME: 26SEP06:10:06
SAMPLING DURATION (hrs.): 24.03 CW VOLUME SAMPLED (gals x 10^6): 980.5600
INTAKE TEMPERATURES (F): MINIMUM= 49.7 MEAN= 50.3 MAXIMUM= 51.9
DISCHARGE TEMPERATURES (F): MINIMUM= 68.4 MEAN= 69.1 MAXIMUM= 70.5 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 24-26SEP06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 2937.6

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
ALEWIFE	190	29	.	.	Fresh Dead	
ALEWIFE	172	48	.	.	Fresh Dead	
ALEWIFE	133	15	.	.	Fresh Dead	
ALEWIFE	146	30	.	.	Fresh Dead	
ALEWIFE	83	3	.	.	Fresh Dead	
ALEWIFE	135	25	.	.	Fresh Dead	
ALEWIFE	89	4	.	.	Fresh Dead	
ALEWIFE	73	2	.	.	Fresh Dead	
ALEWIFE	73	3	.	.	Fresh Dead	
ALEWIFE	170	29	.	.	Fresh Dead	
ALEWIFE	136	18	.	.	Fresh Dead	
ALEWIFE	86	5	.	.	Fresh Dead	
ALEWIFE	80	3	.	.	Fresh Dead	
ALEWIFE	149	17	.	.	Fresh Dead	
ALEWIFE	188	25	.	.	Fresh Dead	
ALEWIFE	180	34	.	.	Fresh Dead	
ALEWIFE	147	16	.	.	Fresh Dead	
ALEWIFE	77	3	.	.	Fresh Dead	
ALEWIFE	118	11	.	.	Fresh Dead	
ALEWIFE	90	5	.	.	Fresh Dead	
ALEWIFE	143	21	.	.	Fresh Dead	
ALEWIFE	117	13	.	.	Fresh Dead	
ALEWIFE	64	2	.	.	Fresh Dead	
ALEWIFE	101	7	.	.	Fresh Dead	
ALEWIFE	85	5	.	.	Fresh Dead	
ALEWIFE	107	10	.	.	Fresh Dead	
ALEWIFE	109	10	.	.	Fresh Dead	
ALEWIFE	127	10	.	.	Fresh Dead	
ALEWIFE	91	5	.	.	Fresh Dead	
ALEWIFE	91	6	.	.	Fresh Dead	
ALEWIFE	82	4	.	.	Fresh Dead	
ALEWIFE	118	9	.	.	Fresh Dead	
ALEWIFE	125	18	.	.	Fresh Dead	
ALEWIFE	114	11	.	.	Fresh Dead	
ALEWIFE	90	5	.	.	Fresh Dead	
ALEWIFE	97	7	.	.	Fresh Dead	
ALEWIFE	143	26	.	.	Fresh Dead	
ALEWIFE	72	3	.	.	Fresh Dead	
ALEWIFE	84	4	.	.	Fresh Dead	
ALEWIFE	130	20	.	.	Fresh Dead	
ALEWIFE	139	14	.	.	Fresh Dead	
ALEWIFE	164	27	.	.	Fresh Dead	
ALEWIFE	144	18	.	.	Fresh Dead	
ALEWIFE	128	22	.	.	Fresh Dead	
ALEWIFE	72	3	.	.	Fresh Dead	
ALEWIFE	114	9	.	.	Fresh Dead	
ALEWIFE	104	8	.	.	Fresh Dead	
ALEWIFE	160	25	.	.	Fresh Dead	
ALEWIFE	68	2	.	.	Fresh Dead	
ALEWIFE	70	2	.	.	Fresh Dead	
ALEWIFE	.	.	153	1850	Fresh Dead	
ALEWIFE	.	.	372	4500	Fresh Dead	
ALEWIFE	.	.	56	575	Fresh Dead	
GIZZARD SHAD	62	3	.	.	Fresh Dead	
GIZZARD SHAD	71	4	.	.	Fresh Dead	
GIZZARD SHAD	67	3	.	.	Fresh Dead	
GIZZARD SHAD	65	3	.	.	Fresh Dead	
GIZZARD SHAD	128	19	.	.	Fresh Dead	
GIZZARD SHAD	79	4	.	.	Fresh Dead	
GIZZARD SHAD	67	3	.	.	Fresh Dead	
BLOATER	86	5	.	.	Fresh Dead	
BLOATER	85	5	.	.	Fresh Dead	
BLOATER	84	4	.	.	Fresh Dead	
BLOATER	67	2	.	.	Fresh Dead	
BLOATER	87	5	.	.	Fresh Dead	
BLOATER	85	5	.	.	Fresh Dead	
BLOATER	97	6	.	.	Fresh Dead	
BLOATER	80	3	.	.	Fresh Dead	
RAINBOW SMELT	73	2	.	.	Fresh Dead	
RAINBOW SMELT	118	9	.	.	Fresh Dead	
RAINBOW SMELT	131	12	.	.	Fresh Dead	
RAINBOW SMELT	121	10	.	.	Fresh Dead	
RAINBOW SMELT	89	4	.	.	Fresh Dead	
RAINBOW SMELT	90	4	.	.	Fresh Dead	
RAINBOW SMELT	108	7	.	.	Fresh Dead	
RAINBOW SMELT	90	4	.	.	Fresh Dead	
RAINBOW SMELT	117	10	.	.	Fresh Dead	
RAINBOW SMELT	132	13	.	.	Fresh Dead	
RAINBOW SMELT	120	10	.	.	Fresh Dead	
RAINBOW SMELT	124	10	.	.	Fresh Dead	
RAINBOW SMELT	95	5	.	.	Fresh Dead	
RAINBOW SMELT	120	9	.	.	Fresh Dead	
RAINBOW SMELT	118	9	.	.	Fresh Dead	
RAINBOW SMELT	87	4	.	.	Fresh Dead	
RAINBOW SMELT	84	4	.	.	Fresh Dead	
RAINBOW SMELT	95	5	.	.	Fresh Dead	
RAINBOW SMELT	126	13	.	.	Fresh Dead	

RAINBOW SMELT	100	6	.	.	Fresh Dead
RAINBOW SMELT	84	4	.	.	Fresh Dead
RAINBOW SMELT	123	11	.	.	Fresh Dead
RAINBOW SMELT	85	4	.	.	Fresh Dead
RAINBOW SMELT	72	3	.	.	Fresh Dead
RAINBOW SMELT	105	7	.	.	Fresh Dead
RAINBOW SMELT	63	2	.	.	Fresh Dead
RAINBOW SMELT	123	11	.	.	Fresh Dead
RAINBOW SMELT	79	4	.	.	Fresh Dead
RAINBOW SMELT	105	7	.	.	Fresh Dead
RAINBOW SMELT	88	5	.	.	Fresh Dead
RAINBOW SMELT	74	3	.	.	Fresh Dead
RAINBOW SMELT	125	12	.	.	Fresh Dead
RAINBOW SMELT	134	14	.	.	Fresh Dead
RAINBOW SMELT	103	6	.	.	Fresh Dead
RAINBOW SMELT	90	5	.	.	Fresh Dead
RAINBOW SMELT	97	6	.	.	Fresh Dead
RAINBOW SMELT	133	14	.	.	Fresh Dead
RAINBOW SMELT	79	3	.	.	Fresh Dead
RAINBOW SMELT	90	4	.	.	Fresh Dead
RAINBOW SMELT	123	8	.	.	Fresh Dead
RAINBOW SMELT	161	21	.	.	Fresh Dead
RAINBOW SMELT	97	6	.	.	Fresh Dead
RAINBOW SMELT	90	4	.	.	Fresh Dead
RAINBOW SMELT	111	8	.	.	Fresh Dead
RAINBOW SMELT	133	14	.	.	Fresh Dead
RAINBOW SMELT	78	3	.	.	Fresh Dead
RAINBOW SMELT	80	3	.	.	Fresh Dead
RAINBOW SMELT	91	5	.	.	Fresh Dead
RAINBOW SMELT	77	4	.	.	Fresh Dead
RAINBOW SMELT	93	5	.	.	Fresh Dead
RAINBOW SMELT	.	.	9	44	Fresh Dead
RAINBOW SMELT	.	.	10	65	Fresh Dead
COMMON SHINER	97	14	.	.	Fresh Dead
SPOTTAIL SHINER	98	8	.	.	Fresh Dead
LONGNOSE DACE	115	16	.	.	Fresh Dead
LONGNOSE DACE	99	11	.	.	Fresh Dead
WHITE SUCKER	222	115	.	.	Fresh Dead
BLACK BULLHEAD	252	346	.	.	Fresh Dead
BURBOT	406	550	.	.	Fresh Dead
BURBOT	178	38	.	.	Fresh Dead
YELLOW PERCH	144	31	.	.	Live
MOTTLED SCULPIN	71	5	.	.	Fresh Dead
MOTTLED SCULPIN	66	4	.	.	Fresh Dead
MOTTLED SCULPIN	71	6	.	.	Fresh Dead
MOTTLED SCULPIN	73	6	.	.	Fresh Dead
MOTTLED SCULPIN	73	5	.	.	Fresh Dead
MOTTLED SCULPIN	65	5	.	.	Fresh Dead
MOTTLED SCULPIN	71	4	.	.	Fresh Dead
MOTTLED SCULPIN	65	4	.	.	Fresh Dead
MOTTLED SCULPIN	72	6	.	.	Fresh Dead
MOTTLED SCULPIN	67	4	.	.	Fresh Dead
MOTTLED SCULPIN	65	3	.	.	Fresh Dead

SAMPLING PERIOD: 27-28SEP06 START DATE AND TIME: 27SEP06:10:10 END DATE AND TIME: 28SEP06:10:05
SAMPLING DURATION (hrs.): 23.92 CW VOLUME SAMPLED (gals x 10^6): 975.8000
INTAKE TEMPERATURES (F): MINIMUM= 48.9 MEAN= 49.4 MAXIMUM= 49.9
DISCHARGE TEMPERATURES (F): MINIMUM= 67.8 MEAN= 68.4 MAXIMUM= 69.0 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 27-30SEP06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 3916.8

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GREAT LAKES CRAYFISH	46	4	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	52	6	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	45	3	.	.	Fresh Dead	
ALEWIFE	120	14	.	.	Fresh Dead	
ALEWIFE	168	21	.	.	Fresh Dead	
ALEWIFE	109	12	.	.	Fresh Dead	
ALEWIFE	147	17	.	.	Fresh Dead	
ALEWIFE	173	26	.	.	Fresh Dead	
ALEWIFE	155	35	.	.	Fresh Dead	
ALEWIFE	153	18	.	.	Fresh Dead	
ALEWIFE	101	8	.	.	Fresh Dead	
ALEWIFE	169	20	.	.	Fresh Dead	
ALEWIFE	91	6	.	.	Fresh Dead	
ALEWIFE	104	7	.	.	Fresh Dead	
ALEWIFE	57	2	.	.	Fresh Dead	
ALEWIFE	68	3	.	.	Fresh Dead	
ALEWIFE	61	2	.	.	Fresh Dead	
ALEWIFE	56	2	.	.	Fresh Dead	
ALEWIFE	55	2	.	.	Fresh Dead	
ALEWIFE	68	3	.	.	Fresh Dead	
ALEWIFE	55	2	.	.	Fresh Dead	
ALEWIFE	.	.	1	1	Fresh Dead	
ALEWIFE	123	14	.	.	Fresh Dead	
ALEWIFE	112	11	.	.	Fresh Dead	
ALEWIFE	103	8	.	.	Fresh Dead	
ALEWIFE	104	21	.	.	Fresh Dead	
ALEWIFE	60	2	.	.	Fresh Dead	

ALEWIFE	75	3	.	.	Fresh	Dead
ALEWIFE	113	11	.	.	Fresh	Dead
ALEWIFE	141	27	.	.	Fresh	Dead
ALEWIFE	106	9	.	.	Fresh	Dead
ALEWIFE	75	4	.	.	Fresh	Dead
ALEWIFE	124	20	.	.	Fresh	Dead
ALEWIFE	105	26	.	.	Fresh	Dead
ALEWIFE	66	3	.	.	Fresh	Dead
ALEWIFE	80	4	.	.	Fresh	Dead
ALEWIFE	67	2	.	.	Fresh	Dead
ALEWIFE	69	2	.	.	Fresh	Dead
ALEWIFE	76	4	.	.	Fresh	Dead
ALEWIFE	67	3	.	.	Fresh	Dead
ALEWIFE	75	4	.	.	Fresh	Dead
ALEWIFE	81	4	.	.	Fresh	Dead
ALEWIFE	139	20	.	.	Fresh	Dead
ALEWIFE	164	23	.	.	Fresh	Dead
ALEWIFE	109	6	.	.	Fresh	Dead
ALEWIFE	66	2	.	.	Fresh	Dead
ALEWIFE	156	34	.	.	Fresh	Dead
ALEWIFE	109	10	.	.	Fresh	Dead
ALEWIFE	169	21	.	.	Fresh	Dead
ALEWIFE	102	7	.	.	Fresh	Dead
ALEWIFE	108	10	.	.	Fresh	Dead
ALEWIFE	72	3	.	.	Fresh	Dead
ALEWIFE	66	2	.	.	Fresh	Dead
ALEWIFE	61	2	.	.	Fresh	Dead
ALEWIFE	67	3	.	.	Fresh	Dead
ALEWIFE	.	.	82	700	Fresh	Dead
ALEWIFE	.	.	320	2400	Fresh	Dead
ALEWIFE	.	.	1	4	Fresh	Dead
ALEWIFE	.	.	120	1100	Fresh	Dead
GIZZARD SHAD	87	5	.	.	Fresh	Dead
BLOATER	40	1	.	.	Fresh	Dead
BLOATER	92	6	.	.	Fresh	Dead
BLOATER	86	5	.	.	Fresh	Dead
BLOATER	84	4	.	.	Fresh	Dead
BLOATER	79	3	.	.	Fresh	Dead
BLOATER	90	5	.	.	Fresh	Dead
BLOATER	37	1	.	.	Fresh	Dead
RAINBOW SMELT	126	4	.	.	Fresh	Dead
RAINBOW SMELT	92	5	.	.	Fresh	Dead
RAINBOW SMELT	86	4	.	.	Fresh	Dead
RAINBOW SMELT	99	3	.	.	Fresh	Dead
RAINBOW SMELT	76	1	.	.	Fresh	Dead
RAINBOW SMELT	92	4	.	.	Fresh	Dead
RAINBOW SMELT	132	10	.	.	Fresh	Dead
RAINBOW SMELT	116	8	.	.	Fresh	Dead
RAINBOW SMELT	123	10	.	.	Fresh	Dead
RAINBOW SMELT	101	6	.	.	Fresh	Dead
RAINBOW SMELT	103	6	.	.	Fresh	Dead
RAINBOW SMELT	118	8	.	.	Fresh	Dead
RAINBOW SMELT	132	11	.	.	Fresh	Dead
RAINBOW SMELT	103	6	.	.	Fresh	Dead
RAINBOW SMELT	95	5	.	.	Fresh	Dead
RAINBOW SMELT	97	5	.	.	Fresh	Dead
RAINBOW SMELT	91	4	.	.	Fresh	Dead
RAINBOW SMELT	71	2	.	.	Fresh	Dead
RAINBOW SMELT	130	12	.	.	Fresh	Dead
RAINBOW SMELT	119	8	.	.	Fresh	Dead
RAINBOW SMELT	94	5	.	.	Fresh	Dead
RAINBOW SMELT	132	12	.	.	Fresh	Dead
RAINBOW SMELT	81	3	.	.	Fresh	Dead
RAINBOW SMELT	92	4	.	.	Fresh	Dead
RAINBOW SMELT	88	3	.	.	Fresh	Dead
RAINBOW SMELT	106	6	.	.	Fresh	Dead
RAINBOW SMELT	126	10	.	.	Fresh	Dead
RAINBOW SMELT	119	8	.	.	Fresh	Dead
RAINBOW SMELT	90	3	.	.	Fresh	Dead
RAINBOW SMELT	116	9	.	.	Fresh	Dead
RAINBOW SMELT	118	6	.	.	Fresh	Dead
RAINBOW SMELT	116	5	.	.	Fresh	Dead
RAINBOW SMELT	101	5	.	.	Fresh	Dead
RAINBOW SMELT	39	1	.	.	Fresh	Dead
SPOTTAIL SHINER	98	10	.	.	Fresh	Dead
SPOTTAIL SHINER	71	3	.	.	Fresh	Dead
SPOTTAIL SHINER	98	7	.	.	Fresh	Dead
SPOTTAIL SHINER	80	4	.	.	Fresh	Dead
SPOTTAIL SHINER	94	7	.	.	Fresh	Dead
SPOTTAIL SHINER	86	6	.	.	Fresh	Dead
SPOTTAIL SHINER	99	9	.	.	Fresh	Dead
SPOTTAIL SHINER	93	7	.	.	Fresh	Dead
SPOTTAIL SHINER	78	5	.	.	Fresh	Dead
SPOTTAIL SHINER	78	5	.	.	Fresh	Dead
SPOTTAIL SHINER	75	4	.	.	Fresh	Dead
SPOTTAIL SHINER	117	13	.	.	Fresh	Dead
SPOTTAIL SHINER	79	5	.	.	Fresh	Dead
SPOTTAIL SHINER	107	11	.	.	Fresh	Dead
SPOTTAIL SHINER	94	8	.	.	Fresh	Dead
SPOTTAIL SHINER	93	7	.	.	Fresh	Dead

SPOTTAIL SHINER	90	6	.	.	Fresh Dead
SPOTTAIL SHINER	95	7	.	.	Fresh Dead
SPOTTAIL SHINER	125	16	.	.	Fresh Dead
SPOTTAIL SHINER	82	4	.	.	Fresh Dead
SPOTTAIL SHINER	95	7	.	.	Fresh Dead
SPOTTAIL SHINER	94	6	.	.	Fresh Dead
SPOTTAIL SHINER	77	4	.	.	Fresh Dead
SPOTTAIL SHINER	80	4	.	.	Fresh Dead
SPOTTAIL SHINER	90	6	.	.	Fresh Dead
SPOTTAIL SHINER	98	8	.	.	Fresh Dead
SPOTTAIL SHINER	91	6	.	.	Fresh Dead
SPOTTAIL SHINER	75	4	.	.	Fresh Dead
SPOTTAIL SHINER	92	6	.	.	Fresh Dead
SPOTTAIL SHINER	71	3	.	.	Fresh Dead
SPOTTAIL SHINER	77	4	.	.	Fresh Dead
SPOTTAIL SHINER	78	4	.	.	Fresh Dead
SPOTTAIL SHINER	84	4	.	.	Fresh Dead
SPOTTAIL SHINER	97	7	.	.	Fresh Dead
SPOTTAIL SHINER	78	4	.	.	Fresh Dead
SPOTTAIL SHINER	82	5	.	.	Fresh Dead
SPOTTAIL SHINER	93	7	.	.	Fresh Dead
SPOTTAIL SHINER	85	5	.	.	Fresh Dead
SPOTTAIL SHINER	81	5	.	.	Fresh Dead
SPOTTAIL SHINER	83	6	.	.	Fresh Dead
SPOTTAIL SHINER	77	4	.	.	Fresh Dead
SPOTTAIL SHINER	70	3	.	.	Fresh Dead
SPOTTAIL SHINER	110	12	.	.	Fresh Dead
SPOTTAIL SHINER	84	5	.	.	Fresh Dead
SPOTTAIL SHINER	85	4	.	.	Fresh Dead
SPOTTAIL SHINER	95	6	.	.	Fresh Dead
SPOTTAIL SHINER	96	7	.	.	Fresh Dead
SPOTTAIL SHINER	78	4	.	.	Fresh Dead
SPOTTAIL SHINER	97	7	.	.	Fresh Dead
SPOTTAIL SHINER	77	4	.	.	Fresh Dead
SPOTTAIL SHINER	.	.	13	160	Fresh Dead
LONGNOSE DACE	140	26	.	.	Fresh Dead
WHITE SUCKER	364	550	.	.	Fresh Dead
THREESPINE STICKLEBACK	57	1	.	.	Fresh Dead
PUMPKINSEED	47	2	.	.	Fresh Dead
SMALLMOUTH BASS	201	110	.	.	Fresh Dead
YELLOW PERCH	122	20	.	.	Fresh Dead
YELLOW PERCH	57	2	.	.	Fresh Dead
YELLOW PERCH	72	3	.	.	Fresh Dead
YELLOW PERCH	83	6	.	.	Fresh Dead
YELLOW PERCH	71	3	.	.	Fresh Dead
YELLOW PERCH	70	3	.	.	Fresh Dead
YELLOW PERCH	68	3	.	.	Fresh Dead
YELLOW PERCH	64	2	.	.	Fresh Dead
YELLOW PERCH	75	4	.	.	Fresh Dead
YELLOW PERCH	72	3	.	.	Fresh Dead
FRESHWATER DRUM	479	1800	.	.	Fresh Dead
MOTTLED SCULPIN	63	4	.	.	Fresh Dead
MOTTLED SCULPIN	71	5	.	.	Fresh Dead
MOTTLED SCULPIN	71	4	.	.	Fresh Dead
MOTTLED SCULPIN	80	7	.	.	Fresh Dead
MOTTLED SCULPIN	84	8	.	.	Fresh Dead
MOTTLED SCULPIN	76	8	.	.	Fresh Dead
MOTTLED SCULPIN	77	6	.	.	Fresh Dead
MOTTLED SCULPIN	71	4	.	.	Fresh Dead
MOTTLED SCULPIN	65	4	.	.	Fresh Dead
MOTTLED SCULPIN	70	5	.	.	Fresh Dead
MOTTLED SCULPIN	59	3	.	.	Fresh Dead
MOTTLED SCULPIN	67	5	.	.	Fresh Dead
MOTTLED SCULPIN	96	11	.	.	Fresh Dead
MOTTLED SCULPIN	68	4	.	.	Fresh Dead
MOTTLED SCULPIN	63	4	.	.	Fresh Dead
MOTTLED SCULPIN	66	4	.	.	Fresh Dead
SLIMY SCULPIN	68	4	.	.	Fresh Dead
SLIMY SCULPIN	74	5	.	.	Fresh Dead

SAMPLING PERIOD: 02-03OCT06 START DATE AND TIME: 02OCT06:10:18 END DATE AND TIME: 03OCT06:10:00
SAMPLING DURATION (hrs.): 23.70 CW VOLUME SAMPLED (gals x 10^6): 895.5600
INTAKE TEMPERATURES (F): MINIMUM= 51.4 MEAN= 53.3 MAXIMUM= 55.6
DISCHARGE TEMPERATURES (F): MINIMUM= 70.2 MEAN= 72.2 MAXIMUM= 74.6 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 01-03OCT06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 2937.6

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GREAT LAKES CRAYFISH	43	3	.	.	Fresh Dead	
ALEWIFE	104	8	.	.	Fresh Dead	
ALEWIFE	79	4	.	.	Fresh Dead	
ALEWIFE	89	6	.	.	Fresh Dead	
ALEWIFE	72	3	.	.	Fresh Dead	
ALEWIFE	99	8	.	.	Fresh Dead	
ALEWIFE	94	6	.	.	Fresh Dead	
ALEWIFE	90	5	.	.	Fresh Dead	
ALEWIFE	78	4	.	.	Fresh Dead	
ALEWIFE	92	6	.	.	Fresh Dead	

ALEWIFE	85	5	.	.	Fresh Dead
ALEWIFE	89	5	.	.	Fresh Dead
ALEWIFE	122	13	.	.	Fresh Dead
ALEWIFE	128	15	.	.	Fresh Dead
ALEWIFE	111	10	.	.	Fresh Dead
ALEWIFE	82	4	.	.	Fresh Dead
ALEWIFE	88	5	.	.	Fresh Dead
ALEWIFE	111	9	.	.	Fresh Dead
ALEWIFE	110	11	.	.	Fresh Dead
ALEWIFE	124	18	.	.	Fresh Dead
ALEWIFE	57	3	.	.	Fresh Dead
ALEWIFE	133	17	.	.	Fresh Dead
ALEWIFE	79	3	.	.	Fresh Dead
ALEWIFE	77	3	.	.	Fresh Dead
ALEWIFE	89	5	.	.	Fresh Dead
ALEWIFE	72	3	.	.	Fresh Dead
ALEWIFE	70	2	.	.	Fresh Dead
ALEWIFE	70	2	.	.	Fresh Dead
ALEWIFE	75	3	.	.	Fresh Dead
ALEWIFE	87	5	.	.	Fresh Dead
ALEWIFE	115	11	.	.	Fresh Dead
ALEWIFE	140	20	.	.	Fresh Dead
ALEWIFE	159	19	.	.	Fresh Dead
ALEWIFE	103	8	.	.	Fresh Dead
ALEWIFE	112	10	.	.	Fresh Dead
ALEWIFE	84	4	.	.	Fresh Dead
ALEWIFE	82	3	.	.	Fresh Dead
ALEWIFE	93	5	.	.	Fresh Dead
ALEWIFE	108	9	.	.	Fresh Dead
ALEWIFE	72	3	.	.	Fresh Dead
ALEWIFE	83	5	.	.	Fresh Dead
ALEWIFE	89	5	.	.	Fresh Dead
ALEWIFE	82	4	.	.	Fresh Dead
ALEWIFE	78	3	.	.	Fresh Dead
ALEWIFE	108	9	.	.	Fresh Dead
ALEWIFE	57	1	.	.	Fresh Dead
ALEWIFE	62	1	.	.	Fresh Dead
ALEWIFE	63	2	.	.	Fresh Dead
ALEWIFE	48	1	.	.	Fresh Dead
ALEWIFE	87	5	.	.	Fresh Dead
ALEWIFE	80	4	.	.	Fresh Dead
ALEWIFE	.	.	100	700	Fresh Dead
ALEWIFE	.	.	338	2300	Fresh Dead
ALEWIFE	.	.	368	2500	Fresh Dead
ALEWIFE	.	.	978	6650	Fresh Dead
ALEWIFE	.	.	868	5900	Fresh Dead
ALEWIFE	.	.	1206	8200	Fresh Dead
ALEWIFE	.	.	397	2700	Fresh Dead
GIZZARD SHAD	85	5	.	.	Fresh Dead
GIZZARD SHAD	117	14	.	.	Fresh Dead
GIZZARD SHAD	78	4	.	.	Fresh Dead
GIZZARD SHAD	87	5	.	.	Fresh Dead
GIZZARD SHAD	70	3	.	.	Fresh Dead
GIZZARD SHAD	114	12	.	.	Fresh Dead
BLOATER	94	7	.	.	Fresh Dead
BLOATER	87	4	.	.	Fresh Dead
BLOATER	77	4	.	.	Fresh Dead
BLOATER	75	4	.	.	Fresh Dead
BLOATER	87	5	.	.	Fresh Dead
BLOATER	103	8	.	.	Fresh Dead
BLOATER	88	5	.	.	Fresh Dead
BLOATER	69	2	.	.	Fresh Dead
BLOATER	89	5	.	.	Fresh Dead
BLOATER	81	4	.	.	Fresh Dead
BLOATER	88	5	.	.	Fresh Dead
BLOATER	89	5	.	.	Fresh Dead
BLOATER	102	8	.	.	Fresh Dead
BLOATER	72	2	.	.	Fresh Dead
BLOATER	91	5	.	.	Fresh Dead
BLOATER	82	4	.	.	Fresh Dead
BLOATER	79	4	.	.	Fresh Dead
BLOATER	87	4	.	.	Fresh Dead
BLOATER	87	5	.	.	Fresh Dead
BLOATER	75	3	.	.	Fresh Dead
BLOATER	70	2	.	.	Fresh Dead
BLOATER	80	4	.	.	Fresh Dead
BLOATER	84	4	.	.	Fresh Dead
BLOATER	80	3	.	.	Fresh Dead
BLOATER	90	5	.	.	Fresh Dead
BLOATER	75	3	.	.	Fresh Dead
BLOATER	92	5	.	.	Fresh Dead
BLOATER	93	6	.	.	Fresh Dead
BLOATER	88	5	.	.	Fresh Dead
BLOATER	74	3	.	.	Fresh Dead
BLOATER	87	5	.	.	Fresh Dead
BLOATER	87	5	.	.	Fresh Dead
BLOATER	85	5	.	.	Fresh Dead
BLOATER	87	5	.	.	Fresh Dead
BLOATER	65	2	.	.	Fresh Dead
CHINOOK SALMON	702	2700	.	.	Fresh Dead

CHINOOK SALMON	175	56	.	.	Fresh Dead
ROUND WHITEFISH	216	65	.	.	Fresh Dead
ROUND WHITEFISH	218	70	.	.	Fresh Dead
RAINBOW SMELT	126	9	.	.	Fresh Dead
RAINBOW SMELT	120	9	.	.	Fresh Dead
RAINBOW SMELT	110	6	.	.	Fresh Dead
RAINBOW SMELT	115	8	.	.	Fresh Dead
RAINBOW SMELT	117	9	.	.	Fresh Dead
RAINBOW SMELT	123	8	.	.	Fresh Dead
RAINBOW SMELT	122	8	.	.	Fresh Dead
RAINBOW SMELT	120	8	.	.	Fresh Dead
RAINBOW SMELT	137	12	.	.	Fresh Dead
RAINBOW SMELT	138	12	.	.	Fresh Dead
RAINBOW SMELT	117	9	.	.	Fresh Dead
RAINBOW SMELT	92	4	.	.	Fresh Dead
RAINBOW SMELT	123	10	.	.	Fresh Dead
RAINBOW SMELT	114	8	.	.	Fresh Dead
RAINBOW SMELT	92	4	.	.	Fresh Dead
RAINBOW SMELT	89	3	.	.	Fresh Dead
RAINBOW SMELT	114	8	.	.	Fresh Dead
RAINBOW SMELT	135	12	.	.	Fresh Dead
RAINBOW SMELT	94	4	.	.	Fresh Dead
RAINBOW SMELT	95	5	.	.	Fresh Dead
RAINBOW SMELT	116	9	.	.	Fresh Dead
RAINBOW SMELT	104	5	.	.	Fresh Dead
RAINBOW SMELT	107	5	.	.	Fresh Dead
RAINBOW SMELT	87	4	.	.	Fresh Dead
RAINBOW SMELT	131	11	.	.	Fresh Dead
RAINBOW SMELT	105	6	.	.	Fresh Dead
RAINBOW SMELT	91	4	.	.	Fresh Dead
RAINBOW SMELT	139	12	.	.	Fresh Dead
RAINBOW SMELT	127	11	.	.	Fresh Dead
RAINBOW SMELT	106	5	.	.	Fresh Dead
RAINBOW SMELT	117	8	.	.	Fresh Dead
RAINBOW SMELT	103	5	.	.	Fresh Dead
RAINBOW SMELT	117	7	.	.	Fresh Dead
RAINBOW SMELT	93	3	.	.	Fresh Dead
RAINBOW SMELT	96	5	.	.	Fresh Dead
RAINBOW SMELT	108	6	.	.	Fresh Dead
RAINBOW SMELT	95	5	.	.	Fresh Dead
RAINBOW SMELT	87	5	.	.	Fresh Dead
RAINBOW SMELT	93	4	.	.	Fresh Dead
RAINBOW SMELT	85	3	.	.	Fresh Dead
RAINBOW SMELT	92	4	.	.	Fresh Dead
RAINBOW SMELT	128	12	.	.	Fresh Dead
RAINBOW SMELT	133	12	.	.	Fresh Dead
RAINBOW SMELT	96	4	.	.	Fresh Dead
RAINBOW SMELT	125	9	.	.	Fresh Dead
RAINBOW SMELT	98	5	.	.	Fresh Dead
RAINBOW SMELT	122	8	.	.	Fresh Dead
RAINBOW SMELT	132	9	.	.	Fresh Dead
RAINBOW SMELT	108	5	.	.	Fresh Dead
RAINBOW SMELT	138	12	.	.	Fresh Dead
RAINBOW SMELT	.	.	135	550	Fresh Dead
RAINBOW SMELT	.	.	194	950	Fresh Dead
RAINBOW SMELT	.	.	571	2800	Fresh Dead
RAINBOW SMELT	.	.	571	2800	Fresh Dead
RAINBOW SMELT	.	.	878	4300	Fresh Dead
RAINBOW SMELT	.	.	19	96	Fresh Dead
COMMON CARP	105	18	.	.	Fresh Dead
SPOTTAIL SHINER	117	16	.	.	Fresh Dead
SPOTTAIL SHINER	119	17	.	.	Fresh Dead
SPOTTAIL SHINER	86	6	.	.	Fresh Dead
SPOTTAIL SHINER	128	21	.	.	Fresh Dead
SPOTTAIL SHINER	96	7	.	.	Fresh Dead
SPOTTAIL SHINER	103	8	.	.	Fresh Dead
SPOTTAIL SHINER	114	12	.	.	Fresh Dead
SPOTTAIL SHINER	121	14	.	.	Fresh Dead
SPOTTAIL SHINER	79	4	.	.	Fresh Dead
SPOTTAIL SHINER	97	8	.	.	Fresh Dead
SPOTTAIL SHINER	97	8	.	.	Fresh Dead
SPOTTAIL SHINER	130	16	.	.	Fresh Dead
SPOTTAIL SHINER	117	14	.	.	Fresh Dead
SPOTTAIL SHINER	97	8	.	.	Fresh Dead
SPOTTAIL SHINER	90	6	.	.	Fresh Dead
SPOTTAIL SHINER	85	5	.	.	Fresh Dead
SPOTTAIL SHINER	79	4	.	.	Fresh Dead
SPOTTAIL SHINER	86	5	.	.	Fresh Dead
SPOTTAIL SHINER	102	9	.	.	Fresh Dead
SPOTTAIL SHINER	107	9	.	.	Fresh Dead
SPOTTAIL SHINER	95	8	.	.	Fresh Dead
SPOTTAIL SHINER	82	4	.	.	Fresh Dead
SPOTTAIL SHINER	75	4	.	.	Fresh Dead
SPOTTAIL SHINER	80	5	.	.	Fresh Dead
SPOTTAIL SHINER	92	6	.	.	Fresh Dead
SPOTTAIL SHINER	76	3	.	.	Fresh Dead
SPOTTAIL SHINER	72	3	.	.	Fresh Dead
SPOTTAIL SHINER	81	5	.	.	Fresh Dead
SPOTTAIL SHINER	113	12	.	.	Fresh Dead
SPOTTAIL SHINER	74	4	.	.	Fresh Dead

SPOTTAIL SHINER	95	7	.	.	Fresh Dead
SPOTTAIL SHINER	76	7	.	.	Fresh Dead
SPOTTAIL SHINER	115	11	.	.	Fresh Dead
SPOTTAIL SHINER	92	6	.	.	Fresh Dead
SPOTTAIL SHINER	124	14	.	.	Fresh Dead
SPOTTAIL SHINER	102	9	.	.	Fresh Dead
SPOTTAIL SHINER	83	5	.	.	Fresh Dead
SPOTTAIL SHINER	110	12	.	.	Fresh Dead
SPOTTAIL SHINER	83	5	.	.	Fresh Dead
SPOTTAIL SHINER	92	7	.	.	Fresh Dead
SPOTTAIL SHINER	83	5	.	.	Fresh Dead
SPOTTAIL SHINER	110	11	.	.	Fresh Dead
SPOTTAIL SHINER	114	12	.	.	Fresh Dead
SPOTTAIL SHINER	90	6	.	.	Fresh Dead
SPOTTAIL SHINER	76	4	.	.	Fresh Dead
SPOTTAIL SHINER	82	5	.	.	Fresh Dead
SPOTTAIL SHINER	78	4	.	.	Fresh Dead
SPOTTAIL SHINER	80	4	.	.	Fresh Dead
SPOTTAIL SHINER	98	8	.	.	Fresh Dead
SPOTTAIL SHINER	.	.	55	450	Fresh Dead
SPOTTAIL SHINER	.	.	22	130	Fresh Dead
SPOTTAIL SHINER	.	.	33	190	Fresh Dead
SPOTTAIL SHINER	.	.	34	244	Fresh Dead
SPOTTAIL SHINER	.	.	17	123	Fresh Dead
FATHEAD MINNOW	65	4	.	.	Fresh Dead
LONGNOSE DACE	91	9	.	.	Fresh Dead
LONGNOSE DACE	86	7	.	.	Fresh Dead
LONGNOSE DACE	85	7	.	.	Fresh Dead
WHITE SUCKER	416	1000	.	.	Fresh Dead
BLACK BULLHEAD	248	212	.	.	Fresh Dead
CHANNEL CATFISH	64	2	.	.	Fresh Dead
TROUT-PERCH	102	11	.	.	Fresh Dead
BURBOT	864	4000	.	.	Fresh Dead
BURBOT	86	6	.	.	Fresh Dead
NINESPINE STICKLEBACK	56	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	76	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	55	2	.	.	Fresh Dead
NINESPINE STICKLEBACK	77	2	.	.	Fresh Dead
PUMPKINSEED	45	1	.	.	Fresh Dead
SMALLMOUTH BASS	92	12	.	.	Fresh Dead
YELLOW PERCH	153	43	.	.	Fresh Dead
YELLOW PERCH	85	5	.	.	Fresh Dead
YELLOW PERCH	92	7	.	.	Fresh Dead
YELLOW PERCH	78	4	.	.	Fresh Dead
YELLOW PERCH	79	4	.	.	Fresh Dead
YELLOW PERCH	151	41	.	.	Fresh Dead
YELLOW PERCH	73	4	.	.	Fresh Dead
YELLOW PERCH	92	7	.	.	Fresh Dead
YELLOW PERCH	124	20	.	.	Fresh Dead
YELLOW PERCH	77	4	.	.	Fresh Dead
YELLOW PERCH	72	4	.	.	Fresh Dead
YELLOW PERCH	72	4	.	.	Fresh Dead
YELLOW PERCH	83	5	.	.	Fresh Dead
YELLOW PERCH	78	4	.	.	Fresh Dead
YELLOW PERCH	68	3	.	.	Fresh Dead
YELLOW PERCH	84	6	.	.	Fresh Dead
YELLOW PERCH	78	4	.	.	Fresh Dead
ROUND GOBY	75	5	.	.	Fresh Dead
MOTTLED SCULPIN	72	7	.	.	Fresh Dead
MOTTLED SCULPIN	76	6	.	.	Fresh Dead
MOTTLED SCULPIN	70	5	.	.	Fresh Dead
MOTTLED SCULPIN	78	6	.	.	Fresh Dead
MOTTLED SCULPIN	84	8	.	.	Fresh Dead
MOTTLED SCULPIN	60	3	.	.	Fresh Dead
MOTTLED SCULPIN	66	5	.	.	Fresh Dead
MOTTLED SCULPIN	75	6	.	.	Fresh Dead
MOTTLED SCULPIN	70	4	.	.	Fresh Dead
MOTTLED SCULPIN	85	9	.	.	Fresh Dead
MOTTLED SCULPIN	67	4	.	.	Fresh Dead
MOTTLED SCULPIN	77	7	.	.	Fresh Dead
MOTTLED SCULPIN	64	4	.	.	Fresh Dead
MOTTLED SCULPIN	85	8	.	.	Fresh Dead
MOTTLED SCULPIN	65	4	.	.	Fresh Dead
MOTTLED SCULPIN	79	6	.	.	Fresh Dead
MOTTLED SCULPIN	80	7	.	.	Fresh Dead
MOTTLED SCULPIN	66	5	.	.	Fresh Dead
MOTTLED SCULPIN	74	6	.	.	Fresh Dead
MOTTLED SCULPIN	65	5	.	.	Fresh Dead
MOTTLED SCULPIN	71	5	.	.	Fresh Dead
MOTTLED SCULPIN	80	9	.	.	Fresh Dead
MOTTLED SCULPIN	63	4	.	.	Fresh Dead
MOTTLED SCULPIN	74	6	.	.	Fresh Dead
MOTTLED SCULPIN	68	4	.	.	Fresh Dead
MOTTLED SCULPIN	62	3	.	.	Fresh Dead
MOTTLED SCULPIN	69	5	.	.	Fresh Dead
MOTTLED SCULPIN	76	6	.	.	Fresh Dead
MOTTLED SCULPIN	81	6	.	.	Fresh Dead
MOTTLED SCULPIN	55	3	.	.	Fresh Dead
SLIMY SCULPIN	75	8	.	.	Fresh Dead

SAMPLING PERIOD: 04-05OCT06 START DATE AND TIME: 04OCT06:10:43 END DATE AND TIME: 05OCT06:10:36
SAMPLING DURATION (hrs.): 23.88 CW VOLUME SAMPLED (gals x 10^6): 719.4400
INTAKE TEMPERATURES (F): MINIMUM= 50.2 MEAN= 52.0 MAXIMUM= 53.9
DISCHARGE TEMPERATURES (F): MINIMUM= 69.2 MEAN= 71.2 MAXIMUM= 73.4 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 04-07OCT06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 3916.8

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GREAT LAKES CRAYFISH	45	3	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	55	3	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	65	8	.	.	Fresh Dead	
GREAT LAKES CRAYFISH	25	2	.	.	Fresh Dead	
ALEWIFE	154	34	.	.	Fresh Dead	
ALEWIFE	75	3	.	.	Fresh Dead	
ALEWIFE	97	7	.	.	Fresh Dead	
ALEWIFE	89	5	.	.	Fresh Dead	
ALEWIFE	73	3	.	.	Fresh Dead	
ALEWIFE	92	5	.	.	Fresh Dead	
ALEWIFE	82	4	.	.	Fresh Dead	
ALEWIFE	83	4	.	.	Fresh Dead	
ALEWIFE	172	45	.	.	Fresh Dead	
ALEWIFE	108	9	.	.	Fresh Dead	
ALEWIFE	112	10	.	.	Fresh Dead	
ALEWIFE	79	4	.	.	Fresh Dead	
ALEWIFE	106	8	.	.	Fresh Dead	
ALEWIFE	124	15	.	.	Fresh Dead	
ALEWIFE	95	6	.	.	Fresh Dead	
ALEWIFE	70	2	.	.	Fresh Dead	
ALEWIFE	114	11	.	.	Fresh Dead	
ALEWIFE	49	1	.	.	Fresh Dead	
ALEWIFE	101	8	.	.	Fresh Dead	
ALEWIFE	78	3	.	.	Fresh Dead	
ALEWIFE	79	3	.	.	Fresh Dead	
ALEWIFE	69	2	.	.	Fresh Dead	
ALEWIFE	77	3	.	.	Fresh Dead	
ALEWIFE	76	3	.	.	Fresh Dead	
ALEWIFE	80	4	.	.	Fresh Dead	
ALEWIFE	67	3	.	.	Fresh Dead	
ALEWIFE	77	3	.	.	Fresh Dead	
ALEWIFE	68	3	.	.	Fresh Dead	
ALEWIFE	63	2	.	.	Fresh Dead	
ALEWIFE	68	2	.	.	Fresh Dead	
ALEWIFE	73	3	.	.	Fresh Dead	
ALEWIFE	107	10	.	.	Fresh Dead	
ALEWIFE	124	12	.	.	Fresh Dead	
ALEWIFE	89	5	.	.	Fresh Dead	
ALEWIFE	88	5	.	.	Fresh Dead	
ALEWIFE	72	3	.	.	Fresh Dead	
ALEWIFE	76	4	.	.	Fresh Dead	
ALEWIFE	92	6	.	.	Fresh Dead	
ALEWIFE	142	28	.	.	Fresh Dead	
ALEWIFE	134	23	.	.	Fresh Dead	
ALEWIFE	83	4	.	.	Fresh Dead	
ALEWIFE	84	4	.	.	Fresh Dead	
ALEWIFE	97	6	.	.	Fresh Dead	
ALEWIFE	80	3	.	.	Fresh Dead	
ALEWIFE	107	9	.	.	Fresh Dead	
ALEWIFE	83	4	.	.	Fresh Dead	
ALEWIFE	100	9	.	.	Fresh Dead	
ALEWIFE	78	3	.	.	Fresh Dead	
ALEWIFE	95	7	.	.	Fresh Dead	
ALEWIFE	66	2	.	.	Fresh Dead	
ALEWIFE	.	.	100	600	Fresh Dead	
ALEWIFE	.	.	250	1600	Fresh Dead	
ALEWIFE	.	.	117	750	Fresh Dead	
ALEWIFE	.	.	2094	13400	Fresh Dead	
ALEWIFE	.	.	1922	12300	Fresh Dead	
ALEWIFE	.	.	89	1100	Fresh Dead	
GIZZARD SHAD	278	212	.	.	Fresh Dead	
GIZZARD SHAD	116	12	.	.	Fresh Dead	
BLOATER	100	7	.	.	Fresh Dead	
BLOATER	75	3	.	.	Fresh Dead	
BLOATER	96	6	.	.	Fresh Dead	
BLOATER	78	3	.	.	Fresh Dead	
BLOATER	82	4	.	.	Fresh Dead	
BLOATER	92	5	.	.	Fresh Dead	
BLOATER	86	5	.	.	Fresh Dead	
BLOATER	94	6	.	.	Fresh Dead	
BLOATER	100	7	.	.	Fresh Dead	
BLOATER	102	7	.	.	Fresh Dead	
ROUND WHITEFISH	414	600	.	.	Fresh Dead	
RAINBOW SMELT	132	11	.	.	Fresh Dead	
RAINBOW SMELT	126	10	.	.	Fresh Dead	
RAINBOW SMELT	137	13	.	.	Fresh Dead	
RAINBOW SMELT	135	15	.	.	Fresh Dead	
RAINBOW SMELT	123	9	.	.	Fresh Dead	
RAINBOW SMELT	100	5	.	.	Fresh Dead	
RAINBOW SMELT	111	7	.	.	Fresh Dead	
RAINBOW SMELT	120	9	.	.	Fresh Dead	

RAINBOW SMELT	132	12	.	.	Fresh Dead
RAINBOW SMELT	132	10	.	.	Fresh Dead
RAINBOW SMELT	92	4	.	.	Fresh Dead
RAINBOW SMELT	89	4	.	.	Fresh Dead
RAINBOW SMELT	135	12	.	.	Fresh Dead
RAINBOW SMELT	125	10	.	.	Fresh Dead
RAINBOW SMELT	137	14	.	.	Fresh Dead
RAINBOW SMELT	114	8	.	.	Fresh Dead
RAINBOW SMELT	106	7	.	.	Fresh Dead
RAINBOW SMELT	113	8	.	.	Fresh Dead
RAINBOW SMELT	134	11	.	.	Fresh Dead
RAINBOW SMELT	87	3	.	.	Fresh Dead
RAINBOW SMELT	97	5	.	.	Fresh Dead
RAINBOW SMELT	119	9	.	.	Fresh Dead
RAINBOW SMELT	157	19	.	.	Fresh Dead
RAINBOW SMELT	118	9	.	.	Fresh Dead
RAINBOW SMELT	83	3	.	.	Fresh Dead
RAINBOW SMELT	91	4	.	.	Fresh Dead
RAINBOW SMELT	85	3	.	.	Fresh Dead
RAINBOW SMELT	141	14	.	.	Fresh Dead
RAINBOW SMELT	93	4	.	.	Fresh Dead
RAINBOW SMELT	104	5	.	.	Fresh Dead
RAINBOW SMELT	122	9	.	.	Fresh Dead
RAINBOW SMELT	110	6	.	.	Fresh Dead
RAINBOW SMELT	81	2	.	.	Fresh Dead
RAINBOW SMELT	76	2	.	.	Fresh Dead
RAINBOW SMELT	85	3	.	.	Fresh Dead
RAINBOW SMELT	96	4	.	.	Fresh Dead
RAINBOW SMELT	85	3	.	.	Fresh Dead
RAINBOW SMELT	87	3	.	.	Fresh Dead
RAINBOW SMELT	86	3	.	.	Fresh Dead
RAINBOW SMELT	95	4	.	.	Fresh Dead
RAINBOW SMELT	80	2	.	.	Fresh Dead
RAINBOW SMELT	80	2	.	.	Fresh Dead
RAINBOW SMELT	86	3	.	.	Fresh Dead
RAINBOW SMELT	140	14	.	.	Fresh Dead
RAINBOW SMELT	153	19	.	.	Fresh Dead
RAINBOW SMELT	128	10	.	.	Fresh Dead
RAINBOW SMELT	132	11	.	.	Fresh Dead
RAINBOW SMELT	104	5	.	.	Fresh Dead
RAINBOW SMELT	115	8	.	.	Fresh Dead
RAINBOW SMELT	113	7	.	.	Fresh Dead
RAINBOW SMELT	.	.	140	850	Fresh Dead
RAINBOW SMELT	.	.	123	800	Fresh Dead
RAINBOW SMELT	.	.	131	850	Fresh Dead
RAINBOW SMELT	.	.	308	2000	Fresh Dead
RAINBOW SMELT	.	.	15	180	Fresh Dead
RAINBOW SMELT	39	1	.	.	Fresh Dead
RAINBOW SMELT	37	1	.	.	Fresh Dead
RAINBOW SMELT	50	1	.	.	Fresh Dead
RAINBOW SMELT	42	1	.	.	Fresh Dead
RAINBOW SMELT	41	1	.	.	Fresh Dead
RAINBOW SMELT	41	1	.	.	Fresh Dead
RAINBOW SMELT	45	1	.	.	Fresh Dead
RAINBOW SMELT	42	1	.	.	Fresh Dead
RAINBOW SMELT	38	1	.	.	Fresh Dead
RAINBOW SMELT	42	1	.	.	Fresh Dead
RAINBOW SMELT	45	1	.	.	Fresh Dead
RAINBOW SMELT	34	1	.	.	Fresh Dead
RAINBOW SMELT	30	1	.	.	Fresh Dead
RAINBOW SMELT	41	1	.	.	Fresh Dead
RAINBOW SMELT	36	1	.	.	Fresh Dead
RAINBOW SMELT	45	1	.	.	Fresh Dead
RAINBOW SMELT	42	1	.	.	Fresh Dead
RAINBOW SMELT	42	1	.	.	Fresh Dead
RAINBOW SMELT	34	1	.	.	Fresh Dead
RAINBOW SMELT	37	1	.	.	Fresh Dead
RAINBOW SMELT	37	1	.	.	Fresh Dead
RAINBOW SMELT	44	1	.	.	Fresh Dead
RAINBOW SMELT	37	1	.	.	Fresh Dead
RAINBOW SMELT	35	1	.	.	Fresh Dead
RAINBOW SMELT	37	1	.	.	Fresh Dead
RAINBOW SMELT	41	1	.	.	Fresh Dead
RAINBOW SMELT	37	1	.	.	Fresh Dead
RAINBOW SMELT	30	1	.	.	Fresh Dead
SPOTTAIL SHINER	93	6	.	.	Fresh Dead
SPOTTAIL SHINER	86	5	.	.	Fresh Dead
SPOTTAIL SHINER	104	10	.	.	Fresh Dead
SPOTTAIL SHINER	92	7	.	.	Fresh Dead
SPOTTAIL SHINER	79	4	.	.	Fresh Dead
SPOTTAIL SHINER	73	4	.	.	Fresh Dead
SPOTTAIL SHINER	94	7	.	.	Fresh Dead
SPOTTAIL SHINER	95	6	.	.	Fresh Dead
SPOTTAIL SHINER	94	7	.	.	Fresh Dead
SPOTTAIL SHINER	81	4	.	.	Fresh Dead
SPOTTAIL SHINER	95	7	.	.	Fresh Dead
SPOTTAIL SHINER	71	3	.	.	Fresh Dead
SPOTTAIL SHINER	96	7	.	.	Fresh Dead
SPOTTAIL SHINER	92	6	.	.	Fresh Dead
SPOTTAIL SHINER	100	7	.	.	Fresh Dead

SPOTTAIL SHINER	85	5	.	.	Fresh Dead
SPOTTAIL SHINER	77	4	.	.	Fresh Dead
SPOTTAIL SHINER	85	4	.	.	Fresh Dead
SPOTTAIL SHINER	93	5	.	.	Fresh Dead
SPOTTAIL SHINER	78	4	.	.	Fresh Dead
SPOTTAIL SHINER	93	6	.	.	Fresh Dead
SPOTTAIL SHINER	82	4	.	.	Fresh Dead
SPOTTAIL SHINER	.	.	1	4	Fresh Dead
SPOTTAIL SHINER	103	10	.	.	Fresh Dead
SPOTTAIL SHINER	79	5	.	.	Fresh Dead
SPOTTAIL SHINER	97	7	.	.	Fresh Dead
SPOTTAIL SHINER	102	9	.	.	Fresh Dead
SPOTTAIL SHINER	88	5	.	.	Fresh Dead
SPOTTAIL SHINER	100	9	.	.	Fresh Dead
SPOTTAIL SHINER	89	6	.	.	Fresh Dead
SPOTTAIL SHINER	86	5	.	.	Fresh Dead
SPOTTAIL SHINER	89	6	.	.	Fresh Dead
SPOTTAIL SHINER	86	5	.	.	Fresh Dead
SPOTTAIL SHINER	99	8	.	.	Fresh Dead
SPOTTAIL SHINER	77	3	.	.	Fresh Dead
SPOTTAIL SHINER	81	5	.	.	Fresh Dead
SPOTTAIL SHINER	83	5	.	.	Fresh Dead
SPOTTAIL SHINER	98	6	.	.	Fresh Dead
SPOTTAIL SHINER	87	6	.	.	Fresh Dead
SPOTTAIL SHINER	90	5	.	.	Fresh Dead
SPOTTAIL SHINER	95	7	.	.	Fresh Dead
SPOTTAIL SHINER	72	3	.	.	Fresh Dead
SPOTTAIL SHINER	66	3	.	.	Fresh Dead
SPOTTAIL SHINER	77	5	.	.	Fresh Dead
SPOTTAIL SHINER	81	4	.	.	Fresh Dead
SPOTTAIL SHINER	85	5	.	.	Fresh Dead
SPOTTAIL SHINER	77	3	.	.	Fresh Dead
SPOTTAIL SHINER	84	5	.	.	Fresh Dead
SPOTTAIL SHINER	93	6	.	.	Fresh Dead
SPOTTAIL SHINER	102	10	.	.	Fresh Dead
SPOTTAIL SHINER	92	6	.	.	Fresh Dead
SPOTTAIL SHINER	85	5	.	.	Fresh Dead
SPOTTAIL SHINER	95	7	.	.	Fresh Dead
SPOTTAIL SHINER	82	4	.	.	Fresh Dead
SPOTTAIL SHINER	109	10	.	.	Fresh Dead
SPOTTAIL SHINER	.	.	43	240	Fresh Dead
SPOTTAIL SHINER	.	.	56	440	Fresh Dead
SPOTTAIL SHINER	99	7	.	.	Fresh Dead
LONGNOSE DACE	94	9	.	.	Fresh Dead
LONGNOSE SUCKER	438	1000	.	.	Fresh Dead
WHITE SUCKER	186	65	.	.	Fresh Dead
WHITE SUCKER	376	630	.	.	Fresh Dead
YELLOW PERCH	135	26	.	.	Fresh Dead
YELLOW PERCH	80	5	.	.	Fresh Dead
YELLOW PERCH	70	3	.	.	Fresh Dead
YELLOW PERCH	71	3	.	.	Fresh Dead
YELLOW PERCH	75	4	.	.	Fresh Dead
YELLOW PERCH	67	2	.	.	Fresh Dead
YELLOW PERCH	96	9	.	.	Fresh Dead
YELLOW PERCH	127	22	.	.	Fresh Dead
YELLOW PERCH	70	3	.	.	Fresh Dead
YELLOW PERCH	71	3	.	.	Fresh Dead
YELLOW PERCH	78	4	.	.	Fresh Dead
YELLOW PERCH	60	2	.	.	Fresh Dead
YELLOW PERCH	78	4	.	.	Fresh Dead
ROUND GOBY	190	101	.	.	Live
MOTTLED SCULPIN	87	9	.	.	Fresh Dead
MOTTLED SCULPIN	72	4	.	.	Fresh Dead
MOTTLED SCULPIN	90	9	.	.	Fresh Dead
MOTTLED SCULPIN	73	4	.	.	Fresh Dead
MOTTLED SCULPIN	70	4	.	.	Fresh Dead
MOTTLED SCULPIN	88	11	.	.	Fresh Dead
MOTTLED SCULPIN	76	5	.	.	Fresh Dead
MOTTLED SCULPIN	78	6	.	.	Fresh Dead
MOTTLED SCULPIN	62	3	.	.	Fresh Dead
MOTTLED SCULPIN	94	13	.	.	Fresh Dead
MOTTLED SCULPIN	88	9	.	.	Fresh Dead
MOTTLED SCULPIN	66	5	.	.	Fresh Dead
MOTTLED SCULPIN	74	7	.	.	Fresh Dead
MOTTLED SCULPIN	69	5	.	.	Fresh Dead
MOTTLED SCULPIN	83	9	.	.	Fresh Dead
MOTTLED SCULPIN	83	8	.	.	Fresh Dead
MOTTLED SCULPIN	68	4	.	.	Fresh Dead
MOTTLED SCULPIN	71	5	.	.	Fresh Dead
SLIMY SCULPIN	79	6	.	.	Fresh Dead

SAMPLING PERIOD: 09-10OCT06 START DATE AND TIME: 09OCT06:09:58 END DATE AND TIME: 10OCT06:10:10
SAMPLING DURATION (hrs.): 24.20 CW VOLUME SAMPLED (gals x 10^6): 987.3600
INTAKE TEMPERATURES (F): MINIMUM= 50.5 MEAN= 51.6 MAXIMUM= 52.4
DISCHARGE TEMPERATURES (F): MINIMUM= 69.3 MEAN= 70.7 MAXIMUM= 71.7 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 08-10OCT06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 2937.6

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
LAKE STURGEON	366	239	.	.	Fresh Dead	
ALEWIFE	.	.	288	1500	Fresh Dead	
ALEWIFE	.	.	308	1600	Fresh Dead	
ALEWIFE	.	.	462	2400	Fresh Dead	
ALEWIFE	.	.	96	500	Fresh Dead	
ALEWIFE	75	3	.	.	Fresh Dead	
ALEWIFE	92	6	.	.	Fresh Dead	
ALEWIFE	137	25	.	.	Fresh Dead	
ALEWIFE	106	10	.	.	Fresh Dead	
ALEWIFE	95	5	.	.	Fresh Dead	
ALEWIFE	158	23	.	.	Fresh Dead	
ALEWIFE	112	9	.	.	Fresh Dead	
ALEWIFE	118	11	.	.	Fresh Dead	
ALEWIFE	162	23	.	.	Fresh Dead	
ALEWIFE	111	13	.	.	Fresh Dead	
ALEWIFE	76	3	.	.	Fresh Dead	
ALEWIFE	84	4	.	.	Fresh Dead	
ALEWIFE	113	9	.	.	Fresh Dead	
ALEWIFE	126	18	.	.	Fresh Dead	
ALEWIFE	68	2	.	.	Fresh Dead	
ALEWIFE	69	2	.	.	Fresh Dead	
ALEWIFE	164	17	.	.	Fresh Dead	
ALEWIFE	94	5	.	.	Fresh Dead	
ALEWIFE	162	23	.	.	Fresh Dead	
ALEWIFE	94	6	.	.	Fresh Dead	
ALEWIFE	86	4	.	.	Fresh Dead	
ALEWIFE	87	5	.	.	Fresh Dead	
ALEWIFE	104	8	.	.	Fresh Dead	
ALEWIFE	79	3	.	.	Fresh Dead	
ALEWIFE	82	4	.	.	Fresh Dead	
ALEWIFE	90	5	.	.	Fresh Dead	
ALEWIFE	70	3	.	.	Fresh Dead	
ALEWIFE	73	3	.	.	Fresh Dead	
ALEWIFE	65	2	.	.	Fresh Dead	
ALEWIFE	75	3	.	.	Fresh Dead	
ALEWIFE	77	3	.	.	Fresh Dead	
ALEWIFE	80	4	.	.	Fresh Dead	
ALEWIFE	75	3	.	.	Fresh Dead	
ALEWIFE	58	2	.	.	Fresh Dead	
ALEWIFE	71	2	.	.	Fresh Dead	
ALEWIFE	74	3	.	.	Fresh Dead	
ALEWIFE	77	3	.	.	Fresh Dead	
ALEWIFE	73	3	.	.	Fresh Dead	
ALEWIFE	68	2	.	.	Fresh Dead	
ALEWIFE	63	2	.	.	Fresh Dead	
ALEWIFE	68	2	.	.	Fresh Dead	
ALEWIFE	75	3	.	.	Fresh Dead	
ALEWIFE	70	2	.	.	Fresh Dead	
ALEWIFE	72	3	.	.	Fresh Dead	
ALEWIFE	67	2	.	.	Fresh Dead	
ALEWIFE	69	2	.	.	Fresh Dead	
ALEWIFE	65	2	.	.	Fresh Dead	
ALEWIFE	70	2	.	.	Fresh Dead	
ALEWIFE	75	3	.	.	Fresh Dead	
ALEWIFE	67	2	.	.	Fresh Dead	
ALEWIFE	.	.	100	470	Fresh Dead	
ALEWIFE	.	.	712	3700	Fresh Dead	
GIZZARD SHAD	134	24	.	.	Fresh Dead	
GIZZARD SHAD	108	11	.	.	Fresh Dead	
GIZZARD SHAD	87	5	.	.	Fresh Dead	
GIZZARD SHAD	76	4	.	.	Fresh Dead	
GIZZARD SHAD	120	5	.	.	Fresh Dead	
GIZZARD SHAD	87	6	.	.	Fresh Dead	
GIZZARD SHAD	78	4	.	.	Fresh Dead	
GIZZARD SHAD	83	5	.	.	Fresh Dead	
GIZZARD SHAD	96	7	.	.	Fresh Dead	
GIZZARD SHAD	71	3	.	.	Fresh Dead	
GIZZARD SHAD	90	6	.	.	Fresh Dead	
GIZZARD SHAD	87	5	.	.	Fresh Dead	
GIZZARD SHAD	98	8	.	.	Fresh Dead	
LAKE WHITEFISH	236	97	.	.	Fresh Dead	
LAKE WHITEFISH	105	8	.	.	Fresh Dead	
ROUND WHITEFISH	445	800	.	.	Fresh Dead	
ROUND WHITEFISH	329	265	.	.	Fresh Dead	
ROUND WHITEFISH	208	60	.	.	Fresh Dead	
LAKE TROUT	739	3800	.	.	Fresh Dead	
RAINBOW SMELT	.	.	177	1100	Fresh Dead	
RAINBOW SMELT	.	.	226	1400	Fresh Dead	
RAINBOW SMELT	.	.	331	2050	Fresh Dead	
RAINBOW SMELT	.	.	73	450	Fresh Dead	
RAINBOW SMELT	149	16	.	.	Fresh Dead	
RAINBOW SMELT	169	25	.	.	Fresh Dead	
RAINBOW SMELT	129	10	.	.	Fresh Dead	
RAINBOW SMELT	161	22	.	.	Fresh Dead	
RAINBOW SMELT	139	14	.	.	Fresh Dead	
RAINBOW SMELT	136	11	.	.	Fresh Dead	
RAINBOW SMELT	133	11	.	.	Fresh Dead	

RAINBOW SMELT	142	14	.	.	Fresh Dead
RAINBOW SMELT	118	8	.	.	Fresh Dead
RAINBOW SMELT	142	17	.	.	Fresh Dead
RAINBOW SMELT	124	10	.	.	Fresh Dead
RAINBOW SMELT	130	10	.	.	Fresh Dead
RAINBOW SMELT	109	6	.	.	Fresh Dead
RAINBOW SMELT	90	4	.	.	Fresh Dead
RAINBOW SMELT	128	11	.	.	Fresh Dead
RAINBOW SMELT	114	7	.	.	Fresh Dead
RAINBOW SMELT	127	8	.	.	Fresh Dead
RAINBOW SMELT	121	8	.	.	Fresh Dead
RAINBOW SMELT	120	8	.	.	Fresh Dead
RAINBOW SMELT	133	11	.	.	Fresh Dead
RAINBOW SMELT	119	7	.	.	Fresh Dead
RAINBOW SMELT	120	7	.	.	Fresh Dead
RAINBOW SMELT	115	7	.	.	Fresh Dead
RAINBOW SMELT	130	11	.	.	Fresh Dead
RAINBOW SMELT	117	7	.	.	Fresh Dead
RAINBOW SMELT	145	18	.	.	Fresh Dead
RAINBOW SMELT	130	8	.	.	Fresh Dead
RAINBOW SMELT	102	6	.	.	Fresh Dead
RAINBOW SMELT	109	6	.	.	Fresh Dead
RAINBOW SMELT	99	5	.	.	Fresh Dead
RAINBOW SMELT	92	3	.	.	Fresh Dead
RAINBOW SMELT	120	8	.	.	Fresh Dead
RAINBOW SMELT	89	3	.	.	Fresh Dead
RAINBOW SMELT	125	10	.	.	Fresh Dead
RAINBOW SMELT	92	3	.	.	Fresh Dead
RAINBOW SMELT	119	8	.	.	Fresh Dead
RAINBOW SMELT	118	6	.	.	Fresh Dead
RAINBOW SMELT	124	8	.	.	Fresh Dead
RAINBOW SMELT	97	4	.	.	Fresh Dead
RAINBOW SMELT	97	4	.	.	Fresh Dead
RAINBOW SMELT	90	3	.	.	Fresh Dead
RAINBOW SMELT	92	3	.	.	Fresh Dead
RAINBOW SMELT	111	6	.	.	Fresh Dead
RAINBOW SMELT	87	3	.	.	Fresh Dead
RAINBOW SMELT	81	2	.	.	Fresh Dead
RAINBOW SMELT	88	3	.	.	Fresh Dead
RAINBOW SMELT	99	5	.	.	Fresh Dead
RAINBOW SMELT	96	5	.	.	Fresh Dead
RAINBOW SMELT	88	3	.	.	Fresh Dead
RAINBOW SMELT	82	3	.	.	Fresh Dead
RAINBOW SMELT	.	.	100	520	Fresh Dead
RAINBOW SMELT	.	.	444	2750	Fresh Dead
SPOTTAIL SHINER	91	8	.	.	Fresh Dead
SPOTTAIL SHINER	92	7	.	.	Fresh Dead
SPOTTAIL SHINER	97	7	.	.	Fresh Dead
SPOTTAIL SHINER	108	9	.	.	Fresh Dead
SPOTTAIL SHINER	94	7	.	.	Fresh Dead
SPOTTAIL SHINER	76	3	.	.	Fresh Dead
SPOTTAIL SHINER	78	4	.	.	Fresh Dead
SPOTTAIL SHINER	97	7	.	.	Fresh Dead
SPOTTAIL SHINER	72	3	.	.	Fresh Dead
SPOTTAIL SHINER	84	5	.	.	Fresh Dead
SPOTTAIL SHINER	88	6	.	.	Fresh Dead
SPOTTAIL SHINER	95	7	.	.	Fresh Dead
SPOTTAIL SHINER	97	7	.	.	Fresh Dead
SPOTTAIL SHINER	86	5	.	.	Fresh Dead
SPOTTAIL SHINER	85	6	.	.	Fresh Dead
SPOTTAIL SHINER	104	10	.	.	Fresh Dead
SPOTTAIL SHINER	77	4	.	.	Fresh Dead
SPOTTAIL SHINER	84	6	.	.	Fresh Dead
SPOTTAIL SHINER	98	7	.	.	Fresh Dead
SPOTTAIL SHINER	89	6	.	.	Fresh Dead
SPOTTAIL SHINER	79	4	.	.	Fresh Dead
SPOTTAIL SHINER	103	10	.	.	Fresh Dead
SPOTTAIL SHINER	88	6	.	.	Fresh Dead
SPOTTAIL SHINER	90	6	.	.	Fresh Dead
SPOTTAIL SHINER	87	5	.	.	Fresh Dead
SPOTTAIL SHINER	94	7	.	.	Fresh Dead
SPOTTAIL SHINER	80	5	.	.	Fresh Dead
SPOTTAIL SHINER	90	6	.	.	Fresh Dead
SPOTTAIL SHINER	70	3	.	.	Fresh Dead
SPOTTAIL SHINER	96	7	.	.	Fresh Dead
SPOTTAIL SHINER	86	5	.	.	Fresh Dead
SPOTTAIL SHINER	81	4	.	.	Fresh Dead
SPOTTAIL SHINER	80	5	.	.	Fresh Dead
SPOTTAIL SHINER	93	5	.	.	Fresh Dead
SPOTTAIL SHINER	80	4	.	.	Fresh Dead
SPOTTAIL SHINER	87	5	.	.	Fresh Dead
SPOTTAIL SHINER	101	9	.	.	Fresh Dead
SPOTTAIL SHINER	90	6	.	.	Fresh Dead
SPOTTAIL SHINER	88	5	.	.	Fresh Dead
SPOTTAIL SHINER	77	4	.	.	Fresh Dead
SPOTTAIL SHINER	89	5	.	.	Fresh Dead
SPOTTAIL SHINER	93	7	.	.	Fresh Dead
SPOTTAIL SHINER	80	5	.	.	Fresh Dead
SPOTTAIL SHINER	108	8	.	.	Fresh Dead
SPOTTAIL SHINER	89	4	.	.	Fresh Dead

SPOTTAIL SHINER	98	8	.	.	Fresh Dead
SPOTTAIL SHINER	81	4	.	.	Fresh Dead
SPOTTAIL SHINER	83	5	.	.	Fresh Dead
SPOTTAIL SHINER	68	3	.	.	Fresh Dead
SPOTTAIL SHINER	74	3	.	.	Fresh Dead
SPOTTAIL SHINER	.	.	60	300	Fresh Dead
SPOTTAIL SHINER	.	.	51	300	Fresh Dead
SPOTTAIL SHINER	.	.	3	19	Fresh Dead
FATHEAD MINNOW	72	5	.	.	Fresh Dead
LONGNOSE DACE	103	11	.	.	Fresh Dead
WHITE SUCKER	450	1100	.	.	Fresh Dead
WHITE SUCKER	449	1080	.	.	Fresh Dead
WHITE SUCKER	247	148	.	.	Fresh Dead
CHANNEL CATFISH	67	3	.	.	Live
BURBOT	201	54	.	.	Fresh Dead
WHITE PERCH	100	14	.	.	Fresh Dead
YELLOW PERCH	149	34	.	.	Fresh Dead
YELLOW PERCH	129	21	.	.	Fresh Dead
YELLOW PERCH	72	3	.	.	Fresh Dead
YELLOW PERCH	86	6	.	.	Fresh Dead
YELLOW PERCH	74	4	.	.	Fresh Dead
YELLOW PERCH	81	5	.	.	Fresh Dead
YELLOW PERCH	68	3	.	.	Fresh Dead
YELLOW PERCH	81	5	.	.	Fresh Dead
YELLOW PERCH	79	4	.	.	Fresh Dead
YELLOW PERCH	79	3	.	.	Fresh Dead
YELLOW PERCH	72	4	.	.	Fresh Dead
YELLOW PERCH	71	3	.	.	Fresh Dead
YELLOW PERCH	78	4	.	.	Fresh Dead
YELLOW PERCH	69	3	.	.	Fresh Dead
YELLOW PERCH	82	5	.	.	Fresh Dead
YELLOW PERCH	78	5	.	.	Fresh Dead
YELLOW PERCH	82	5	.	.	Fresh Dead
YELLOW PERCH	64	2	.	.	Fresh Dead
YELLOW PERCH	65	3	.	.	Fresh Dead
YELLOW PERCH	86	5	.	.	Fresh Dead
YELLOW PERCH	80	4	.	.	Fresh Dead
YELLOW PERCH	69	3	.	.	Fresh Dead
YELLOW PERCH	77	4	.	.	Fresh Dead
YELLOW PERCH	66	3	.	.	Fresh Dead
YELLOW PERCH	75	4	.	.	Fresh Dead
YELLOW PERCH	115	14	.	.	Fresh Dead
YELLOW PERCH	80	4	.	.	Fresh Dead
YELLOW PERCH	80	5	.	.	Fresh Dead
YELLOW PERCH	74	4	.	.	Fresh Dead
YELLOW PERCH	78	5	.	.	Fresh Dead
YELLOW PERCH	245	185	.	.	Live
YELLOW PERCH	128	21	.	.	Fresh Dead
YELLOW PERCH	87	6	.	.	Fresh Dead
YELLOW PERCH	74	3	.	.	Fresh Dead
YELLOW PERCH	67	3	.	.	Fresh Dead
YELLOW PERCH	69	3	.	.	Fresh Dead
YELLOW PERCH	78	4	.	.	Fresh Dead
YELLOW PERCH	90	6	.	.	Fresh Dead
YELLOW PERCH	85	5	.	.	Fresh Dead
YELLOW PERCH	111	13	.	.	Fresh Dead
YELLOW PERCH	64	3	.	.	Fresh Dead
YELLOW PERCH	68	3	.	.	Fresh Dead
YELLOW PERCH	75	4	.	.	Fresh Dead
YELLOW PERCH	65	3	.	.	Fresh Dead
YELLOW PERCH	67	3	.	.	Fresh Dead
YELLOW PERCH	84	5	.	.	Fresh Dead
YELLOW PERCH	75	4	.	.	Fresh Dead
YELLOW PERCH	80	5	.	.	Fresh Dead
YELLOW PERCH	66	3	.	.	Fresh Dead
YELLOW PERCH	73	3	.	.	Fresh Dead
YELLOW PERCH	80	4	.	.	Fresh Dead
YELLOW PERCH	141	26	.	.	Fresh Dead
YELLOW PERCH	.	.	2	6	Fresh Dead
YELLOW PERCH	82	4	.	.	Fresh Dead
YELLOW PERCH	79	4	.	.	Fresh Dead
FRESHWATER DRUM	472	1550	.	.	Fresh Dead
ROUND GOBY	133	38	.	.	Fresh Dead
MOTTLED SCULPIN	67	5	.	.	Fresh Dead
MOTTLED SCULPIN	78	6	.	.	Fresh Dead
MOTTLED SCULPIN	77	5	.	.	Fresh Dead
MOTTLED SCULPIN	65	4	.	.	Fresh Dead
MOTTLED SCULPIN	79	6	.	.	Fresh Dead
MOTTLED SCULPIN	67	4	.	.	Fresh Dead
MOTTLED SCULPIN	74	5	.	.	Fresh Dead
MOTTLED SCULPIN	78	7	.	.	Fresh Dead
MOTTLED SCULPIN	72	4	.	.	Fresh Dead
MOTTLED SCULPIN	70	5	.	.	Fresh Dead
MOTTLED SCULPIN	83	6	.	.	Fresh Dead
MOTTLED SCULPIN	75	5	.	.	Fresh Dead
MOTTLED SCULPIN	68	4	.	.	Fresh Dead
MOTTLED SCULPIN	74	5	.	.	Fresh Dead
MOTTLED SCULPIN	66	4	.	.	Fresh Dead
MOTTLED SCULPIN	80	8	.	.	Fresh Dead
MOTTLED SCULPIN	72	5	.	.	Fresh Dead

MOTTLED SCULPIN	73	4	.	.	Fresh Dead
MOTTLED SCULPIN	61	4	.	.	Fresh Dead
MOTTLED SCULPIN	65	6	.	.	Fresh Dead
MOTTLED SCULPIN	61	3	.	.	Fresh Dead
MOTTLED SCULPIN	63	3	.	.	Fresh Dead

SAMPLING PERIOD: 11-12OCT06 START DATE AND TIME: 11OCT06:10:00 END DATE AND TIME: 12OCT06:10:00
SAMPLING DURATION (hrs.): 24.00 CW VOLUME SAMPLED (gals x 10^6): 979.2000
INTAKE TEMPERATURES (F): MINIMUM= 50.4 MEAN= 52.0 MAXIMUM= 54.6
DISCHARGE TEMPERATURES (F): MINIMUM= 69.4 MEAN= 71.2 MAXIMUM= 73.8 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 11-14OCT06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 3916.8

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
ALEWIFE	182	54	.	.	Fresh Dead	
ALEWIFE	181	50	.	.	Fresh Dead	
ALEWIFE	136	24	.	.	Fresh Dead	
ALEWIFE	120	16	.	.	Fresh Dead	
ALEWIFE	91	5	.	.	Fresh Dead	
ALEWIFE	71	3	.	.	Fresh Dead	
ALEWIFE	74	3	.	.	Fresh Dead	
ALEWIFE	75	3	.	.	Fresh Dead	
ALEWIFE	78	4	.	.	Fresh Dead	
ALEWIFE	79	3	.	.	Fresh Dead	
ALEWIFE	78	3	.	.	Fresh Dead	
ALEWIFE	72	2	.	.	Fresh Dead	
ALEWIFE	67	2	.	.	Fresh Dead	
ALEWIFE	180	50	.	.	Fresh Dead	
ALEWIFE	167	45	.	.	Fresh Dead	
ALEWIFE	164	42	.	.	Fresh Dead	
ALEWIFE	168	50	.	.	Fresh Dead	
ALEWIFE	165	47	.	.	Fresh Dead	
ALEWIFE	155	39	.	.	Fresh Dead	
ALEWIFE	135	24	.	.	Fresh Dead	
ALEWIFE	123	15	.	.	Fresh Dead	
ALEWIFE	108	11	.	.	Fresh Dead	
ALEWIFE	108	9	.	.	Fresh Dead	
ALEWIFE	117	12	.	.	Fresh Dead	
ALEWIFE	111	11	.	.	Fresh Dead	
ALEWIFE	106	10	.	.	Fresh Dead	
ALEWIFE	90	5	.	.	Fresh Dead	
ALEWIFE	88	5	.	.	Fresh Dead	
ALEWIFE	77	4	.	.	Fresh Dead	
ALEWIFE	79	3	.	.	Fresh Dead	
ALEWIFE	83	4	.	.	Fresh Dead	
ALEWIFE	79	3	.	.	Fresh Dead	
ALEWIFE	75	3	.	.	Fresh Dead	
ALEWIFE	73	3	.	.	Fresh Dead	
ALEWIFE	74	3	.	.	Fresh Dead	
ALEWIFE	75	3	.	.	Fresh Dead	
ALEWIFE	62	2	.	.	Fresh Dead	
ALEWIFE	88	5	.	.	Fresh Dead	
ALEWIFE	70	3	.	.	Fresh Dead	
ALEWIFE	68	2	.	.	Fresh Dead	
ALEWIFE	70	2	.	.	Fresh Dead	
ALEWIFE	68	2	.	.	Fresh Dead	
ALEWIFE	68	2	.	.	Fresh Dead	
ALEWIFE	79	4	.	.	Fresh Dead	
ALEWIFE	72	2	.	.	Fresh Dead	
ALEWIFE	81	3	.	.	Fresh Dead	
ALEWIFE	75	3	.	.	Fresh Dead	
ALEWIFE	77	3	.	.	Fresh Dead	
ALEWIFE	84	4	.	.	Fresh Dead	
ALEWIFE	76	3	.	.	Fresh Dead	
ALEWIFE	62	2	.	.	Fresh Dead	
ALEWIFE	74	3	.	.	Fresh Dead	
ALEWIFE	.	.	73	800	Fresh Dead	
ALEWIFE	.	.	82	600	Fresh Dead	
GIZZARD SHAD	78	4	.	.	Fresh Dead	
RAINBOW SMELT	103	6	.	.	Fresh Dead	
RAINBOW SMELT	106	6	.	.	Fresh Dead	
RAINBOW SMELT	137	14	.	.	Fresh Dead	
RAINBOW SMELT	127	11	.	.	Fresh Dead	
RAINBOW SMELT	136	13	.	.	Fresh Dead	
RAINBOW SMELT	94	5	.	.	Fresh Dead	
RAINBOW SMELT	90	4	.	.	Fresh Dead	
RAINBOW SMELT	88	3	.	.	Fresh Dead	
RAINBOW SMELT	107	6	.	.	Fresh Dead	
RAINBOW SMELT	91	4	.	.	Fresh Dead	
RAINBOW SMELT	104	6	.	.	Fresh Dead	
RAINBOW SMELT	100	5	.	.	Fresh Dead	
RAINBOW SMELT	107	5	.	.	Fresh Dead	
RAINBOW SMELT	167	22	.	.	Fresh Dead	
RAINBOW SMELT	95	4	.	.	Fresh Dead	
RAINBOW SMELT	130	11	.	.	Fresh Dead	
RAINBOW SMELT	132	12	.	.	Fresh Dead	
RAINBOW SMELT	100	5	.	.	Fresh Dead	
RAINBOW SMELT	126	11	.	.	Fresh Dead	

RAINBOW SMELT	106	6	.	.	Fresh Dead
RAINBOW SMELT	133	11	.	.	Fresh Dead
RAINBOW SMELT	124	10	.	.	Fresh Dead
RAINBOW SMELT	129	10	.	.	Fresh Dead
RAINBOW SMELT	104	6	.	.	Fresh Dead
RAINBOW SMELT	100	5	.	.	Fresh Dead
RAINBOW SMELT	99	5	.	.	Fresh Dead
RAINBOW SMELT	115	8	.	.	Fresh Dead
RAINBOW SMELT	95	4	.	.	Fresh Dead
RAINBOW SMELT	88	4	.	.	Fresh Dead
RAINBOW SMELT	89	3	.	.	Fresh Dead
RAINBOW SMELT	87	3	.	.	Fresh Dead
RAINBOW SMELT	159	18	.	.	Fresh Dead
RAINBOW SMELT	137	12	.	.	Fresh Dead
RAINBOW SMELT	84	3	.	.	Fresh Dead
RAINBOW SMELT	122	10	.	.	Fresh Dead
RAINBOW SMELT	102	5	.	.	Fresh Dead
RAINBOW SMELT	95	4	.	.	Fresh Dead
RAINBOW SMELT	93	3	.	.	Fresh Dead
RAINBOW SMELT	87	4	.	.	Fresh Dead
LONGNOSE SUCKER	298	286	.	.	Fresh Dead
WHITE SUCKER	454	1000	.	.	Live
WHITE SUCKER	383	800	.	.	Fresh Dead
WHITE SUCKER	432	950	.	.	Live
WHITE SUCKER	511	1300	.	.	Live
WHITE SUCKER	239	130	.	.	Live
BLACK BULLHEAD	264	313	.	.	Fresh Dead
BURBOT	228	61	.	.	Live
BURBOT	397	500	.	.	Fresh Dead
YELLOW PERCH	140	29	.	.	Fresh Dead
YELLOW PERCH	133	23	.	.	Fresh Dead
YELLOW PERCH	82	5	.	.	Fresh Dead
YELLOW PERCH	73	3	.	.	Fresh Dead
YELLOW PERCH	75	4	.	.	Fresh Dead
MOTTLED SCULPIN	72	5	.	.	Fresh Dead

SAMPLING PERIOD: 16-17OCT06 START DATE AND TIME: 16OCT06:10:13 END DATE AND TIME: 17OCT06:10:07
SAMPLING DURATION (hrs.): 23.90 CW VOLUME SAMPLED (gals x 10^6): 615.4728
INTAKE TEMPERATURES (F): MINIMUM= 44.6 MEAN= 46.1 MAXIMUM= 48.0
DISCHARGE TEMPERATURES (F): MINIMUM= 44.9 MEAN= 55.9 MAXIMUM= 65.7 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 15-17OCT06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 1998.0

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GREAT LAKES CRAYFISH	50	4	.	.	Fresh Dead	
ALEWIFE	143	30	.	.	Fresh Dead	
ALEWIFE	108	11	.	.	Fresh Dead	
ALEWIFE	134	16	.	.	Fresh Dead	
ALEWIFE	111	9	.	.	Fresh Dead	
ALEWIFE	69	2	.	.	Fresh Dead	
ALEWIFE	85	4	.	.	Fresh Dead	
ALEWIFE	89	5	.	.	Fresh Dead	
ALEWIFE	85	5	.	.	Fresh Dead	
ALEWIFE	138	17	.	.	Fresh Dead	
ALEWIFE	73	3	.	.	Fresh Dead	
ALEWIFE	106	10	.	.	Fresh Dead	
ALEWIFE	92	6	.	.	Fresh Dead	
ALEWIFE	95	6	.	.	Fresh Dead	
ALEWIFE	80	4	.	.	Fresh Dead	
ALEWIFE	84	5	.	.	Fresh Dead	
ALEWIFE	100	7	.	.	Fresh Dead	
ALEWIFE	96	6	.	.	Fresh Dead	
ALEWIFE	83	4	.	.	Fresh Dead	
ALEWIFE	92	5	.	.	Fresh Dead	
ALEWIFE	99	7	.	.	Fresh Dead	
ALEWIFE	71	2	.	.	Fresh Dead	
ALEWIFE	97	6	.	.	Fresh Dead	
ALEWIFE	80	4	.	.	Fresh Dead	
ALEWIFE	84	4	.	.	Fresh Dead	
ALEWIFE	68	2	.	.	Fresh Dead	
ALEWIFE	84	4	.	.	Fresh Dead	
ALEWIFE	81	3	.	.	Fresh Dead	
ALEWIFE	79	3	.	.	Fresh Dead	
ALEWIFE	71	3	.	.	Fresh Dead	
ALEWIFE	76	3	.	.	Fresh Dead	
ALEWIFE	97	6	.	.	Fresh Dead	
ALEWIFE	107	8	.	.	Fresh Dead	
ALEWIFE	100	7	.	.	Fresh Dead	
ALEWIFE	67	2	.	.	Fresh Dead	
ALEWIFE	86	4	.	.	Fresh Dead	
ALEWIFE	103	8	.	.	Fresh Dead	
ALEWIFE	80	4	.	.	Fresh Dead	
ALEWIFE	85	5	.	.	Fresh Dead	
ALEWIFE	99	7	.	.	Fresh Dead	
ALEWIFE	100	7	.	.	Fresh Dead	
ALEWIFE	72	2	.	.	Fresh Dead	
ALEWIFE	77	4	.	.	Fresh Dead	
ALEWIFE	79	4	.	.	Fresh Dead	

ALEWIFE	70	3	.	.	Fresh Dead
ALEWIFE	78	3	.	.	Fresh Dead
ALEWIFE	85	5	.	.	Fresh Dead
ALEWIFE	110	10	.	.	Fresh Dead
ALEWIFE	84	4	.	.	Fresh Dead
ALEWIFE	69	3	.	.	Fresh Dead
ALEWIFE	77	3	.	.	Fresh Dead
ALEWIFE	.	.	100	600	Fresh Dead
ALEWIFE	.	.	419	2850	Fresh Dead
ALEWIFE	.	.	669	4550	Fresh Dead
ALEWIFE	.	.	956	6500	Fresh Dead
ALEWIFE	.	.	338	2300	Fresh Dead
GIZZARD SHAD	107	10	.	.	Fresh Dead
GIZZARD SHAD	103	10	.	.	Fresh Dead
GIZZARD SHAD	75	3	.	.	Fresh Dead
GIZZARD SHAD	65	3	.	.	Fresh Dead
GIZZARD SHAD	70	3	.	.	Fresh Dead
GIZZARD SHAD	80	5	.	.	Fresh Dead
GIZZARD SHAD	81	5	.	.	Fresh Dead
GIZZARD SHAD	89	7	.	.	Fresh Dead
GIZZARD SHAD	75	4	.	.	Fresh Dead
GIZZARD SHAD	66	2	.	.	Fresh Dead
GIZZARD SHAD	84	5	.	.	Fresh Dead
GIZZARD SHAD	71	3	.	.	Fresh Dead
GIZZARD SHAD	97	8	.	.	Fresh Dead
GIZZARD SHAD	75	4	.	.	Fresh Dead
GIZZARD SHAD	88	6	.	.	Fresh Dead
GIZZARD SHAD	61	2	.	.	Fresh Dead
GIZZARD SHAD	71	3	.	.	Fresh Dead
GIZZARD SHAD	75	3	.	.	Fresh Dead
GIZZARD SHAD	60	2	.	.	Fresh Dead
GIZZARD SHAD	65	2	.	.	Fresh Dead
GIZZARD SHAD	80	5	.	.	Fresh Dead
GIZZARD SHAD	96	9	.	.	Fresh Dead
GIZZARD SHAD	94	7	.	.	Fresh Dead
GIZZARD SHAD	82	5	.	.	Fresh Dead
GIZZARD SHAD	84	5	.	.	Fresh Dead
GIZZARD SHAD	73	3	.	.	Fresh Dead
GIZZARD SHAD	68	3	.	.	Fresh Dead
LAKE WHITEFISH	176	34	.	.	Fresh Dead
BLOATER	88	5	.	.	Fresh Dead
BLOATER	92	5	.	.	Fresh Dead
BLOATER	97	5	.	.	Fresh Dead
BLOATER	91	4	.	.	Fresh Dead
BLOATER	103	7	.	.	Fresh Dead
BLOATER	75	3	.	.	Fresh Dead
BLOATER	98	6	.	.	Fresh Dead
BLOATER	85	4	.	.	Fresh Dead
BLOATER	79	3	.	.	Fresh Dead
BLOATER	80	4	.	.	Fresh Dead
BLOATER	87	4	.	.	Fresh Dead
BLOATER	66	2	.	.	Fresh Dead
BLOATER	86	4	.	.	Fresh Dead
RAINBOW SMELT	144	13	.	.	Fresh Dead
RAINBOW SMELT	123	9	.	.	Fresh Dead
RAINBOW SMELT	131	11	.	.	Fresh Dead
RAINBOW SMELT	114	8	.	.	Fresh Dead
RAINBOW SMELT	127	9	.	.	Fresh Dead
RAINBOW SMELT	129	10	.	.	Fresh Dead
RAINBOW SMELT	130	10	.	.	Fresh Dead
RAINBOW SMELT	136	13	.	.	Fresh Dead
RAINBOW SMELT	91	4	.	.	Fresh Dead
RAINBOW SMELT	91	4	.	.	Fresh Dead
RAINBOW SMELT	115	6	.	.	Fresh Dead
RAINBOW SMELT	113	7	.	.	Fresh Dead
RAINBOW SMELT	83	3	.	.	Fresh Dead
RAINBOW SMELT	85	3	.	.	Fresh Dead
RAINBOW SMELT	113	7	.	.	Fresh Dead
RAINBOW SMELT	107	5	.	.	Fresh Dead
RAINBOW SMELT	113	6	.	.	Fresh Dead
RAINBOW SMELT	85	3	.	.	Fresh Dead
RAINBOW SMELT	128	11	.	.	Fresh Dead
RAINBOW SMELT	83	3	.	.	Fresh Dead
RAINBOW SMELT	95	4	.	.	Fresh Dead
RAINBOW SMELT	98	5	.	.	Fresh Dead
RAINBOW SMELT	94	4	.	.	Fresh Dead
RAINBOW SMELT	88	4	.	.	Fresh Dead
RAINBOW SMELT	96	5	.	.	Fresh Dead
RAINBOW SMELT	77	2	.	.	Fresh Dead
RAINBOW SMELT	79	2	.	.	Fresh Dead
RAINBOW SMELT	85	3	.	.	Fresh Dead
RAINBOW SMELT	103	6	.	.	Fresh Dead
RAINBOW SMELT	84	3	.	.	Fresh Dead
RAINBOW SMELT	145	15	.	.	Fresh Dead
RAINBOW SMELT	143	14	.	.	Fresh Dead
RAINBOW SMELT	129	8	.	.	Fresh Dead
RAINBOW SMELT	101	5	.	.	Fresh Dead
RAINBOW SMELT	120	8	.	.	Fresh Dead
RAINBOW SMELT	155	14	.	.	Fresh Dead
RAINBOW SMELT	101	5	.	.	Fresh Dead

RAINBOW SMELT	132	11	.	.	Fresh Dead
RAINBOW SMELT	130	14	.	.	Fresh Dead
RAINBOW SMELT	92	4	.	.	Fresh Dead
RAINBOW SMELT	127	11	.	.	Fresh Dead
RAINBOW SMELT	92	4	.	.	Fresh Dead
RAINBOW SMELT	110	7	.	.	Fresh Dead
RAINBOW SMELT	100	5	.	.	Fresh Dead
RAINBOW SMELT	90	4	.	.	Fresh Dead
RAINBOW SMELT	105	5	.	.	Fresh Dead
RAINBOW SMELT	162	16	.	.	Fresh Dead
RAINBOW SMELT	110	6	.	.	Fresh Dead
RAINBOW SMELT	121	9	.	.	Fresh Dead
RAINBOW SMELT	118	9	.	.	Fresh Dead
RAINBOW SMELT	.	.	41	300	Fresh Dead
RAINBOW SMELT	.	.	173	1100	Fresh Dead
RAINBOW SMELT	.	.	276	1350	Fresh Dead
RAINBOW SMELT	.	.	23	162	Fresh Dead
COMMON CARP	76	7	.	.	Fresh Dead
GOLDEN SHINER	83	4	.	.	Fresh Dead
SPOTTAIL SHINER	95	6	.	.	Fresh Dead
SPOTTAIL SHINER	86	6	.	.	Fresh Dead
SPOTTAIL SHINER	96	7	.	.	Fresh Dead
SPOTTAIL SHINER	77	4	.	.	Fresh Dead
SPOTTAIL SHINER	91	6	.	.	Fresh Dead
SPOTTAIL SHINER	105	9	.	.	Fresh Dead
SPOTTAIL SHINER	96	7	.	.	Fresh Dead
SPOTTAIL SHINER	78	4	.	.	Fresh Dead
SPOTTAIL SHINER	102	9	.	.	Fresh Dead
SPOTTAIL SHINER	92	7	.	.	Fresh Dead
SPOTTAIL SHINER	77	4	.	.	Fresh Dead
SPOTTAIL SHINER	78	4	.	.	Fresh Dead
SPOTTAIL SHINER	86	5	.	.	Fresh Dead
SPOTTAIL SHINER	97	7	.	.	Fresh Dead
SPOTTAIL SHINER	87	5	.	.	Fresh Dead
SPOTTAIL SHINER	96	7	.	.	Fresh Dead
SPOTTAIL SHINER	99	8	.	.	Fresh Dead
SPOTTAIL SHINER	91	6	.	.	Fresh Dead
SPOTTAIL SHINER	94	6	.	.	Fresh Dead
SPOTTAIL SHINER	86	5	.	.	Fresh Dead
SPOTTAIL SHINER	93	6	.	.	Fresh Dead
SPOTTAIL SHINER	67	2	.	.	Fresh Dead
SPOTTAIL SHINER	88	5	.	.	Fresh Dead
SPOTTAIL SHINER	96	7	.	.	Fresh Dead
SPOTTAIL SHINER	87	6	.	.	Fresh Dead
SPOTTAIL SHINER	93	6	.	.	Fresh Dead
SPOTTAIL SHINER	102	8	.	.	Fresh Dead
SPOTTAIL SHINER	100	8	.	.	Fresh Dead
SPOTTAIL SHINER	100	8	.	.	Fresh Dead
SPOTTAIL SHINER	89	5	.	.	Fresh Dead
SPOTTAIL SHINER	94	7	.	.	Fresh Dead
SPOTTAIL SHINER	113	13	.	.	Fresh Dead
SPOTTAIL SHINER	94	7	.	.	Fresh Dead
SPOTTAIL SHINER	97	7	.	.	Fresh Dead
SPOTTAIL SHINER	97	7	.	.	Fresh Dead
SPOTTAIL SHINER	94	7	.	.	Fresh Dead
SPOTTAIL SHINER	80	5	.	.	Fresh Dead
SPOTTAIL SHINER	98	7	.	.	Fresh Dead
SPOTTAIL SHINER	95	7	.	.	Fresh Dead
SPOTTAIL SHINER	90	5	.	.	Fresh Dead
SPOTTAIL SHINER	87	5	.	.	Fresh Dead
SPOTTAIL SHINER	95	7	.	.	Fresh Dead
SPOTTAIL SHINER	87	5	.	.	Fresh Dead
SPOTTAIL SHINER	94	8	.	.	Fresh Dead
SPOTTAIL SHINER	95	7	.	.	Fresh Dead
SPOTTAIL SHINER	96	7	.	.	Fresh Dead
SPOTTAIL SHINER	85	5	.	.	Fresh Dead
SPOTTAIL SHINER	93	5	.	.	Fresh Dead
SPOTTAIL SHINER	115	15	.	.	Fresh Dead
SPOTTAIL SHINER	98	7	.	.	Fresh Dead
SPOTTAIL SHINER	.	.	31	175	Fresh Dead
SPOTTAIL SHINER	.	.	94	800	Fresh Dead
SPOTTAIL SHINER	.	.	3	15	Fresh Dead
SPOTTAIL SHINER	.	.	1	4	Fresh Dead
LONGNOSE DACE	88	8	.	.	Fresh Dead
WHITE SUCKER	469	1150	.	.	Fresh Dead
WHITE SUCKER	474	1100	.	.	Live
WHITE SUCKER	442	1000	.	.	Live
WHITE SUCKER	379	700	.	.	Live
WHITE SUCKER	409	800	.	.	Live
WHITE SUCKER	333	500	.	.	Fresh Dead
WHITE SUCKER	256	170	.	.	Fresh Dead
WHITE SUCKER	325	480	.	.	Fresh Dead
BLACK BULLHEAD	177	71	.	.	Fresh Dead
BURBOT	486	850	.	.	Fresh Dead
NINESPINE STICKLEBACK	75	2	.	.	Fresh Dead
BLUEGILL	123	34	.	.	Fresh Dead
BLUEGILL	76	6	.	.	Fresh Dead
YELLOW PERCH	81	4	.	.	Fresh Dead
YELLOW PERCH	86	5	.	.	Fresh Dead
YELLOW PERCH	80	4	.	.	Fresh Dead

YELLOW PERCH	83	5	.	.	Fresh Dead
YELLOW PERCH	80	4	.	.	Fresh Dead
YELLOW PERCH	79	4	.	.	Fresh Dead
YELLOW PERCH	75	4	.	.	Fresh Dead
YELLOW PERCH	76	4	.	.	Fresh Dead
YELLOW PERCH	92	7	.	.	Fresh Dead
YELLOW PERCH	76	4	.	.	Fresh Dead
YELLOW PERCH	77	4	.	.	Fresh Dead
YELLOW PERCH	75	3	.	.	Fresh Dead
YELLOW PERCH	78	4	.	.	Fresh Dead
YELLOW PERCH	75	4	.	.	Fresh Dead
YELLOW PERCH	77	4	.	.	Fresh Dead
YELLOW PERCH	75	4	.	.	Fresh Dead
YELLOW PERCH	78	4	.	.	Fresh Dead
YELLOW PERCH	63	2	.	.	Fresh Dead
YELLOW PERCH	85	5	.	.	Fresh Dead
YELLOW PERCH	83	5	.	.	Fresh Dead
YELLOW PERCH	70	3	.	.	Fresh Dead
YELLOW PERCH	79	4	.	.	Fresh Dead
YELLOW PERCH	78	4	.	.	Fresh Dead
YELLOW PERCH	75	4	.	.	Fresh Dead
YELLOW PERCH	72	3	.	.	Fresh Dead
YELLOW PERCH	82	5	.	.	Fresh Dead
YELLOW PERCH	72	3	.	.	Fresh Dead
YELLOW PERCH	139	26	.	.	Fresh Dead
YELLOW PERCH	82	5	.	.	Fresh Dead
YELLOW PERCH	90	6	.	.	Fresh Dead
YELLOW PERCH	71	3	.	.	Fresh Dead
YELLOW PERCH	93	7	.	.	Fresh Dead
YELLOW PERCH	80	5	.	.	Fresh Dead
YELLOW PERCH	87	5	.	.	Fresh Dead
YELLOW PERCH	82	5	.	.	Fresh Dead
YELLOW PERCH	90	6	.	.	Fresh Dead
YELLOW PERCH	72	3	.	.	Fresh Dead
YELLOW PERCH	79	4	.	.	Fresh Dead
YELLOW PERCH	68	4	.	.	Fresh Dead
YELLOW PERCH	75	4	.	.	Fresh Dead
YELLOW PERCH	86	6	.	.	Fresh Dead
YELLOW PERCH	89	6	.	.	Fresh Dead
YELLOW PERCH	75	3	.	.	Fresh Dead
YELLOW PERCH	79	4	.	.	Fresh Dead
YELLOW PERCH	73	3	.	.	Fresh Dead
YELLOW PERCH	78	4	.	.	Fresh Dead
YELLOW PERCH	83	5	.	.	Fresh Dead
YELLOW PERCH	87	6	.	.	Fresh Dead
YELLOW PERCH	79	4	.	.	Fresh Dead
YELLOW PERCH	73	3	.	.	Fresh Dead
YELLOW PERCH	74	3	.	.	Fresh Dead
YELLOW PERCH	68	2	.	.	Fresh Dead
YELLOW PERCH	68	3	.	.	Fresh Dead
YELLOW PERCH	66	3	.	.	Fresh Dead
YELLOW PERCH	61	2	.	.	Fresh Dead
YELLOW PERCH	.	.	2	7	Fresh Dead
MOTTLED SCULPIN	77	6	.	.	Fresh Dead
MOTTLED SCULPIN	89	9	.	.	Fresh Dead
MOTTLED SCULPIN	78	6	.	.	Fresh Dead
MOTTLED SCULPIN	82	9	.	.	Fresh Dead
MOTTLED SCULPIN	76	6	.	.	Fresh Dead
MOTTLED SCULPIN	68	4	.	.	Fresh Dead

SAMPLING PERIOD: 18-19OCT06 START DATE AND TIME: 18OCT06:10:00 END DATE AND TIME: 19OCT06:10:00
SAMPLING DURATION (hrs.): 24.00 CW VOLUME SAMPLED (gals x 10^6): 504.0000
INTAKE TEMPERATURES (F): MINIMUM= 45.1 MEAN= 45.8 MAXIMUM= 46.1
DISCHARGE TEMPERATURES (F): MINIMUM= 47.6 MEAN= 56.5 MAXIMUM= 64.2 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 18-21OCT06 CW VOLUME (gals x 10^6) FOR EXTRAPOLATION PERIOD: 1774.0

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
ALEWIFE	169	44	.	.	Fresh Dead	
ALEWIFE	112	9	.	.	Fresh Dead	
ALEWIFE	114	10	.	.	Fresh Dead	
ALEWIFE	77	4	.	.	Fresh Dead	
ALEWIFE	68	2	.	.	Fresh Dead	
ALEWIFE	75	3	.	.	Fresh Dead	
ALEWIFE	92	6	.	.	Fresh Dead	
ALEWIFE	77	3	.	.	Fresh Dead	
ALEWIFE	80	4	.	.	Fresh Dead	
ALEWIFE	73	3	.	.	Fresh Dead	
ALEWIFE	79	4	.	.	Fresh Dead	
ALEWIFE	73	3	.	.	Fresh Dead	
ALEWIFE	72	3	.	.	Fresh Dead	
ALEWIFE	78	3	.	.	Fresh Dead	
ALEWIFE	154	35	.	.	Fresh Dead	
ALEWIFE	86	5	.	.	Fresh Dead	
ALEWIFE	132	13	.	.	Fresh Dead	
ALEWIFE	134	21	.	.	Fresh Dead	
ALEWIFE	75	3	.	.	Fresh Dead	
ALEWIFE	87	5	.	.	Fresh Dead	

ALEWIFE	67	2	.	.	Fresh Dead
ALEWIFE	74	3	.	.	Fresh Dead
ALEWIFE	72	3	.	.	Fresh Dead
ALEWIFE	82	4	.	.	Fresh Dead
ALEWIFE	71	2	.	.	Fresh Dead
ALEWIFE	67	2	.	.	Fresh Dead
ALEWIFE	72	3	.	.	Fresh Dead
ALEWIFE	70	2	.	.	Fresh Dead
ALEWIFE	69	2	.	.	Fresh Dead
ALEWIFE	75	3	.	.	Fresh Dead
ALEWIFE	68	2	.	.	Fresh Dead
ALEWIFE	93	5	.	.	Fresh Dead
ALEWIFE	83	5	.	.	Fresh Dead
ALEWIFE	69	3	.	.	Fresh Dead
ALEWIFE	111	10	.	.	Fresh Dead
ALEWIFE	96	5	.	.	Fresh Dead
ALEWIFE	72	3	.	.	Fresh Dead
ALEWIFE	76	3	.	.	Fresh Dead
ALEWIFE	73	3	.	.	Fresh Dead
ALEWIFE	75	3	.	.	Fresh Dead
ALEWIFE	83	4	.	.	Fresh Dead
ALEWIFE	78	4	.	.	Fresh Dead
ALEWIFE	83	4	.	.	Fresh Dead
ALEWIFE	123	19	.	.	Fresh Dead
ALEWIFE	95	6	.	.	Fresh Dead
ALEWIFE	74	3	.	.	Fresh Dead
ALEWIFE	77	3	.	.	Fresh Dead
ALEWIFE	81	4	.	.	Fresh Dead
ALEWIFE	76	3	.	.	Fresh Dead
ALEWIFE	79	3	.	.	Fresh Dead
ALEWIFE	.	.	48	200	Fresh Dead
ALEWIFE	.	.	23	150	Fresh Dead
ALEWIFE	.	.	5	50	Fresh Dead
LAKE TROUT	658	2750	.	.	Live
RAINBOW SMELT	124	11	.	.	Fresh Dead
RAINBOW SMELT	120	9	.	.	Fresh Dead
RAINBOW SMELT	129	12	.	.	Fresh Dead
RAINBOW SMELT	127	10	.	.	Fresh Dead
RAINBOW SMELT	122	7	.	.	Fresh Dead
RAINBOW SMELT	95	4	.	.	Fresh Dead
RAINBOW SMELT	105	5	.	.	Fresh Dead
RAINBOW SMELT	82	3	.	.	Fresh Dead
RAINBOW SMELT	79	2	.	.	Fresh Dead
RAINBOW SMELT	121	9	.	.	Fresh Dead
RAINBOW SMELT	152	20	.	.	Fresh Dead
RAINBOW SMELT	107	6	.	.	Fresh Dead
RAINBOW SMELT	118	11	.	.	Fresh Dead
RAINBOW SMELT	152	14	.	.	Fresh Dead
RAINBOW SMELT	118	9	.	.	Fresh Dead
RAINBOW SMELT	85	3	.	.	Fresh Dead
RAINBOW SMELT	113	6	.	.	Fresh Dead
RAINBOW SMELT	99	4	.	.	Fresh Dead
RAINBOW SMELT	84	3	.	.	Fresh Dead
RAINBOW SMELT	127	11	.	.	Fresh Dead
RAINBOW SMELT	98	5	.	.	Fresh Dead
RAINBOW SMELT	80	3	.	.	Fresh Dead
RAINBOW SMELT	78	2	.	.	Fresh Dead
RAINBOW SMELT	105	6	.	.	Fresh Dead
RAINBOW SMELT	97	4	.	.	Fresh Dead
SPOTTAIL SHINER	99	8	.	.	Fresh Dead
SPOTTAIL SHINER	103	9	.	.	Fresh Dead
SPOTTAIL SHINER	98	7	.	.	Fresh Dead
SPOTTAIL SHINER	94	6	.	.	Fresh Dead
SPOTTAIL SHINER	90	6	.	.	Fresh Dead
SPOTTAIL SHINER	88	6	.	.	Fresh Dead
SPOTTAIL SHINER	92	7	.	.	Fresh Dead
WHITE SUCKER	449	1000	.	.	Live
BLACK BULLHEAD	279	380	.	.	Live
BURBOT	398	480	.	.	Fresh Dead
YELLOW PERCH	128	19	.	.	Fresh Dead

SAMPLING PERIOD: 23-24OCT06 START DATE AND TIME: 23OCT06:11:00 END DATE AND TIME: 24OCT06:11:00
SAMPLING DURATION (hrs.): 24.00 CW VOLUME SAMPLED (gals x 10^6): 374.4000
INTAKE TEMPERATURES (F): MINIMUM= 42.0 MEAN= 42.6 MAXIMUM= 43.6
DISCHARGE TEMPERATURES (F): MINIMUM= 44.4 MEAN= 57.0 MAXIMUM= 75.0 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 22-24OCT06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 1261.4

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
ALEWIFE	120	13	.	.	Fresh Dead	
ALEWIFE	114	11	.	.	Fresh Dead	
ALEWIFE	120	16	.	.	Fresh Dead	
ALEWIFE	106	9	.	.	Fresh Dead	
ALEWIFE	90	5	.	.	Fresh Dead	
ALEWIFE	122	14	.	.	Fresh Dead	
ALEWIFE	107	10	.	.	Fresh Dead	
ALEWIFE	177	54	.	.	Fresh Dead	
ALEWIFE	88	5	.	.	Fresh Dead	

ALEWIFE	118	15	.	.	Fresh Dead
ALEWIFE	129	21	.	.	Fresh Dead
ALEWIFE	81	4	.	.	Fresh Dead
ALEWIFE	160	42	.	.	Fresh Dead
ALEWIFE	125	19	.	.	Fresh Dead
ALEWIFE	107	9	.	.	Fresh Dead
ALEWIFE	74	2	.	.	Fresh Dead
ALEWIFE	92	5	.	.	Fresh Dead
ALEWIFE	151	37	.	.	Fresh Dead
ALEWIFE	110	11	.	.	Fresh Dead
ALEWIFE	132	24	.	.	Fresh Dead
ALEWIFE	146	31	.	.	Fresh Dead
ALEWIFE	141	27	.	.	Fresh Dead
ALEWIFE	146	32	.	.	Fresh Dead
ALEWIFE	129	21	.	.	Fresh Dead
ALEWIFE	169	45	.	.	Fresh Dead
ALEWIFE	96	6	.	.	Fresh Dead
ALEWIFE	84	5	.	.	Fresh Dead
ALEWIFE	77	4	.	.	Fresh Dead
ALEWIFE	82	4	.	.	Fresh Dead
ALEWIFE	85	5	.	.	Fresh Dead
ALEWIFE	77	4	.	.	Fresh Dead
ALEWIFE	75	3	.	.	Fresh Dead
ALEWIFE	179	54	.	.	Fresh Dead
ALEWIFE	151	36	.	.	Fresh Dead
ALEWIFE	128	20	.	.	Fresh Dead
ALEWIFE	145	29	.	.	Fresh Dead
ALEWIFE	94	6	.	.	Fresh Dead
ALEWIFE	155	37	.	.	Fresh Dead
ALEWIFE	129	18	.	.	Fresh Dead
ALEWIFE	132	23	.	.	Fresh Dead
ALEWIFE	118	15	.	.	Fresh Dead
ALEWIFE	87	5	.	.	Fresh Dead
ALEWIFE	90	6	.	.	Fresh Dead
ALEWIFE	84	4	.	.	Fresh Dead
ALEWIFE	80	4	.	.	Fresh Dead
ALEWIFE	87	5	.	.	Fresh Dead
ALEWIFE	77	3	.	.	Fresh Dead
ALEWIFE	95	6	.	.	Fresh Dead
ALEWIFE	88	5	.	.	Fresh Dead
ALEWIFE	153	36	.	.	Fresh Dead
ALEWIFE	.	.	100	1600	Fresh Dead
ALEWIFE	.	.	74	1200	Fresh Dead
ALEWIFE	.	.	8	95	Fresh Dead
GIZZARD SHAD	125	19	.	.	Fresh Dead
GIZZARD SHAD	120	17	.	.	Fresh Dead
GIZZARD SHAD	115	13	.	.	Fresh Dead
GIZZARD SHAD	132	21	.	.	Fresh Dead
GIZZARD SHAD	118	12	.	.	Fresh Dead
GIZZARD SHAD	123	18	.	.	Fresh Dead
GIZZARD SHAD	114	13	.	.	Fresh Dead
GIZZARD SHAD	109	12	.	.	Fresh Dead
GIZZARD SHAD	118	15	.	.	Fresh Dead
GIZZARD SHAD	114	14	.	.	Fresh Dead
GIZZARD SHAD	102	11	.	.	Fresh Dead
GIZZARD SHAD	140	27	.	.	Fresh Dead
GIZZARD SHAD	100	9	.	.	Fresh Dead
GIZZARD SHAD	131	21	.	.	Fresh Dead
GIZZARD SHAD	123	17	.	.	Fresh Dead
GIZZARD SHAD	112	14	.	.	Fresh Dead
GIZZARD SHAD	111	14	.	.	Fresh Dead
GIZZARD SHAD	99	9	.	.	Fresh Dead
GIZZARD SHAD	125	17	.	.	Fresh Dead
GIZZARD SHAD	106	11	.	.	Fresh Dead
GIZZARD SHAD	124	18	.	.	Fresh Dead
GIZZARD SHAD	115	15	.	.	Fresh Dead
GIZZARD SHAD	123	16	.	.	Fresh Dead
GIZZARD SHAD	100	9	.	.	Fresh Dead
GIZZARD SHAD	118	16	.	.	Fresh Dead
GIZZARD SHAD	104	11	.	.	Fresh Dead
GIZZARD SHAD	108	13	.	.	Fresh Dead
GIZZARD SHAD	113	14	.	.	Fresh Dead
GIZZARD SHAD	114	14	.	.	Fresh Dead
LAKE TROUT	756	3500	.	.	Live
RAINBOW SMELT	98	5	.	.	Fresh Dead
RAINBOW SMELT	123	9	.	.	Fresh Dead
RAINBOW SMELT	142	13	.	.	Fresh Dead
RAINBOW SMELT	92	4	.	.	Fresh Dead
RAINBOW SMELT	106	7	.	.	Fresh Dead
SPOTTAIL SHINER	103	9	.	.	Live
WHITE SUCKER	505	1450	.	.	Live
WHITE SUCKER	532	1600	.	.	Fresh Dead

SAMPLING PERIOD: 25-26OCT06 START DATE AND TIME: 25OCT06:10:03 END DATE AND TIME: 26OCT06:10:27
SAMPLING DURATION (hrs.): 24.40 CW VOLUME SAMPLED (gals x 10^6): 512.4000
INTAKE TEMPERATURES (F): MINIMUM= 42.0 MEAN= 43.1 MAXIMUM= 45.1
DISCHARGE TEMPERATURES (F): MINIMUM= 43.2 MEAN= 52.6 MAXIMUM= 63.8 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 25-28OCT06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 1938.2

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
ALEWIFE	75	3	.	.	Fresh Dead	
ALEWIFE	82	4	.	.	Fresh Dead	
ALEWIFE	74	3	.	.	Fresh Dead	
ALEWIFE	81	4	.	.	Fresh Dead	
ALEWIFE	158	18	.	.	Fresh Dead	
ALEWIFE	80	4	.	.	Fresh Dead	
ALEWIFE	91	5	.	.	Fresh Dead	
ALEWIFE	78	3	.	.	Fresh Dead	
ALEWIFE	77	3	.	.	Fresh Dead	
ALEWIFE	76	3	.	.	Fresh Dead	
ALEWIFE	88	5	.	.	Fresh Dead	
ALEWIFE	158	41	.	.	Fresh Dead	
ALEWIFE	82	5	.	.	Fresh Dead	
ALEWIFE	78	3	.	.	Fresh Dead	
ALEWIFE	82	4	.	.	Fresh Dead	
ALEWIFE	90	5	.	.	Fresh Dead	
ALEWIFE	83	4	.	.	Fresh Dead	
ALEWIFE	84	4	.	.	Fresh Dead	
ALEWIFE	81	4	.	.	Fresh Dead	
ALEWIFE	74	3	.	.	Fresh Dead	
ALEWIFE	91	6	.	.	Fresh Dead	
ALEWIFE	84	4	.	.	Fresh Dead	
ALEWIFE	85	5	.	.	Fresh Dead	
ALEWIFE	80	4	.	.	Fresh Dead	
ALEWIFE	89	5	.	.	Fresh Dead	
ALEWIFE	75	4	.	.	Fresh Dead	
ALEWIFE	94	7	.	.	Fresh Dead	
ALEWIFE	81	4	.	.	Fresh Dead	
ALEWIFE	77	3	.	.	Fresh Dead	
ALEWIFE	78	3	.	.	Fresh Dead	
ALEWIFE	79	3	.	.	Fresh Dead	
ALEWIFE	90	5	.	.	Fresh Dead	
ALEWIFE	89	5	.	.	Fresh Dead	
ALEWIFE	82	4	.	.	Fresh Dead	
ALEWIFE	76	3	.	.	Fresh Dead	
ALEWIFE	84	5	.	.	Fresh Dead	
ALEWIFE	77	3	.	.	Fresh Dead	
ALEWIFE	84	4	.	.	Fresh Dead	
ALEWIFE	80	3	.	.	Fresh Dead	
ALEWIFE	94	6	.	.	Fresh Dead	
ALEWIFE	86	4	.	.	Fresh Dead	
ALEWIFE	88	5	.	.	Fresh Dead	
ALEWIFE	83	4	.	.	Fresh Dead	
ALEWIFE	81	4	.	.	Fresh Dead	
ALEWIFE	78	4	.	.	Fresh Dead	
ALEWIFE	77	3	.	.	Fresh Dead	
ALEWIFE	95	6	.	.	Fresh Dead	
ALEWIFE	75	3	.	.	Fresh Dead	
ALEWIFE	80	4	.	.	Fresh Dead	
ALEWIFE	73	3	.	.	Fresh Dead	
ALEWIFE	.	.	291	1350	Fresh Dead	
ALEWIFE	.	.	136	850	Fresh Dead	
ALEWIFE	.	.	385	2000	Fresh Dead	
ALEWIFE	.	.	5	25	Fresh Dead	
GIZZARD SHAD	130	19	.	.	Fresh Dead	
GIZZARD SHAD	80	5	.	.	Fresh Dead	
GIZZARD SHAD	113	13	.	.	Fresh Dead	
GIZZARD SHAD	106	10	.	.	Fresh Dead	
GIZZARD SHAD	95	8	.	.	Fresh Dead	
GIZZARD SHAD	105	11	.	.	Fresh Dead	
GIZZARD SHAD	105	10	.	.	Fresh Dead	
GIZZARD SHAD	113	12	.	.	Fresh Dead	
GIZZARD SHAD	88	6	.	.	Fresh Dead	
GIZZARD SHAD	97	7	.	.	Fresh Dead	
GIZZARD SHAD	98	9	.	.	Fresh Dead	
GIZZARD SHAD	99	8	.	.	Fresh Dead	
GIZZARD SHAD	100	8	.	.	Fresh Dead	
GIZZARD SHAD	112	12	.	.	Fresh Dead	
GIZZARD SHAD	105	9	.	.	Fresh Dead	
GIZZARD SHAD	92	8	.	.	Fresh Dead	
GIZZARD SHAD	102	10	.	.	Fresh Dead	
GIZZARD SHAD	100	9	.	.	Fresh Dead	
GIZZARD SHAD	98	8	.	.	Fresh Dead	
GIZZARD SHAD	95	7	.	.	Fresh Dead	
GIZZARD SHAD	104	10	.	.	Fresh Dead	
GIZZARD SHAD	94	7	.	.	Fresh Dead	
GIZZARD SHAD	92	6	.	.	Fresh Dead	
GIZZARD SHAD	105	12	.	.	Fresh Dead	
GIZZARD SHAD	110	12	.	.	Fresh Dead	
GIZZARD SHAD	108	12	.	.	Fresh Dead	
GIZZARD SHAD	103	9	.	.	Fresh Dead	
GIZZARD SHAD	124	17	.	.	Fresh Dead	
GIZZARD SHAD	118	16	.	.	Fresh Dead	
GIZZARD SHAD	89	8	.	.	Fresh Dead	
GIZZARD SHAD	115	14	.	.	Fresh Dead	
GIZZARD SHAD	114	13	.	.	Fresh Dead	
GIZZARD SHAD	98	9	.	.	Fresh Dead	

GIZZARD SHAD	114	15	.	.	Fresh Dead
GIZZARD SHAD	106	11	.	.	Fresh Dead
GIZZARD SHAD	121	15	.	.	Fresh Dead
GIZZARD SHAD	108	11	.	.	Fresh Dead
GIZZARD SHAD	115	14	.	.	Fresh Dead
GIZZARD SHAD	100	9	.	.	Fresh Dead
GIZZARD SHAD	114	13	.	.	Fresh Dead
GIZZARD SHAD	114	13	.	.	Fresh Dead
GIZZARD SHAD	113	13	.	.	Fresh Dead
GIZZARD SHAD	149	30	.	.	Fresh Dead
GIZZARD SHAD	126	18	.	.	Fresh Dead
GIZZARD SHAD	100	10	.	.	Fresh Dead
GIZZARD SHAD	104	10	.	.	Fresh Dead
GIZZARD SHAD	131	20	.	.	Fresh Dead
GIZZARD SHAD	111	13	.	.	Fresh Dead
GIZZARD SHAD	124	17	.	.	Fresh Dead
GIZZARD SHAD	128	19	.	.	Fresh Dead
GIZZARD SHAD	.	.	74	800	Fresh Dead
GIZZARD SHAD	.	.	83	950	Fresh Dead
GIZZARD SHAD	.	.	9	70	Fresh Dead
SPOTTAIL SHINER	89	5	.	.	Fresh Dead
WHITE SUCKER	465	1200	.	.	Fresh Dead
WHITE SUCKER	468	1100	.	.	Fresh Dead
WHITE SUCKER	544	1600	.	.	Fresh Dead
CHANNEL CATFISH	280	212	.	.	Fresh Dead
BURBOT	520	1050	.	.	Fresh Dead
YELLOW PERCH	61	2	.	.	Fresh Dead
YELLOW PERCH	76	3	.	.	Fresh Dead
MOTTLED SCULPIN	72	4	.	.	Fresh Dead

SAMPLING PERIOD: 30-31OCT06 START DATE AND TIME: 30OCT06:10:00 END DATE AND TIME: 31OCT06:10:00
SAMPLING DURATION (hrs.): 24.00 CW VOLUME SAMPLED (gals x 10^6): 504.0000
INTAKE TEMPERATURES (F): MINIMUM= 43.1 MEAN= 44.3 MAXIMUM= 47.3
DISCHARGE TEMPERATURES (F): MINIMUM= 42.8 MEAN= 54.0 MAXIMUM= 65.3 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 29-31OCT06 CW VOLUME (gals x 10^6) FOR EXTRAPOLATION PERIOD: 1512.0

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
ALEWIFE	163	41	.	.	Fresh Dead	
ALEWIFE	92	5	.	.	Fresh Dead	
ALEWIFE	138	24	.	.	Fresh Dead	
ALEWIFE	138	25	.	.	Fresh Dead	
ALEWIFE	140	27	.	.	Fresh Dead	
ALEWIFE	75	3	.	.	Fresh Dead	
ALEWIFE	124	18	.	.	Fresh Dead	
ALEWIFE	93	6	.	.	Fresh Dead	
ALEWIFE	126	19	.	.	Fresh Dead	
ALEWIFE	102	8	.	.	Fresh Dead	
ALEWIFE	74	3	.	.	Fresh Dead	
ALEWIFE	75	3	.	.	Fresh Dead	
ALEWIFE	159	38	.	.	Fresh Dead	
ALEWIFE	144	26	.	.	Fresh Dead	
ALEWIFE	124	19	.	.	Fresh Dead	
ALEWIFE	135	20	.	.	Fresh Dead	
ALEWIFE	91	5	.	.	Fresh Dead	
ALEWIFE	95	6	.	.	Fresh Dead	
ALEWIFE	90	5	.	.	Fresh Dead	
ALEWIFE	68	2	.	.	Fresh Dead	
ALEWIFE	62	2	.	.	Fresh Dead	
ALEWIFE	87	5	.	.	Fresh Dead	
ALEWIFE	99	8	.	.	Fresh Dead	
ALEWIFE	90	5	.	.	Fresh Dead	
ALEWIFE	85	4	.	.	Fresh Dead	
ALEWIFE	123	15	.	.	Fresh Dead	
ALEWIFE	72	2	.	.	Fresh Dead	
ALEWIFE	79	4	.	.	Fresh Dead	
ALEWIFE	156	36	.	.	Fresh Dead	
ALEWIFE	72	3	.	.	Fresh Dead	
ALEWIFE	60	2	.	.	Fresh Dead	
ALEWIFE	128	18	.	.	Fresh Dead	
ALEWIFE	88	5	.	.	Fresh Dead	
ALEWIFE	76	3	.	.	Fresh Dead	
ALEWIFE	73	2	.	.	Fresh Dead	
ALEWIFE	87	5	.	.	Fresh Dead	
ALEWIFE	68	3	.	.	Fresh Dead	
ALEWIFE	77	3	.	.	Fresh Dead	
ALEWIFE	79	3	.	.	Fresh Dead	
ALEWIFE	78	3	.	.	Fresh Dead	
ALEWIFE	75	3	.	.	Fresh Dead	
ALEWIFE	.	.	644	3500	Fresh Dead	
ALEWIFE	93	6	.	.	Fresh Dead	
ALEWIFE	102	8	.	.	Fresh Dead	
ALEWIFE	94	5	.	.	Fresh Dead	
ALEWIFE	133	17	.	.	Fresh Dead	
ALEWIFE	110	10	.	.	Fresh Dead	
ALEWIFE	123	14	.	.	Fresh Dead	
ALEWIFE	115	10	.	.	Fresh Dead	
ALEWIFE	90	5	.	.	Fresh Dead	

ALEWIFE	78	3	.	.	Fresh Dead
ALEWIFE	.	.	34	180	Fresh Dead
GIZZARD SHAD	110	12	.	.	Fresh Dead
GIZZARD SHAD	105	10	.	.	Fresh Dead
GIZZARD SHAD	94	8	.	.	Fresh Dead
GIZZARD SHAD	97	8	.	.	Fresh Dead
GIZZARD SHAD	118	15	.	.	Fresh Dead
GIZZARD SHAD	101	8	.	.	Fresh Dead
BROWN TROUT	196	71	.	.	Fresh Dead
RAINBOW SMELT	146	15	.	.	Fresh Dead
RAINBOW SMELT	140	14	.	.	Fresh Dead
RAINBOW SMELT	125	10	.	.	Fresh Dead
RAINBOW SMELT	126	10	.	.	Fresh Dead
RAINBOW SMELT	120	12	.	.	Fresh Dead
RAINBOW SMELT	83	3	.	.	Fresh Dead
RAINBOW SMELT	92	4	.	.	Fresh Dead
RAINBOW SMELT	128	11	.	.	Fresh Dead
RAINBOW SMELT	195	43	.	.	Fresh Dead
COMMON SHINER	169	63	.	.	Fresh Dead
SPOTTAIL SHINER	98	8	.	.	Fresh Dead
SPOTTAIL SHINER	83	4	.	.	Fresh Dead
SPOTTAIL SHINER	86	5	.	.	Fresh Dead
WHITE SUCKER	319	400	.	.	Fresh Dead
WHITE SUCKER	491	1300	.	.	Fresh Dead
WHITE SUCKER	423	950	.	.	Fresh Dead
WHITE SUCKER	446	1000	.	.	Fresh Dead
BLACK BULLHEAD	235	224	.	.	Fresh Dead
CHANNEL CATFISH	85	6	.	.	Fresh Dead
BLACK CRAPPIE	100	13	.	.	Fresh Dead
YELLOW PERCH	185	55	.	.	Fresh Dead
YELLOW PERCH	112	13	.	.	Fresh Dead
YELLOW PERCH	110	10	.	.	Fresh Dead
YELLOW PERCH	54	2	.	.	Fresh Dead
MOTTLED SCULPIN	73	6	.	.	Fresh Dead
MOTTLED SCULPIN	70	5	.	.	Fresh Dead
MOTTLED SCULPIN	79	8	.	.	Fresh Dead

SAMPLING PERIOD: 01-02NOV06 START DATE AND TIME: 01NOV06:10:15 END DATE AND TIME: 02NOV06:10:03
SAMPLING DURATION (hrs.): 23.80 CW VOLUME SAMPLED (gals x 10^6): 499.8000
INTAKE TEMPERATURES (F): MINIMUM= 41.8 MEAN= 43.8 MAXIMUM= 45.4
DISCHARGE TEMPERATURES (F): MINIMUM= 44.0 MEAN= 53.5 MAXIMUM= 64.0 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 01-04NOV06 CW VOLUME (gals x 10^6) FOR EXTRAPOLATION PERIOD: 2016.0

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
ALEWIFE	138	24	.	.	Fresh Dead	
ALEWIFE	83	4	.	.	Fresh Dead	
ALEWIFE	102	8	.	.	Fresh Dead	
ALEWIFE	149	28	.	.	Fresh Dead	
ALEWIFE	157	39	.	.	Fresh Dead	
ALEWIFE	148	31	.	.	Fresh Dead	
ALEWIFE	145	27	.	.	Fresh Dead	
ALEWIFE	139	25	.	.	Fresh Dead	
ALEWIFE	156	35	.	.	Fresh Dead	
ALEWIFE	127	19	.	.	Fresh Dead	
ALEWIFE	153	35	.	.	Fresh Dead	
ALEWIFE	179	46	.	.	Fresh Dead	
ALEWIFE	122	18	.	.	Fresh Dead	
ALEWIFE	76	3	.	.	Fresh Dead	
ALEWIFE	82	4	.	.	Fresh Dead	
ALEWIFE	95	6	.	.	Fresh Dead	
ALEWIFE	76	3	.	.	Fresh Dead	
ALEWIFE	77	3	.	.	Fresh Dead	
ALEWIFE	70	2	.	.	Fresh Dead	
ALEWIFE	90	5	.	.	Fresh Dead	
ALEWIFE	79	3	.	.	Fresh Dead	
ALEWIFE	88	5	.	.	Fresh Dead	
ALEWIFE	129	19	.	.	Fresh Dead	
ALEWIFE	73	3	.	.	Fresh Dead	
ALEWIFE	79	3	.	.	Fresh Dead	
ALEWIFE	78	3	.	.	Fresh Dead	
ALEWIFE	138	25	.	.	Fresh Dead	
ALEWIFE	96	6	.	.	Fresh Dead	
ALEWIFE	95	7	.	.	Fresh Dead	
ALEWIFE	90	5	.	.	Fresh Dead	
ALEWIFE	100	7	.	.	Fresh Dead	
ALEWIFE	155	20	.	.	Fresh Dead	
ALEWIFE	73	3	.	.	Fresh Dead	
ALEWIFE	108	9	.	.	Fresh Dead	
ALEWIFE	81	3	.	.	Fresh Dead	
ALEWIFE	84	4	.	.	Fresh Dead	
ALEWIFE	149	19	.	.	Fresh Dead	
ALEWIFE	82	4	.	.	Fresh Dead	
ALEWIFE	73	3	.	.	Fresh Dead	
ALEWIFE	109	9	.	.	Fresh Dead	
ALEWIFE	78	3	.	.	Fresh Dead	
ALEWIFE	77	3	.	.	Fresh Dead	
ALEWIFE	79	4	.	.	Fresh Dead	

ALEWIFE	160	20	.	.	Fresh Dead
ALEWIFE	90	5	.	.	Fresh Dead
ALEWIFE	83	4	.	.	Fresh Dead
ALEWIFE	93	6	.	.	Fresh Dead
ALEWIFE	78	3	.	.	Fresh Dead
ALEWIFE	95	7	.	.	Fresh Dead
ALEWIFE	84	4	.	.	Fresh Dead
ALEWIFE	.	.	78	250	Fresh Dead
GIZZARD SHAD	111	11	.	.	Fresh Dead
GIZZARD SHAD	108	12	.	.	Fresh Dead
GIZZARD SHAD	81	5	.	.	Fresh Dead
GIZZARD SHAD	108	11	.	.	Fresh Dead
GIZZARD SHAD	100	8	.	.	Fresh Dead
GIZZARD SHAD	114	14	.	.	Fresh Dead
GIZZARD SHAD	103	10	.	.	Fresh Dead
GIZZARD SHAD	88	5	.	.	Fresh Dead
GIZZARD SHAD	109	11	.	.	Fresh Dead
GIZZARD SHAD	106	11	.	.	Fresh Dead
GIZZARD SHAD	102	10	.	.	Fresh Dead
GIZZARD SHAD	99	9	.	.	Fresh Dead
GIZZARD SHAD	102	9	.	.	Fresh Dead
GIZZARD SHAD	94	7	.	.	Fresh Dead
GIZZARD SHAD	102	10	.	.	Fresh Dead
GIZZARD SHAD	84	5	.	.	Fresh Dead
SPOTTAIL SHINER	97	7	.	.	Fresh Dead
WHITE SUCKER	437	1150	.	.	Fresh Dead
YELLOW PERCH	179	62	.	.	Live

SAMPLING PERIOD: 06-07NOV06 START DATE AND TIME: 06NOV06:10:45 END DATE AND TIME: 07NOV06:11:08
SAMPLING DURATION (hrs.): 24.38 CW VOLUME SAMPLED (gals x 10^6): 512.0500
INTAKE TEMPERATURES (F): MINIMUM= 40.8 MEAN= 41.9 MAXIMUM= 44.9
DISCHARGE TEMPERATURES (F): MINIMUM= 43.3 MEAN= 51.9 MAXIMUM= 62.8 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 05-07NOV06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 1512.0

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
ALEWIFE	110	10	.	.	Fresh Dead	
ALEWIFE	85	5	.	.	Fresh Dead	
ALEWIFE	74	3	.	.	Fresh Dead	
ALEWIFE	81	4	.	.	Fresh Dead	
ALEWIFE	65	2	.	.	Fresh Dead	
ALEWIFE	72	3	.	.	Fresh Dead	
ALEWIFE	75	3	.	.	Fresh Dead	
ALEWIFE	80	4	.	.	Fresh Dead	
ALEWIFE	75	3	.	.	Fresh Dead	
ALEWIFE	85	4	.	.	Fresh Dead	
ALEWIFE	71	3	.	.	Fresh Dead	
ALEWIFE	83	4	.	.	Fresh Dead	
ALEWIFE	78	3	.	.	Fresh Dead	
ALEWIFE	70	2	.	.	Fresh Dead	
ALEWIFE	66	2	.	.	Fresh Dead	
ALEWIFE	69	3	.	.	Fresh Dead	
ALEWIFE	70	2	.	.	Fresh Dead	
ALEWIFE	167	43	.	.	Fresh Dead	
ALEWIFE	106	7	.	.	Fresh Dead	
ALEWIFE	79	3	.	.	Fresh Dead	
ALEWIFE	78	4	.	.	Fresh Dead	
ALEWIFE	79	3	.	.	Fresh Dead	
ALEWIFE	74	3	.	.	Fresh Dead	
ALEWIFE	71	3	.	.	Fresh Dead	
ALEWIFE	98	7	.	.	Fresh Dead	
ALEWIFE	116	11	.	.	Fresh Dead	
ALEWIFE	80	4	.	.	Fresh Dead	
ALEWIFE	78	3	.	.	Fresh Dead	
ALEWIFE	180	56	.	.	Fresh Dead	
ALEWIFE	81	4	.	.	Fresh Dead	
ALEWIFE	91	6	.	.	Fresh Dead	
ALEWIFE	149	32	.	.	Fresh Dead	
ALEWIFE	97	6	.	.	Fresh Dead	
ALEWIFE	86	5	.	.	Fresh Dead	
ALEWIFE	69	2	.	.	Fresh Dead	
ALEWIFE	77	3	.	.	Fresh Dead	
ALEWIFE	90	5	.	.	Fresh Dead	
ALEWIFE	87	5	.	.	Fresh Dead	
ALEWIFE	66	2	.	.	Fresh Dead	
ALEWIFE	70	2	.	.	Fresh Dead	
ALEWIFE	75	2	.	.	Fresh Dead	
ALEWIFE	68	2	.	.	Fresh Dead	
ALEWIFE	78	3	.	.	Fresh Dead	
ALEWIFE	74	3	.	.	Fresh Dead	
ALEWIFE	78	3	.	.	Fresh Dead	
ALEWIFE	90	5	.	.	Fresh Dead	
ALEWIFE	75	3	.	.	Fresh Dead	
ALEWIFE	68	2	.	.	Fresh Dead	
ALEWIFE	97	6	.	.	Fresh Dead	
ALEWIFE	.	.	290	1400	Fresh Dead	
ALEWIFE	.	.	99	550	Fresh Dead	
ALEWIFE	.	.	296	1400	Fresh Dead	

GIZZARD SHAD	125	17	.	.	Fresh Dead
GIZZARD SHAD	102	10	.	.	Fresh Dead
GIZZARD SHAD	452	850	.	.	Live
GIZZARD SHAD	277	180	.	.	Live
GIZZARD SHAD	115	13	.	.	Fresh Dead
GIZZARD SHAD	108	11	.	.	Fresh Dead
GIZZARD SHAD	132	20	.	.	Fresh Dead
GIZZARD SHAD	109	12	.	.	Fresh Dead
GIZZARD SHAD	105	10	.	.	Fresh Dead
BLOATER	82	4	.	.	Fresh Dead
BLOATER	99	8	.	.	Fresh Dead
BLOATER	55	2	.	.	Fresh Dead
RAINBOW SMELT	142	14	.	.	Fresh Dead
RAINBOW SMELT	139	15	.	.	Fresh Dead
RAINBOW SMELT	105	6	.	.	Fresh Dead
RAINBOW SMELT	96	4	.	.	Fresh Dead
RAINBOW SMELT	100	5	.	.	Fresh Dead
RAINBOW SMELT	72	2	.	.	Fresh Dead
RAINBOW SMELT	86	3	.	.	Fresh Dead
RAINBOW SMELT	85	3	.	.	Fresh Dead
RAINBOW SMELT	93	4	.	.	Fresh Dead
RAINBOW SMELT	97	5	.	.	Fresh Dead
RAINBOW SMELT	104	6	.	.	Fresh Dead
RAINBOW SMELT	97	5	.	.	Fresh Dead
RAINBOW SMELT	82	2	.	.	Fresh Dead
RAINBOW SMELT	76	2	.	.	Fresh Dead
RAINBOW SMELT	97	5	.	.	Fresh Dead
RAINBOW SMELT	87	4	.	.	Fresh Dead
RAINBOW SMELT	85	3	.	.	Fresh Dead
RAINBOW SMELT	113	6	.	.	Fresh Dead
RAINBOW SMELT	79	3	.	.	Fresh Dead
RAINBOW SMELT	147	15	.	.	Fresh Dead
RAINBOW SMELT	87	4	.	.	Fresh Dead
RAINBOW SMELT	94	5	.	.	Fresh Dead
RAINBOW SMELT	137	12	.	.	Fresh Dead
RAINBOW SMELT	107	7	.	.	Fresh Dead
RAINBOW SMELT	96	4	.	.	Fresh Dead
RAINBOW SMELT	92	4	.	.	Fresh Dead
RAINBOW SMELT	88	4	.	.	Fresh Dead
RAINBOW SMELT	81	3	.	.	Fresh Dead
RAINBOW SMELT	93	4	.	.	Fresh Dead
RAINBOW SMELT	88	4	.	.	Fresh Dead
RAINBOW SMELT	100	5	.	.	Fresh Dead
RAINBOW SMELT	61	1	.	.	Fresh Dead
RAINBOW SMELT	117	7	.	.	Fresh Dead
RAINBOW SMELT	82	3	.	.	Fresh Dead
RAINBOW SMELT	87	4	.	.	Fresh Dead
RAINBOW SMELT	99	5	.	.	Fresh Dead
RAINBOW SMELT	.	.	2	5	Fresh Dead
RAINBOW SMELT	43	1	.	.	Fresh Dead
RAINBOW SMELT	40	1	.	.	Fresh Dead
RAINBOW SMELT	38	1	.	.	Fresh Dead
RAINBOW SMELT	37	1	.	.	Fresh Dead
SPOTTAIL SHINER	90	6	.	.	Live
SPOTTAIL SHINER	80	4	.	.	Fresh Dead
SPOTTAIL SHINER	91	6	.	.	Fresh Dead
SPOTTAIL SHINER	118	10	.	.	Fresh Dead
BLACK BULLHEAD	245	172	.	.	Live
TROUT-PERCH	111	11	.	.	Fresh Dead
BURBOT	183	44	.	.	Fresh Dead
THREESPINE STICKLEBACK	46	1	.	.	Fresh Dead
YELLOW PERCH	78	4	.	.	Fresh Dead
YELLOW PERCH	68	3	.	.	Fresh Dead
YELLOW PERCH	79	4	.	.	Fresh Dead
YELLOW PERCH	72	3	.	.	Fresh Dead
MOTTLED SCULPIN	73	6	.	.	Fresh Dead
DEEPWATER SCULPIN	108	13	.	.	Fresh Dead

SAMPLING PERIOD: 08-09NOV06 START DATE AND TIME: 08NOV06:10:20 END DATE AND TIME: 09NOV06:10:22
SAMPLING DURATION (hrs.): 24.03 CW VOLUME SAMPLED (gals x 10^6): 504.7000
INTAKE TEMPERATURES (F): MINIMUM= 40.3 MEAN= 42.2 MAXIMUM= 45.2
DISCHARGE TEMPERATURES (F): MINIMUM= 43.9 MEAN= 52.4 MAXIMUM= 63.2 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 08-11NOV06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 2016.0

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
ALEWIFE	187	52	.	.	Fresh Dead	
ALEWIFE	106	9	.	.	Fresh Dead	
ALEWIFE	129	16	.	.	Fresh Dead	
ALEWIFE	108	9	.	.	Fresh Dead	
ALEWIFE	92	6	.	.	Fresh Dead	
ALEWIFE	137	16	.	.	Fresh Dead	
ALEWIFE	84	4	.	.	Fresh Dead	
ALEWIFE	95	7	.	.	Fresh Dead	
ALEWIFE	136	24	.	.	Fresh Dead	
ALEWIFE	83	4	.	.	Fresh Dead	
ALEWIFE	110	12	.	.	Fresh Dead	
ALEWIFE	83	5	.	.	Fresh Dead	

ALEWIFE	94	7	.	.	Fresh Dead
ALEWIFE	81	4	.	.	Fresh Dead
ALEWIFE	148	23	.	.	Fresh Dead
ALEWIFE	105	9	.	.	Fresh Dead
ALEWIFE	95	6	.	.	Fresh Dead
ALEWIFE	79	3	.	.	Fresh Dead
ALEWIFE	104	9	.	.	Fresh Dead
ALEWIFE	76	3	.	.	Fresh Dead
ALEWIFE	75	3	.	.	Fresh Dead
ALEWIFE	83	5	.	.	Fresh Dead
ALEWIFE	100	8	.	.	Fresh Dead
ALEWIFE	87	4	.	.	Fresh Dead
ALEWIFE	80	4	.	.	Fresh Dead
ALEWIFE	79	4	.	.	Fresh Dead
ALEWIFE	82	4	.	.	Fresh Dead
ALEWIFE	81	4	.	.	Fresh Dead
ALEWIFE	62	2	.	.	Fresh Dead
ALEWIFE	82	4	.	.	Fresh Dead
ALEWIFE	62	2	.	.	Fresh Dead
ALEWIFE	87	5	.	.	Fresh Dead
ALEWIFE	89	5	.	.	Fresh Dead
ALEWIFE	78	3	.	.	Fresh Dead
ALEWIFE	96	8	.	.	Fresh Dead
ALEWIFE	77	4	.	.	Fresh Dead
ALEWIFE	83	4	.	.	Fresh Dead
ALEWIFE	82	4	.	.	Fresh Dead
ALEWIFE	83	5	.	.	Fresh Dead
ALEWIFE	84	5	.	.	Fresh Dead
ALEWIFE	89	5	.	.	Fresh Dead
ALEWIFE	87	5	.	.	Fresh Dead
ALEWIFE	95	7	.	.	Fresh Dead
ALEWIFE	78	3	.	.	Fresh Dead
ALEWIFE	92	6	.	.	Fresh Dead
ALEWIFE	97	7	.	.	Fresh Dead
ALEWIFE	92	5	.	.	Fresh Dead
ALEWIFE	84	4	.	.	Fresh Dead
ALEWIFE	73	3	.	.	Fresh Dead
ALEWIFE	79	4	.	.	Fresh Dead
ALEWIFE	.	.	15	50	Fresh Dead
ALEWIFE	.	.	77	365	Fresh Dead
ALEWIFE	.	.	25	70	Fresh Dead
ALEWIFE	.	.	96	450	Fresh Dead
GIZZARD SHAD	126	20	.	.	Fresh Dead
GIZZARD SHAD	107	10	.	.	Fresh Dead
GIZZARD SHAD	97	7	.	.	Fresh Dead
GIZZARD SHAD	101	9	.	.	Fresh Dead
GIZZARD SHAD	87	5	.	.	Fresh Dead
GIZZARD SHAD	82	6	.	.	Fresh Dead
BLOATER	66	2	.	.	Fresh Dead
BLOATER	86	5	.	.	Fresh Dead
RAINBOW SMELT	130	13	.	.	Fresh Dead
RAINBOW SMELT	119	9	.	.	Fresh Dead
RAINBOW SMELT	86	3	.	.	Fresh Dead
RAINBOW SMELT	112	8	.	.	Fresh Dead
RAINBOW SMELT	123	10	.	.	Fresh Dead
RAINBOW SMELT	.	.	2	13	Fresh Dead
RAINBOW SMELT	87	3	.	.	Fresh Dead
RAINBOW SMELT	86	3	.	.	Fresh Dead
SPOTTAIL SHINER	92	7	.	.	Fresh Dead
SPOTTAIL SHINER	109	9	.	.	Fresh Dead
SPOTTAIL SHINER	102	9	.	.	Fresh Dead
WHITE SUCKER	357	550	.	.	Fresh Dead
CHANNEL CATFISH	179	41	.	.	Fresh Dead
CHANNEL CATFISH	65	2	.	.	Fresh Dead
BURBOT	205	58	.	.	Fresh Dead
YELLOW PERCH	145	30	.	.	Fresh Dead
YELLOW PERCH	124	19	.	.	Fresh Dead
YELLOW PERCH	144	34	.	.	Fresh Dead
YELLOW PERCH	127	24	.	.	Fresh Dead
YELLOW PERCH	80	5	.	.	Fresh Dead
YELLOW PERCH	133	22	.	.	Fresh Dead
YELLOW PERCH	.	.	1	4	Fresh Dead
MOTTLED SCULPIN	68	5	.	.	Fresh Dead
DEEPWATER SCULPIN	82	4	.	.	Fresh Dead

SAMPLING PERIOD: 13-14NOV06 START DATE AND TIME: 13NOV06:10:25 END DATE AND TIME: 14NOV06:10:24
SAMPLING DURATION (hrs.): 23.98 CW VOLUME SAMPLED (gals x 10^6): 503.6500
INTAKE TEMPERATURES (F): MINIMUM= 40.8 MEAN= 41.5 MAXIMUM= 44.8
DISCHARGE TEMPERATURES (F): MINIMUM= 42.2 MEAN= 51.2 MAXIMUM= 62.4 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 12-14NOV06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 1598.4

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
ALEWIFE	87	5	.	.	Fresh Dead	
ALEWIFE	104	7	.	.	Fresh Dead	
ALEWIFE	107	9	.	.	Fresh Dead	
ALEWIFE	98	7	.	.	Fresh Dead	
ALEWIFE	88	5	.	.	Fresh Dead	

ALEWIFE	76	3	.	.	Fresh Dead
ALEWIFE	92	6	.	.	Fresh Dead
ALEWIFE	107	9	.	.	Fresh Dead
ALEWIFE	105	8	.	.	Fresh Dead
ALEWIFE	82	4	.	.	Fresh Dead
ALEWIFE	103	8	.	.	Fresh Dead
ALEWIFE	80	3	.	.	Fresh Dead
ALEWIFE	88	4	.	.	Fresh Dead
ALEWIFE	90	5	.	.	Fresh Dead
ALEWIFE	102	8	.	.	Fresh Dead
ALEWIFE	106	9	.	.	Fresh Dead
ALEWIFE	95	6	.	.	Fresh Dead
ALEWIFE	147	21	.	.	Fresh Dead
ALEWIFE	82	3	.	.	Fresh Dead
ALEWIFE	77	3	.	.	Fresh Dead
ALEWIFE	92	5	.	.	Fresh Dead
ALEWIFE	94	6	.	.	Fresh Dead
ALEWIFE	82	4	.	.	Fresh Dead
ALEWIFE	88	5	.	.	Fresh Dead
ALEWIFE	85	5	.	.	Fresh Dead
ALEWIFE	96	6	.	.	Fresh Dead
ALEWIFE	82	4	.	.	Fresh Dead
ALEWIFE	82	4	.	.	Fresh Dead
ALEWIFE	91	5	.	.	Fresh Dead
ALEWIFE	92	6	.	.	Fresh Dead
ALEWIFE	98	7	.	.	Fresh Dead
ALEWIFE	91	5	.	.	Fresh Dead
ALEWIFE	88	5	.	.	Fresh Dead
ALEWIFE	82	4	.	.	Fresh Dead
ALEWIFE	91	5	.	.	Fresh Dead
ALEWIFE	86	4	.	.	Fresh Dead
ALEWIFE	101	8	.	.	Fresh Dead
ALEWIFE	117	12	.	.	Fresh Dead
ALEWIFE	81	4	.	.	Fresh Dead
ALEWIFE	90	6	.	.	Fresh Dead
ALEWIFE	94	5	.	.	Fresh Dead
ALEWIFE	85	5	.	.	Fresh Dead
ALEWIFE	78	4	.	.	Fresh Dead
ALEWIFE	97	6	.	.	Fresh Dead
ALEWIFE	89	5	.	.	Fresh Dead
ALEWIFE	77	3	.	.	Fresh Dead
ALEWIFE	90	5	.	.	Fresh Dead
ALEWIFE	85	4	.	.	Fresh Dead
ALEWIFE	81	4	.	.	Fresh Dead
ALEWIFE	93	5	.	.	Fresh Dead
ALEWIFE	.	.	100	340	Fresh Dead
ALEWIFE	.	.	1002	4200	Fresh Dead
ALEWIFE	.	.	1145	4800	Fresh Dead
ALEWIFE	.	.	1383	5800	Fresh Dead
ALEWIFE	.	.	1312	5500	Fresh Dead
ALEWIFE	.	.	692	2900	Fresh Dead
ALEWIFE	.	.	1073	4500	Fresh Dead
ALEWIFE	.	.	954	4000	Fresh Dead
ALEWIFE	.	.	1169	4900	Fresh Dead
ALEWIFE	.	.	739	3100	Fresh Dead
ALEWIFE	.	.	632	2650	Fresh Dead
ALEWIFE	.	.	1729	7250	Fresh Dead
ALEWIFE	.	.	167	700	Fresh Dead
GIZZARD SHAD	123	17	.	.	Fresh Dead
GIZZARD SHAD	118	14	.	.	Fresh Dead
GIZZARD SHAD	123	17	.	.	Fresh Dead
GIZZARD SHAD	118	16	.	.	Fresh Dead
GIZZARD SHAD	113	14	.	.	Fresh Dead
GIZZARD SHAD	109	12	.	.	Fresh Dead
GIZZARD SHAD	117	15	.	.	Fresh Dead
GIZZARD SHAD	123	15	.	.	Fresh Dead
GIZZARD SHAD	121	16	.	.	Fresh Dead
GIZZARD SHAD	122	15	.	.	Fresh Dead
GIZZARD SHAD	117	15	.	.	Fresh Dead
GIZZARD SHAD	116	13	.	.	Fresh Dead
GIZZARD SHAD	120	16	.	.	Fresh Dead
GIZZARD SHAD	105	11	.	.	Fresh Dead
GIZZARD SHAD	101	9	.	.	Fresh Dead
GIZZARD SHAD	113	14	.	.	Fresh Dead
GIZZARD SHAD	113	13	.	.	Fresh Dead
GIZZARD SHAD	95	7	.	.	Fresh Dead
GIZZARD SHAD	123	17	.	.	Fresh Dead
GIZZARD SHAD	102	11	.	.	Fresh Dead
RAINBOW SMELT	130	11	.	.	Fresh Dead
RAINBOW SMELT	109	6	.	.	Fresh Dead
RAINBOW SMELT	127	9	.	.	Fresh Dead
RAINBOW SMELT	76	3	.	.	Fresh Dead
RAINBOW SMELT	104	5	.	.	Fresh Dead
SPOTTAIL SHINER	83	5	.	.	Fresh Dead
SPOTTAIL SHINER	96	7	.	.	Fresh Dead
SPOTTAIL SHINER	99	8	.	.	Fresh Dead
SPOTTAIL SHINER	88	5	.	.	Fresh Dead
SPOTTAIL SHINER	84	5	.	.	Fresh Dead
SPOTTAIL SHINER	85	4	.	.	Fresh Dead
SPOTTAIL SHINER	94	7	.	.	Fresh Dead

THREESPINE STICKLEBACK	55	1	.	.	Fresh Dead
YELLOW PERCH	87	6	.	.	Fresh Dead
YELLOW PERCH	91	7	.	.	Fresh Dead
YELLOW PERCH	75	3	.	.	Fresh Dead
YELLOW PERCH	144	26	.	.	Fresh Dead
YELLOW PERCH	86	5	.	.	Fresh Dead
YELLOW PERCH	86	5	.	.	Fresh Dead
YELLOW PERCH	92	7	.	.	Fresh Dead
YELLOW PERCH	142	26	.	.	Fresh Dead
YELLOW PERCH	114	13	.	.	Fresh Dead
YELLOW PERCH	58	2	.	.	Fresh Dead
MOTTLED SCULPIN	79	8	.	.	Fresh Dead
MOTTLED SCULPIN	88	10	.	.	Fresh Dead

SAMPLING PERIOD: 15-16NOV06 START DATE AND TIME: 15NOV06:10:07 END DATE AND TIME: 16NOV06:10:15
SAMPLING DURATION (hrs.): 24.13 CW VOLUME SAMPLED (gals x 10^6): 767.4400
INTAKE TEMPERATURES (F): MINIMUM= 40.0 MEAN= 40.9 MAXIMUM= 41.7
DISCHARGE TEMPERATURES (F): MINIMUM= 40.2 MEAN= 50.2 MAXIMUM= 60.2 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 15-18NOV06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 3052.8

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
ALEWIFE	85	4	.	.	Fresh Dead	
ALEWIFE	83	4	.	.	Fresh Dead	
ALEWIFE	96	7	.	.	Fresh Dead	
ALEWIFE	81	3	.	.	Fresh Dead	
ALEWIFE	93	5	.	.	Fresh Dead	
ALEWIFE	86	4	.	.	Fresh Dead	
ALEWIFE	69	2	.	.	Fresh Dead	
ALEWIFE	83	4	.	.	Fresh Dead	
ALEWIFE	87	4	.	.	Fresh Dead	
ALEWIFE	82	4	.	.	Fresh Dead	
ALEWIFE	106	8	.	.	Fresh Dead	
ALEWIFE	85	4	.	.	Fresh Dead	
ALEWIFE	78	3	.	.	Fresh Dead	
ALEWIFE	78	3	.	.	Fresh Dead	
ALEWIFE	80	4	.	.	Fresh Dead	
ALEWIFE	88	5	.	.	Fresh Dead	
ALEWIFE	141	20	.	.	Fresh Dead	
ALEWIFE	97	6	.	.	Fresh Dead	
ALEWIFE	95	6	.	.	Fresh Dead	
ALEWIFE	97	7	.	.	Fresh Dead	
ALEWIFE	72	3	.	.	Fresh Dead	
ALEWIFE	102	8	.	.	Fresh Dead	
ALEWIFE	101	7	.	.	Fresh Dead	
ALEWIFE	96	6	.	.	Fresh Dead	
ALEWIFE	81	4	.	.	Fresh Dead	
ALEWIFE	89	4	.	.	Fresh Dead	
ALEWIFE	79	4	.	.	Fresh Dead	
ALEWIFE	85	4	.	.	Fresh Dead	
ALEWIFE	77	3	.	.	Fresh Dead	
ALEWIFE	79	3	.	.	Fresh Dead	
ALEWIFE	76	3	.	.	Fresh Dead	
ALEWIFE	99	6	.	.	Fresh Dead	
ALEWIFE	81	3	.	.	Fresh Dead	
ALEWIFE	80	3	.	.	Fresh Dead	
ALEWIFE	81	3	.	.	Fresh Dead	
ALEWIFE	74	2	.	.	Fresh Dead	
ALEWIFE	74	3	.	.	Fresh Dead	
ALEWIFE	72	2	.	.	Fresh Dead	
ALEWIFE	78	3	.	.	Fresh Dead	
ALEWIFE	77	2	.	.	Fresh Dead	
ALEWIFE	81	4	.	.	Fresh Dead	
ALEWIFE	78	3	.	.	Fresh Dead	
ALEWIFE	126	15	.	.	Fresh Dead	
ALEWIFE	113	10	.	.	Fresh Dead	
ALEWIFE	108	9	.	.	Fresh Dead	
ALEWIFE	105	8	.	.	Fresh Dead	
ALEWIFE	93	6	.	.	Fresh Dead	
ALEWIFE	92	5	.	.	Fresh Dead	
ALEWIFE	91	5	.	.	Fresh Dead	
ALEWIFE	75	2	.	.	Fresh Dead	
ALEWIFE	.	.	100	460	Fresh Dead	
ALEWIFE	.	.	317	1500	Fresh Dead	
ALEWIFE	.	.	423	2000	Fresh Dead	
ALEWIFE	.	.	3507	16600	Fresh Dead	
ALEWIFE	.	.	254	1200	Fresh Dead	
GIZZARD SHAD	463	1150	.	.	Fresh Dead	
GIZZARD SHAD	102	8	.	.	Fresh Dead	
GIZZARD SHAD	109	11	.	.	Fresh Dead	
BLOATER	93	5	.	.	Fresh Dead	
LAKE TROUT	634	1900	.	.	Fresh Dead	
SPOTTAIL SHINER	89	5	.	.	Fresh Dead	
SPOTTAIL SHINER	82	4	.	.	Fresh Dead	
SPOTTAIL SHINER	90	6	.	.	Fresh Dead	
SPOTTAIL SHINER	88	6	.	.	Fresh Dead	
SPOTTAIL SHINER	95	5	.	.	Fresh Dead	
LONGNOSE DACE	86	8	.	.	Fresh Dead	

WHITE SUCKER	467	1200	.	.	Live
BURBOT	698	1700	.	.	Live
BURBOT	628	1450	.	.	Fresh Dead
THREESPINE STICKLEBACK	50	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	53	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	48	1	.	.	Fresh Dead
YELLOW PERCH	74	3	.	.	Fresh Dead
YELLOW PERCH	78	3	.	.	Fresh Dead
MOTTLED SCULPIN	71	6	.	.	Fresh Dead

SAMPLING PERIOD: 19-20NOV06 START DATE AND TIME: 19NOV06:10:22 END DATE AND TIME: 20NOV06:10:22
SAMPLING DURATION (hrs.): 24.00 CW VOLUME SAMPLED (gals x 10^6): 763.2000
INTAKE TEMPERATURES (F): MINIMUM= 38.7 MEAN= 40.6 MAXIMUM= 43.3
DISCHARGE TEMPERATURES (F): MINIMUM= 57.1 MEAN= 66.2 MAXIMUM= 75.3 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 19-21NOV06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 2424.6

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
ALEWIFE	99	7	.	.	Fresh Dead	
ALEWIFE	88	4	.	.	Fresh Dead	
ALEWIFE	95	5	.	.	Fresh Dead	
ALEWIFE	99	6	.	.	Fresh Dead	
ALEWIFE	95	5	.	.	Fresh Dead	
ALEWIFE	102	7	.	.	Fresh Dead	
ALEWIFE	97	6	.	.	Fresh Dead	
ALEWIFE	82	3	.	.	Fresh Dead	
ALEWIFE	92	5	.	.	Fresh Dead	
ALEWIFE	111	9	.	.	Fresh Dead	
ALEWIFE	83	4	.	.	Fresh Dead	
ALEWIFE	83	4	.	.	Fresh Dead	
ALEWIFE	88	5	.	.	Fresh Dead	
ALEWIFE	95	5	.	.	Fresh Dead	
ALEWIFE	85	4	.	.	Fresh Dead	
ALEWIFE	88	4	.	.	Fresh Dead	
ALEWIFE	91	5	.	.	Fresh Dead	
ALEWIFE	84	3	.	.	Fresh Dead	
ALEWIFE	152	24	.	.	Fresh Dead	
ALEWIFE	154	28	.	.	Fresh Dead	
ALEWIFE	85	4	.	.	Fresh Dead	
ALEWIFE	78	3	.	.	Fresh Dead	
ALEWIFE	93	5	.	.	Fresh Dead	
ALEWIFE	126	15	.	.	Fresh Dead	
ALEWIFE	89	4	.	.	Fresh Dead	
ALEWIFE	91	5	.	.	Fresh Dead	
ALEWIFE	95	6	.	.	Fresh Dead	
ALEWIFE	117	13	.	.	Fresh Dead	
ALEWIFE	118	11	.	.	Fresh Dead	
ALEWIFE	88	4	.	.	Fresh Dead	
ALEWIFE	104	7	.	.	Fresh Dead	
ALEWIFE	89	5	.	.	Fresh Dead	
ALEWIFE	89	5	.	.	Fresh Dead	
ALEWIFE	87	4	.	.	Fresh Dead	
ALEWIFE	109	8	.	.	Fresh Dead	
ALEWIFE	95	5	.	.	Fresh Dead	
ALEWIFE	87	4	.	.	Fresh Dead	
ALEWIFE	89	4	.	.	Fresh Dead	
ALEWIFE	90	4	.	.	Fresh Dead	
ALEWIFE	119	10	.	.	Fresh Dead	
ALEWIFE	83	4	.	.	Fresh Dead	
ALEWIFE	86	4	.	.	Fresh Dead	
ALEWIFE	85	4	.	.	Fresh Dead	
ALEWIFE	81	3	.	.	Fresh Dead	
ALEWIFE	86	4	.	.	Fresh Dead	
ALEWIFE	97	6	.	.	Fresh Dead	
ALEWIFE	102	8	.	.	Fresh Dead	
ALEWIFE	72	2	.	.	Fresh Dead	
ALEWIFE	93	5	.	.	Fresh Dead	
ALEWIFE	83	4	.	.	Fresh Dead	
ALEWIFE	.	.	6	20	Fresh Dead	
ALEWIFE	.	.	65	230	Fresh Dead	
GIZZARD SHAD	108	10	.	.	Live	
GIZZARD SHAD	115	13	.	.	Fresh Dead	
WHITE SUCKER	478	1240	.	.	Live	
THREESPINE STICKLEBACK	44	1	.	.	Fresh Dead	
THREESPINE STICKLEBACK	58	2	.	.	Fresh Dead	
THREESPINE STICKLEBACK	55	1	.	.	Fresh Dead	
THREESPINE STICKLEBACK	51	1	.	.	Live	
THREESPINE STICKLEBACK	50	1	.	.	Fresh Dead	
THREESPINE STICKLEBACK	52	1	.	.	Fresh Dead	
THREESPINE STICKLEBACK	45	1	.	.	Fresh Dead	
THREESPINE STICKLEBACK	57	1	.	.	Fresh Dead	
THREESPINE STICKLEBACK	52	1	.	.	Fresh Dead	
THREESPINE STICKLEBACK	50	1	.	.	Fresh Dead	
THREESPINE STICKLEBACK	55	1	.	.	Fresh Dead	
FRESHWATER DRUM	454	1250	.	.	Fresh Dead	

SAMPLING PERIOD: 21-22NOV06 START DATE AND TIME: 21NOV06:10:00 END DATE AND TIME: 22NOV06:10:00
SAMPLING DURATION (hrs.): 24.00 CW VOLUME SAMPLED (gals x 10^6): 979.2000
INTAKE TEMPERATURES (F): MINIMUM= 39.2 MEAN= 40.7 MAXIMUM= 43.0
DISCHARGE TEMPERATURES (F): MINIMUM= 57.9 MEAN= 59.5 MAXIMUM= 62.7 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 22-25NOV06 CW VOLUME (gals x 10^6) FOR EXTRAPOLATION PERIOD: 3916.8

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GREAT LAKES CRAYFISH	49	5	.	.	Fresh Dead	
ALEWIFE	84	4	.	.	Fresh Dead	
ALEWIFE	91	5	.	.	Fresh Dead	
ALEWIFE	108	8	.	.	Fresh Dead	
ALEWIFE	93	5	.	.	Fresh Dead	
ALEWIFE	92	5	.	.	Fresh Dead	
ALEWIFE	84	4	.	.	Fresh Dead	
ALEWIFE	89	5	.	.	Fresh Dead	
ALEWIFE	90	4	.	.	Fresh Dead	
ALEWIFE	82	3	.	.	Fresh Dead	
ALEWIFE	83	3	.	.	Fresh Dead	
ALEWIFE	88	4	.	.	Fresh Dead	
ALEWIFE	81	3	.	.	Fresh Dead	
ALEWIFE	86	4	.	.	Fresh Dead	
ALEWIFE	97	6	.	.	Fresh Dead	
ALEWIFE	90	5	.	.	Fresh Dead	
ALEWIFE	87	4	.	.	Fresh Dead	
ALEWIFE	88	4	.	.	Fresh Dead	
ALEWIFE	92	5	.	.	Fresh Dead	
ALEWIFE	103	7	.	.	Fresh Dead	
ALEWIFE	90	5	.	.	Fresh Dead	
ALEWIFE	97	6	.	.	Fresh Dead	
ALEWIFE	84	4	.	.	Fresh Dead	
ALEWIFE	94	5	.	.	Fresh Dead	
ALEWIFE	104	8	.	.	Fresh Dead	
ALEWIFE	87	4	.	.	Fresh Dead	
ALEWIFE	104	7	.	.	Fresh Dead	
ALEWIFE	93	5	.	.	Fresh Dead	
ALEWIFE	104	8	.	.	Fresh Dead	
ALEWIFE	90	5	.	.	Fresh Dead	
ALEWIFE	107	8	.	.	Fresh Dead	
ALEWIFE	88	4	.	.	Fresh Dead	
ALEWIFE	96	5	.	.	Fresh Dead	
ALEWIFE	97	6	.	.	Fresh Dead	
ALEWIFE	93	5	.	.	Fresh Dead	
ALEWIFE	74	3	.	.	Fresh Dead	
ALEWIFE	87	4	.	.	Fresh Dead	
ALEWIFE	95	5	.	.	Fresh Dead	
ALEWIFE	95	6	.	.	Fresh Dead	
ALEWIFE	85	4	.	.	Fresh Dead	
ALEWIFE	85	4	.	.	Fresh Dead	
ALEWIFE	122	14	.	.	Fresh Dead	
ALEWIFE	103	7	.	.	Fresh Dead	
ALEWIFE	137	19	.	.	Fresh Dead	
ALEWIFE	103	7	.	.	Fresh Dead	
ALEWIFE	99	7	.	.	Fresh Dead	
ALEWIFE	118	11	.	.	Fresh Dead	
ALEWIFE	103	7	.	.	Fresh Dead	
ALEWIFE	93	5	.	.	Fresh Dead	
ALEWIFE	97	6	.	.	Fresh Dead	
ALEWIFE	83	4	.	.	Fresh Dead	
ALEWIFE	.	.	100	600	Fresh Dead	
ALEWIFE	.	.	703	4150	Fresh Dead	
ALEWIFE	.	.	1202	7100	Fresh Dead	
ALEWIFE	.	.	1134	6700	Fresh Dead	
ALEWIFE	.	.	930	5500	Fresh Dead	
GIZZARD SHAD	117	12	.	.	Fresh Dead	
GIZZARD SHAD	111	11	.	.	Fresh Dead	
GIZZARD SHAD	112	11	.	.	Fresh Dead	
GIZZARD SHAD	101	8	.	.	Fresh Dead	
GIZZARD SHAD	103	9	.	.	Fresh Dead	
GIZZARD SHAD	98	7	.	.	Fresh Dead	
GIZZARD SHAD	118	10	.	.	Fresh Dead	
GIZZARD SHAD	96	7	.	.	Fresh Dead	
GIZZARD SHAD	104	8	.	.	Fresh Dead	
GIZZARD SHAD	113	12	.	.	Fresh Dead	
GIZZARD SHAD	109	10	.	.	Fresh Dead	
GIZZARD SHAD	91	6	.	.	Fresh Dead	
GIZZARD SHAD	101	9	.	.	Fresh Dead	
GIZZARD SHAD	105	9	.	.	Fresh Dead	
GIZZARD SHAD	108	10	.	.	Fresh Dead	
GIZZARD SHAD	96	8	.	.	Fresh Dead	
GIZZARD SHAD	117	13	.	.	Fresh Dead	
GIZZARD SHAD	109	11	.	.	Fresh Dead	
GIZZARD SHAD	93	6	.	.	Fresh Dead	
GIZZARD SHAD	113	12	.	.	Fresh Dead	
GIZZARD SHAD	98	8	.	.	Fresh Dead	
GIZZARD SHAD	107	11	.	.	Fresh Dead	
GIZZARD SHAD	110	12	.	.	Fresh Dead	
GIZZARD SHAD	100	8	.	.	Fresh Dead	
GIZZARD SHAD	100	8	.	.	Fresh Dead	

GIZZARD SHAD	109	10	.	.	Fresh Dead
GIZZARD SHAD	98	7	.	.	Fresh Dead
GIZZARD SHAD	104	8	.	.	Fresh Dead
GIZZARD SHAD	104	9	.	.	Fresh Dead
GIZZARD SHAD	100	8	.	.	Fresh Dead
GIZZARD SHAD	93	7	.	.	Fresh Dead
GIZZARD SHAD	111	11	.	.	Fresh Dead
GIZZARD SHAD	97	7	.	.	Fresh Dead
GIZZARD SHAD	116	14	.	.	Fresh Dead
GIZZARD SHAD	103	8	.	.	Fresh Dead
GIZZARD SHAD	97	7	.	.	Fresh Dead
GIZZARD SHAD	101	8	.	.	Fresh Dead
GIZZARD SHAD	125	17	.	.	Fresh Dead
GIZZARD SHAD	118	12	.	.	Fresh Dead
GIZZARD SHAD	110	11	.	.	Fresh Dead
GIZZARD SHAD	97	7	.	.	Fresh Dead
GIZZARD SHAD	102	9	.	.	Fresh Dead
GIZZARD SHAD	106	10	.	.	Fresh Dead
GIZZARD SHAD	107	9	.	.	Fresh Dead
GIZZARD SHAD	93	6	.	.	Fresh Dead
GIZZARD SHAD	113	10	.	.	Fresh Dead
GIZZARD SHAD	98	7	.	.	Fresh Dead
GIZZARD SHAD	106	10	.	.	Fresh Dead
GIZZARD SHAD	97	7	.	.	Fresh Dead
GIZZARD SHAD	112	12	.	.	Fresh Dead
GIZZARD SHAD	.	.	40	500	Fresh Dead
GIZZARD SHAD	.	.	70	650	Fresh Dead
GIZZARD SHAD	.	.	79	800	Fresh Dead
BLOATER	76	3	.	.	Fresh Dead
ROUND WHITEFISH	471	800	.	.	Fresh Dead
LAKE TROUT	98	7	.	.	Fresh Dead
LAKE TROUT	94	7	.	.	Fresh Dead
RAINBOW SMELT	115	9	.	.	Fresh Dead
RAINBOW SMELT	128	11	.	.	Fresh Dead
RAINBOW SMELT	124	9	.	.	Fresh Dead
RAINBOW SMELT	134	12	.	.	Fresh Dead
RAINBOW SMELT	127	10	.	.	Fresh Dead
RAINBOW SMELT	129	11	.	.	Fresh Dead
RAINBOW SMELT	127	11	.	.	Fresh Dead
RAINBOW SMELT	130	12	.	.	Fresh Dead
RAINBOW SMELT	108	7	.	.	Fresh Dead
RAINBOW SMELT	115	8	.	.	Fresh Dead
RAINBOW SMELT	120	9	.	.	Fresh Dead
RAINBOW SMELT	96	6	.	.	Fresh Dead
RAINBOW SMELT	87	3	.	.	Fresh Dead
RAINBOW SMELT	85	3	.	.	Fresh Dead
RAINBOW SMELT	98	5	.	.	Fresh Dead
RAINBOW SMELT	145	18	.	.	Fresh Dead
RAINBOW SMELT	133	10	.	.	Fresh Dead
RAINBOW SMELT	128	11	.	.	Fresh Dead
RAINBOW SMELT	120	8	.	.	Fresh Dead
RAINBOW SMELT	120	10	.	.	Fresh Dead
RAINBOW SMELT	123	10	.	.	Fresh Dead
RAINBOW SMELT	115	8	.	.	Fresh Dead
RAINBOW SMELT	148	16	.	.	Fresh Dead
RAINBOW SMELT	107	6	.	.	Fresh Dead
RAINBOW SMELT	93	4	.	.	Fresh Dead
RAINBOW SMELT	115	8	.	.	Fresh Dead
RAINBOW SMELT	109	8	.	.	Fresh Dead
RAINBOW SMELT	129	12	.	.	Fresh Dead
RAINBOW SMELT	131	13	.	.	Fresh Dead
RAINBOW SMELT	121	9	.	.	Fresh Dead
RAINBOW SMELT	111	7	.	.	Fresh Dead
RAINBOW SMELT	122	9	.	.	Fresh Dead
RAINBOW SMELT	103	5	.	.	Fresh Dead
RAINBOW SMELT	103	6	.	.	Fresh Dead
RAINBOW SMELT	99	5	.	.	Fresh Dead
RAINBOW SMELT	117	8	.	.	Fresh Dead
RAINBOW SMELT	94	4	.	.	Fresh Dead
RAINBOW SMELT	101	5	.	.	Fresh Dead
RAINBOW SMELT	113	8	.	.	Fresh Dead
RAINBOW SMELT	103	6	.	.	Fresh Dead
RAINBOW SMELT	104	6	.	.	Fresh Dead
RAINBOW SMELT	121	10	.	.	Fresh Dead
RAINBOW SMELT	92	4	.	.	Fresh Dead
RAINBOW SMELT	113	8	.	.	Fresh Dead
RAINBOW SMELT	102	5	.	.	Fresh Dead
RAINBOW SMELT	91	4	.	.	Fresh Dead
RAINBOW SMELT	92	4	.	.	Fresh Dead
RAINBOW SMELT	93	4	.	.	Fresh Dead
RAINBOW SMELT	101	5	.	.	Fresh Dead
RAINBOW SMELT	84	3	.	.	Fresh Dead
RAINBOW SMELT	97	4	.	.	Fresh Dead
RAINBOW SMELT	.	.	34	135	Fresh Dead
RAINBOW SMELT	.	.	70	300	Fresh Dead
RAINBOW SMELT	.	.	763	4100	Fresh Dead
COMMON SHINER	137	28	.	.	Fresh Dead
SPOTTAIL SHINER	79	4	.	.	Fresh Dead
SPOTTAIL SHINER	96	7	.	.	Fresh Dead
SPOTTAIL SHINER	100	9	.	.	Fresh Dead

SPOTTAIL SHINER	85	5	.	.	Fresh Dead
SPOTTAIL SHINER	88	4	.	.	Fresh Dead
SPOTTAIL SHINER	79	4	.	.	Fresh Dead
SPOTTAIL SHINER	96	7	.	.	Fresh Dead
SPOTTAIL SHINER	94	6	.	.	Fresh Dead
SPOTTAIL SHINER	87	5	.	.	Fresh Dead
SPOTTAIL SHINER	92	7	.	.	Fresh Dead
SPOTTAIL SHINER	85	4	.	.	Fresh Dead
SPOTTAIL SHINER	84	5	.	.	Fresh Dead
SPOTTAIL SHINER	88	5	.	.	Fresh Dead
SPOTTAIL SHINER	93	6	.	.	Fresh Dead
SPOTTAIL SHINER	96	7	.	.	Fresh Dead
SPOTTAIL SHINER	79	4	.	.	Fresh Dead
SPOTTAIL SHINER	83	4	.	.	Fresh Dead
SPOTTAIL SHINER	75	3	.	.	Fresh Dead
SPOTTAIL SHINER	92	5	.	.	Fresh Dead
SPOTTAIL SHINER	74	3	.	.	Fresh Dead
SPOTTAIL SHINER	78	4	.	.	Fresh Dead
SPOTTAIL SHINER	94	6	.	.	Fresh Dead
SPOTTAIL SHINER	92	6	.	.	Fresh Dead
SPOTTAIL SHINER	93	6	.	.	Fresh Dead
SPOTTAIL SHINER	91	6	.	.	Fresh Dead
SPOTTAIL SHINER	89	5	.	.	Fresh Dead
SPOTTAIL SHINER	87	4	.	.	Fresh Dead
SPOTTAIL SHINER	82	4	.	.	Fresh Dead
SPOTTAIL SHINER	92	5	.	.	Fresh Dead
SPOTTAIL SHINER	93	6	.	.	Fresh Dead
SPOTTAIL SHINER	90	5	.	.	Fresh Dead
SPOTTAIL SHINER	99	7	.	.	Fresh Dead
SPOTTAIL SHINER	89	6	.	.	Fresh Dead
SPOTTAIL SHINER	91	6	.	.	Fresh Dead
SPOTTAIL SHINER	87	6	.	.	Fresh Dead
SPOTTAIL SHINER	86	4	.	.	Fresh Dead
SPOTTAIL SHINER	81	4	.	.	Fresh Dead
SPOTTAIL SHINER	110	12	.	.	Fresh Dead
SPOTTAIL SHINER	116	13	.	.	Fresh Dead
SPOTTAIL SHINER	92	6	.	.	Fresh Dead
SPOTTAIL SHINER	113	11	.	.	Fresh Dead
SPOTTAIL SHINER	96	8	.	.	Fresh Dead
SPOTTAIL SHINER	99	7	.	.	Fresh Dead
SPOTTAIL SHINER	87	5	.	.	Fresh Dead
SPOTTAIL SHINER	98	7	.	.	Fresh Dead
SPOTTAIL SHINER	89	6	.	.	Fresh Dead
SPOTTAIL SHINER	87	5	.	.	Fresh Dead
SPOTTAIL SHINER	90	5	.	.	Fresh Dead
SPOTTAIL SHINER	88	5	.	.	Fresh Dead
SPOTTAIL SHINER	86	6	.	.	Fresh Dead
SPOTTAIL SHINER	.	.	100	650	Fresh Dead
SPOTTAIL SHINER	.	.	96	600	Fresh Dead
LONGNOSE DACE	94	9	.	.	Fresh Dead
LONGNOSE DACE	87	7	.	.	Fresh Dead
LONGNOSE DACE	79	6	.	.	Fresh Dead
WHITE SUCKER	470	1500	.	.	Fresh Dead
WHITE SUCKER	521	1650	.	.	Fresh Dead
CHANNEL CATFISH	178	35	.	.	Fresh Dead
CHANNEL CATFISH	115	7	.	.	Fresh Dead
CHANNEL CATFISH	63	2	.	.	Fresh Dead
CHANNEL CATFISH	66	2	.	.	Fresh Dead
CHANNEL CATFISH	60	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	52	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	50	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	52	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	52	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	53	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	51	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	55	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	49	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	55	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	52	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	50	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	52	1	.	.	Live
THREESPINE STICKLEBACK	53	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	51	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	50	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	49	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	46	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	49	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	49	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	52	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	53	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	60	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	56	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	55	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	52	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	52	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	51	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	55	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	52	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	47	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	45	1	.	.	Fresh Dead

THREESPINE STICKLEBACK	54	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	48	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	49	1	.	.	Fresh Dead
WHITE PERCH	68	3	.	.	Fresh Dead
WHITE PERCH	205	130	.	.	Fresh Dead
BLUEGILL	72	6	.	.	Fresh Dead
BLUEGILL	75	6	.	.	Fresh Dead
YELLOW PERCH	78	4	.	.	Fresh Dead
YELLOW PERCH	73	3	.	.	Fresh Dead
YELLOW PERCH	67	3	.	.	Fresh Dead
YELLOW PERCH	85	5	.	.	Fresh Dead
YELLOW PERCH	73	3	.	.	Fresh Dead
YELLOW PERCH	161	41	.	.	Fresh Dead
YELLOW PERCH	126	17	.	.	Fresh Dead
YELLOW PERCH	87	6	.	.	Fresh Dead
YELLOW PERCH	79	3	.	.	Fresh Dead
YELLOW PERCH	91	6	.	.	Fresh Dead
YELLOW PERCH	82	4	.	.	Fresh Dead
YELLOW PERCH	90	6	.	.	Fresh Dead
YELLOW PERCH	76	3	.	.	Fresh Dead
YELLOW PERCH	70	3	.	.	Fresh Dead
YELLOW PERCH	74	3	.	.	Fresh Dead
YELLOW PERCH	77	4	.	.	Fresh Dead
YELLOW PERCH	75	3	.	.	Fresh Dead
YELLOW PERCH	75	3	.	.	Fresh Dead
YELLOW PERCH	76	4	.	.	Fresh Dead
YELLOW PERCH	74	3	.	.	Fresh Dead
YELLOW PERCH	86	5	.	.	Fresh Dead
YELLOW PERCH	78	3	.	.	Fresh Dead
YELLOW PERCH	69	2	.	.	Fresh Dead
YELLOW PERCH	79	4	.	.	Fresh Dead
YELLOW PERCH	79	4	.	.	Fresh Dead
YELLOW PERCH	75	4	.	.	Fresh Dead
YELLOW PERCH	79	4	.	.	Fresh Dead
YELLOW PERCH	72	3	.	.	Fresh Dead
YELLOW PERCH	78	4	.	.	Fresh Dead
YELLOW PERCH	67	3	.	.	Fresh Dead
YELLOW PERCH	76	3	.	.	Fresh Dead
YELLOW PERCH	81	4	.	.	Fresh Dead
YELLOW PERCH	72	3	.	.	Fresh Dead
YELLOW PERCH	70	3	.	.	Fresh Dead
YELLOW PERCH	65	2	.	.	Fresh Dead
YELLOW PERCH	66	2	.	.	Fresh Dead
YELLOW PERCH	66	2	.	.	Fresh Dead
YELLOW PERCH	72	2	.	.	Fresh Dead
YELLOW PERCH	90	6	.	.	Live
YELLOW PERCH	72	3	.	.	Fresh Dead
YELLOW PERCH	89	6	.	.	Fresh Dead
YELLOW PERCH	82	4	.	.	Fresh Dead
YELLOW PERCH	77	3	.	.	Fresh Dead
YELLOW PERCH	81	5	.	.	Fresh Dead
YELLOW PERCH	71	3	.	.	Fresh Dead
YELLOW PERCH	72	3	.	.	Fresh Dead
YELLOW PERCH	72	3	.	.	Fresh Dead
YELLOW PERCH	80	4	.	.	Fresh Dead
YELLOW PERCH	76	3	.	.	Fresh Dead
YELLOW PERCH	85	5	.	.	Fresh Dead
YELLOW PERCH	.	.	23	70	Fresh Dead
MOTTLED SCULPIN	88	10	.	.	Fresh Dead
MOTTLED SCULPIN	68	4	.	.	Fresh Dead
MOTTLED SCULPIN	73	6	.	.	Fresh Dead
MOTTLED SCULPIN	77	6	.	.	Fresh Dead
MOTTLED SCULPIN	48	2	.	.	Fresh Dead

SAMPLING PERIOD: 27-28NOV06 START DATE AND TIME: 27NOV06:10:07 END DATE AND TIME: 28NOV06:10:04
SAMPLING DURATION (hrs.): 23.95 CW VOLUME SAMPLED (gals x 10^6): 977.1600
INTAKE TEMPERATURES (F): MINIMUM= 42.1 MEAN= 43.4 MAXIMUM= 48.9
DISCHARGE TEMPERATURES (F): MINIMUM= 60.9 MEAN= 62.2 MAXIMUM= 67.1 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 26-28NOV06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 2937.6

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
ALEWIFE	87	4	.	.	Fresh Dead	
ALEWIFE	88	4	.	.	Fresh Dead	
ALEWIFE	96	5	.	.	Fresh Dead	
ALEWIFE	91	5	.	.	Fresh Dead	
ALEWIFE	91	5	.	.	Fresh Dead	
ALEWIFE	97	6	.	.	Fresh Dead	
ALEWIFE	93	5	.	.	Fresh Dead	
ALEWIFE	98	6	.	.	Fresh Dead	
ALEWIFE	87	4	.	.	Fresh Dead	
ALEWIFE	80	3	.	.	Fresh Dead	
ALEWIFE	97	6	.	.	Fresh Dead	
ALEWIFE	86	4	.	.	Fresh Dead	
ALEWIFE	87	4	.	.	Fresh Dead	
ALEWIFE	92	5	.	.	Fresh Dead	
ALEWIFE	78	3	.	.	Fresh Dead	
ALEWIFE	80	3	.	.	Fresh Dead	

ALEWIFE	96	5	.	.	Fresh Dead
ALEWIFE	83	4	.	.	Fresh Dead
ALEWIFE	117	11	.	.	Fresh Dead
ALEWIFE	96	5	.	.	Fresh Dead
ALEWIFE	95	5	.	.	Fresh Dead
ALEWIFE	98	6	.	.	Fresh Dead
ALEWIFE	89	4	.	.	Fresh Dead
ALEWIFE	96	6	.	.	Fresh Dead
ALEWIFE	94	5	.	.	Fresh Dead
ALEWIFE	84	4	.	.	Fresh Dead
ALEWIFE	88	4	.	.	Fresh Dead
ALEWIFE	106	8	.	.	Fresh Dead
ALEWIFE	94	5	.	.	Fresh Dead
ALEWIFE	80	3	.	.	Fresh Dead
ALEWIFE	75	3	.	.	Fresh Dead
ALEWIFE	75	3	.	.	Fresh Dead
ALEWIFE	92	4	.	.	Fresh Dead
ALEWIFE	83	5	.	.	Live
ALEWIFE	100	6	.	.	Fresh Dead
ALEWIFE	82	3	.	.	Fresh Dead
ALEWIFE	89	4	.	.	Fresh Dead
ALEWIFE	95	5	.	.	Fresh Dead
ALEWIFE	87	4	.	.	Fresh Dead
ALEWIFE	90	5	.	.	Fresh Dead
ALEWIFE	80	3	.	.	Fresh Dead
ALEWIFE	77	3	.	.	Fresh Dead
ALEWIFE	87	4	.	.	Fresh Dead
ALEWIFE	88	4	.	.	Fresh Dead
ALEWIFE	87	4	.	.	Fresh Dead
ALEWIFE	138	19	.	.	Fresh Dead
ALEWIFE	86	4	.	.	Fresh Dead
ALEWIFE	82	3	.	.	Fresh Dead
ALEWIFE	84	3	.	.	Fresh Dead
ALEWIFE	85	3	.	.	Fresh Dead
ALEWIFE	.	.	100	440	Fresh Dead
ALEWIFE	.	.	1418	6400	Fresh Dead
ALEWIFE	.	.	1329	6000	Fresh Dead
ALEWIFE	.	.	1396	6300	Fresh Dead
ALEWIFE	.	.	1374	6200	Fresh Dead
ALEWIFE	.	.	1374	6200	Fresh Dead
ALEWIFE	.	.	1462	6600	Fresh Dead
ALEWIFE	.	.	1462	6600	Fresh Dead
ALEWIFE	.	.	1352	6100	Fresh Dead
ALEWIFE	.	.	1662	7500	Fresh Dead
ALEWIFE	.	.	1529	6900	Fresh Dead
ALEWIFE	.	.	1352	6100	Fresh Dead
ALEWIFE	.	.	1617	7300	Fresh Dead
ALEWIFE	.	.	1329	6000	Fresh Dead
ALEWIFE	.	.	1573	7100	Fresh Dead
ALEWIFE	.	.	1551	7000	Fresh Dead
ALEWIFE	.	.	1529	6900	Fresh Dead
ALEWIFE	.	.	1662	7500	Fresh Dead
ALEWIFE	.	.	1418	6400	Fresh Dead
ALEWIFE	.	.	1573	7100	Fresh Dead
ALEWIFE	.	.	1595	7200	Fresh Dead
ALEWIFE	.	.	1507	6800	Fresh Dead
ALEWIFE	.	.	1595	7200	Fresh Dead
ALEWIFE	.	.	1396	7000	Fresh Dead
ALEWIFE	.	.	1595	7500	Fresh Dead
ALEWIFE	.	.	1396	6300	Fresh Dead
ALEWIFE	.	.	244	1100	Fresh Dead
ALEWIFE	.	.	1219	5500	Fresh Dead
ALEWIFE	.	.	1573	7100	Fresh Dead
ALEWIFE	.	.	1551	7000	Fresh Dead
ALEWIFE	.	.	1551	7000	Fresh Dead
ALEWIFE	.	.	1617	7300	Fresh Dead
ALEWIFE	.	.	1706	7700	Fresh Dead
ALEWIFE	.	.	1551	7000	Fresh Dead
ALEWIFE	.	.	1662	7500	Fresh Dead
ALEWIFE	.	.	1706	7700	Fresh Dead
ALEWIFE	.	.	1640	7400	Fresh Dead
ALEWIFE	.	.	576	2600	Fresh Dead
ALEWIFE	.	.	1440	6500	Fresh Dead
ALEWIFE	.	.	1285	5800	Fresh Dead
ALEWIFE	.	.	1396	6300	Fresh Dead
ALEWIFE	.	.	1374	6200	Fresh Dead
ALEWIFE	.	.	1484	6700	Fresh Dead
ALEWIFE	.	.	1307	5900	Fresh Dead
ALEWIFE	.	.	1507	6800	Fresh Dead
ALEWIFE	.	.	1462	6600	Fresh Dead
ALEWIFE	.	.	1462	6600	Fresh Dead
ALEWIFE	.	.	1307	5900	Fresh Dead
ALEWIFE	.	.	975	4400	Fresh Dead
ALEWIFE	.	.	1263	5700	Fresh Dead
ALEWIFE	.	.	1285	5800	Fresh Dead
GIZZARD SHAD	118	12	.	.	Fresh Dead
GIZZARD SHAD	114	8	.	.	Fresh Dead
GIZZARD SHAD	110	10	.	.	Fresh Dead
GIZZARD SHAD	117	12	.	.	Fresh Dead
GIZZARD SHAD	98	6	.	.	Fresh Dead

GIZZARD SHAD	98	7	.	.	Fresh Dead
ROUND WHITEFISH	238	135	.	.	Fresh Dead
ROUND WHITEFISH	226	92	.	.	Fresh Dead
LAKE TROUT	95	7	.	.	Fresh Dead
LAKE TROUT	96	6	.	.	Fresh Dead
RAINBOW SMELT	114	8	.	.	Fresh Dead
RAINBOW SMELT	130	11	.	.	Fresh Dead
RAINBOW SMELT	128	11	.	.	Fresh Dead
RAINBOW SMELT	100	5	.	.	Fresh Dead
RAINBOW SMELT	123	10	.	.	Fresh Dead
RAINBOW SMELT	142	15	.	.	Fresh Dead
RAINBOW SMELT	120	8	.	.	Fresh Dead
RAINBOW SMELT	114	7	.	.	Fresh Dead
RAINBOW SMELT	178	30	.	.	Fresh Dead
RAINBOW SMELT	123	10	.	.	Fresh Dead
RAINBOW SMELT	112	6	.	.	Fresh Dead
RAINBOW SMELT	148	17	.	.	Fresh Dead
RAINBOW SMELT	158	19	.	.	Fresh Dead
RAINBOW SMELT	114	7	.	.	Fresh Dead
RAINBOW SMELT	117	7	.	.	Fresh Dead
RAINBOW SMELT	140	14	.	.	Fresh Dead
RAINBOW SMELT	135	11	.	.	Fresh Dead
RAINBOW SMELT	139	13	.	.	Fresh Dead
SPOTTAIL SHINER	94	6	.	.	Fresh Dead
SPOTTAIL SHINER	90	4	.	.	Fresh Dead
SPOTTAIL SHINER	85	4	.	.	Fresh Dead
SPOTTAIL SHINER	108	11	.	.	Fresh Dead
WHITE SUCKER	525	1300	.	.	Fresh Dead
BURBOT	216	68	.	.	Fresh Dead
BURBOT	96	7	.	.	Fresh Dead
BURBOT	101	7	.	.	Fresh Dead
BURBOT	82	3	.	.	Fresh Dead
THREESPINE STICKLEBACK	60	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	49	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	58	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	50	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	58	2	.	.	Fresh Dead
THREESPINE STICKLEBACK	53	1	.	.	Fresh Dead
YELLOW PERCH	86	5	.	.	Fresh Dead
YELLOW PERCH	73	4	.	.	Fresh Dead
YELLOW PERCH	77	4	.	.	Fresh Dead
YELLOW PERCH	68	2	.	.	Fresh Dead
YELLOW PERCH	108	10	.	.	Fresh Dead
YELLOW PERCH	75	3	.	.	Fresh Dead
YELLOW PERCH	76	3	.	.	Fresh Dead
ROUND GOBY	135	35	.	.	Fresh Dead
MOTTLED SCULPIN	78	6	.	.	Fresh Dead
MOTTLED SCULPIN	82	7	.	.	Fresh Dead
MOTTLED SCULPIN	85	11	.	.	Fresh Dead
SLIMY SCULPIN	62	4	.	.	Fresh Dead
SLIMY SCULPIN	91	10	.	.	Fresh Dead

SAMPLING PERIOD: 29-30NOV06 START DATE AND TIME: 29NOV06:10:00 END DATE AND TIME: 30NOV06:10:00
SAMPLING DURATION (hrs.): 24.00 CW VOLUME SAMPLED (gals x 10^6): 979.2000
INTAKE TEMPERATURES (F): MINIMUM= 43.5 MEAN= 45.3 MAXIMUM= 48.4
DISCHARGE TEMPERATURES (F): MINIMUM= 62.3 MEAN= 63.9 MAXIMUM= 66.8 MULTIPLICATION FACTOR: .
WEEKLY EXTRAPOLATION PERIOD: 29NOV-02DEC06 CW VOLUME (gals x 10^6)FOR EXTRAPOLATION PERIOD: 3916.8

SPECIES	LENGTH	WEIGHT	PLUS COUNT	BATCH WEIGHT	CONDITION	APPLY MULTIPLICATION FACTOR?
GREAT LAKES CRAYFISH	45	3	.	.	Fresh Dead	
ALEWIFE	89	5	.	.	Fresh Dead	
ALEWIFE	123	14	.	.	Fresh Dead	
ALEWIFE	97	6	.	.	Fresh Dead	
ALEWIFE	106	8	.	.	Fresh Dead	
ALEWIFE	97	7	.	.	Fresh Dead	
ALEWIFE	135	19	.	.	Fresh Dead	
ALEWIFE	91	5	.	.	Fresh Dead	
ALEWIFE	145	22	.	.	Fresh Dead	
ALEWIFE	100	6	.	.	Fresh Dead	
ALEWIFE	89	5	.	.	Fresh Dead	
ALEWIFE	102	6	.	.	Fresh Dead	
ALEWIFE	91	5	.	.	Fresh Dead	
ALEWIFE	113	10	.	.	Fresh Dead	
ALEWIFE	95	6	.	.	Fresh Dead	
ALEWIFE	86	3	.	.	Fresh Dead	
ALEWIFE	136	17	.	.	Fresh Dead	
ALEWIFE	95	5	.	.	Fresh Dead	
ALEWIFE	107	8	.	.	Fresh Dead	
ALEWIFE	88	5	.	.	Fresh Dead	
ALEWIFE	99	6	.	.	Fresh Dead	
ALEWIFE	92	5	.	.	Fresh Dead	
ALEWIFE	92	4	.	.	Fresh Dead	
ALEWIFE	87	4	.	.	Fresh Dead	
ALEWIFE	99	6	.	.	Fresh Dead	
ALEWIFE	93	5	.	.	Fresh Dead	
ALEWIFE	91	5	.	.	Fresh Dead	
ALEWIFE	92	5	.	.	Fresh Dead	

ALEWIFE	86	3	.	.	Fresh Dead
ALEWIFE	119	12	.	.	Fresh Dead
ALEWIFE	83	3	.	.	Fresh Dead
ALEWIFE	79	3	.	.	Fresh Dead
ALEWIFE	95	5	.	.	Fresh Dead
ALEWIFE	97	5	.	.	Fresh Dead
ALEWIFE	102	7	.	.	Fresh Dead
ALEWIFE	87	4	.	.	Fresh Dead
ALEWIFE	81	3	.	.	Fresh Dead
ALEWIFE	96	5	.	.	Fresh Dead
ALEWIFE	88	4	.	.	Fresh Dead
ALEWIFE	83	3	.	.	Fresh Dead
ALEWIFE	97	6	.	.	Fresh Dead
ALEWIFE	81	3	.	.	Fresh Dead
ALEWIFE	90	4	.	.	Fresh Dead
ALEWIFE	97	5	.	.	Fresh Dead
ALEWIFE	93	5	.	.	Fresh Dead
ALEWIFE	78	3	.	.	Fresh Dead
ALEWIFE	97	6	.	.	Fresh Dead
ALEWIFE	97	6	.	.	Fresh Dead
ALEWIFE	80	3	.	.	Fresh Dead
ALEWIFE	86	4	.	.	Fresh Dead
ALEWIFE	87	3	.	.	Fresh Dead
ALEWIFE	.	.	100	500	Fresh Dead
ALEWIFE	.	.	281	1500	Fresh Dead
ALEWIFE	.	.	561	3000	Fresh Dead
ALEWIFE	.	.	561	3000	Fresh Dead
GIZZARD SHAD	105	8	.	.	Fresh Dead
GIZZARD SHAD	116	11	.	.	Fresh Dead
GIZZARD SHAD	110	9	.	.	Fresh Dead
GIZZARD SHAD	104	8	.	.	Fresh Dead
GIZZARD SHAD	108	9	.	.	Fresh Dead
GIZZARD SHAD	103	7	.	.	Fresh Dead
GIZZARD SHAD	95	7	.	.	Fresh Dead
GIZZARD SHAD	98	6	.	.	Fresh Dead
GIZZARD SHAD	97	6	.	.	Fresh Dead
RAINBOW SMELT	160	21	.	.	Fresh Dead
RAINBOW SMELT	140	13	.	.	Fresh Dead
RAINBOW SMELT	108	5	.	.	Fresh Dead
RAINBOW SMELT	.	.	1	6	Fresh Dead
RAINBOW SMELT	141	14	.	.	Fresh Dead
RAINBOW SMELT	126	8	.	.	Fresh Dead
RAINBOW SMELT	128	11	.	.	Fresh Dead
RAINBOW SMELT	132	11	.	.	Fresh Dead
RAINBOW SMELT	100	4	.	.	Fresh Dead
RAINBOW SMELT	81	2	.	.	Fresh Dead
RAINBOW SMELT	149	19	.	.	Fresh Dead
RAINBOW SMELT	118	7	.	.	Fresh Dead
RAINBOW SMELT	151	18	.	.	Fresh Dead
RAINBOW SMELT	140	12	.	.	Fresh Dead
RAINBOW SMELT	105	5	.	.	Fresh Dead
RAINBOW SMELT	109	6	.	.	Fresh Dead
RAINBOW SMELT	130	11	.	.	Fresh Dead
RAINBOW SMELT	108	6	.	.	Fresh Dead
RAINBOW SMELT	107	6	.	.	Live
RAINBOW SMELT	110	6	.	.	Fresh Dead
RAINBOW SMELT	93	4	.	.	Fresh Dead
RAINBOW SMELT	91	3	.	.	Fresh Dead
RAINBOW SMELT	94	4	.	.	Fresh Dead
RAINBOW SMELT	97	4	.	.	Fresh Dead
RAINBOW SMELT	86	3	.	.	Fresh Dead
SPOTTAIL SHINER	85	5	.	.	Fresh Dead
LONGNOSE SUCKER	231	103	.	.	Fresh Dead
THREESPINE STICKLEBACK	58	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	56	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	58	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	50	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	54	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	56	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	55	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	49	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	55	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	53	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	54	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	50	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	60	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	56	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	51	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	49	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	54	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	55	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	48	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	55	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	49	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	48	1	.	.	Fresh Dead
THREESPINE STICKLEBACK	52	1	.	.	Fresh Dead
WHITE PERCH	86	7	.	.	Fresh Dead
SMALLMOUTH BASS	110	16	.	.	Fresh Dead
MOTTLED SCULPIN	71	5	.	.	Live
MOTTLED SCULPIN	64	4	.	.	Live

APPENDIX C

APPENDIX C. NUMBER, BIOMASS, AND RELATIVE ABUNDANCE OF SHELLFISH AND FISH COLLECTED DURING IMPINGEMENT AT POINT BEACH NUCLEAR PLANT BY SAMPLING DATE, DECEMBER 2005 - NOVEMBER 2006.

SPECIES	07-08DEC05				14-15DEC05				21-22DEC05				28-29DEC05				04-05JAN06			
	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%
GREAT LAKES CRAYFISH	1	4.76	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LAKE STURGEON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE type	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GIZZARD SHAD	1	4.76	0.006	0.21	11	6.71	0.443	4.55	--	--	--	--	5	4.76	0.152	15.26	--	--	--	--
LAKE WHITEFISH	--	--	--	--	1	0.61	0.008	0.08	--	--	--	--	--	--	--	--	--	--	--	--
BLOATER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COHO SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHINOOK SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND WHITEFISH	--	--	--	--	3	1.83	1.884	19.33	3	14.29	1.450	36.06	1	0.95	0.670	67.27	3	20.00	1.440	40.21
BROWN TROUT	--	--	--	--	5	3.05	0.768	7.88	1	4.76	0.095	2.36	--	--	--	--	1	6.67	1.050	29.32
LAKE TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RAINBOW SMELT	2	9.52	0.005	0.18	3	1.83	0.004	0.04	2	9.52	0.014	0.35	52	49.52	0.062	6.22	1	6.67	0.004	0.11
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON CARP	--	--	--	--	3	1.83	0.029	0.30	--	--	--	--	--	--	--	--	--	--	--	--
GOLDEN SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SPOTTAIL SHINER	--	--	--	--	8	4.88	0.053	0.54	--	--	--	--	--	--	--	--	--	--	--	--
FATHEAD MINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE DACE	--	--	--	--	1	0.61	0.002	0.02	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE SUCKER	--	--	--	--	1	0.61	1.000	10.26	--	--	--	--	--	--	--	--	1	6.67	0.910	25.41
WHITE SUCKER	1	4.76	1.000	35.03	--	--	--	--	1	4.76	0.137	3.41	--	--	--	--	--	--	--	--
BLACK BULLHEAD	1	4.76	0.190	6.65	1	0.61	0.105	1.08	1	4.76	0.180	4.48	--	--	--	--	--	--	--	--
CHANNEL CATFISH	1	4.76	1.450	50.79	7	4.27	1.210	12.42	4	19.05	0.058	1.44	--	--	--	--	--	--	--	--
TROUT-PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BURBOT	2	9.52	0.070	2.45	7	4.27	0.057	0.58	--	--	--	--	2	1.90	0.010	1.00	1	6.67	0.158	4.41
BROOK STICKLEBACK	--	--	--	--	1	0.61	0.001	0.01	--	--	--	--	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	--	--	--	--	--	--	--	--	1	4.76	0.001	0.02	7	6.67	0.008	0.80	5	33.33	0.005	0.14
NINESPINE STICKLEBACK	--	--	--	--	--	--	--	--	1	4.76	0.002	0.05	--	--	--	--	--	--	--	--
WHITE PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PUMPKINSEED	--	--	--	--	1	0.61	0.008	0.08	--	--	--	--	--	--	--	--	--	--	--	--
BLUEGILL	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SMALLMOUTH BASS	2	9.52	0.085	2.98	1	0.61	0.240	2.46	--	--	--	--	--	--	--	--	--	--	--	--
BLACK CRAPPIE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
YELLOW PERCH	3	14.29	0.012	0.42	93	56.71	0.303	3.11	2	9.52	0.011	0.27	33	31.43	0.066	6.63	1	6.67	0.002	0.06
FRESHWATER DRUM	--	--	--	--	4	2.44	3.550	36.43	1	4.76	2.050	50.98	--	--	--	--	--	--	--	--
ROUND GOBY	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MOTTLED SCULPIN	--	--	--	--	3	1.83	0.020	0.21	1	4.76	0.003	0.07	4	3.81	0.023	2.31	1	6.67	0.007	0.20
SLIMY SCULPIN	7	33.33	0.037	1.30	9	5.49	0.049	0.50	3	14.29	0.020	0.50	1	0.95	0.005	0.50	1	6.67	0.005	0.14
UNID COTTUS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--	1	0.61	0.010	0.10	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	21	100.00	2.855	100.00	164	100.00	9.744	100.00	21	100.00	4.021	100.00	105	100.00	0.996	100.00	15	100.00	3.581	100.00

APPENDIX C (cont.)

SPECIES	11-12JAN06				18-19JAN06				25-26JAN06				01-02FEB06				08-09FEB06			
	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%
GREAT LAKES CRAYFISH	--	--	--	--	1	8.33	--	--	--	--	--	--	1	0.21	0.002	0.08	--	--	--	--
LAKE STURGEON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE type	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GIZZARD SHAD	--	--	--	--	--	--	--	--	2	16.67	0.137	34.25	--	--	--	--	1	7.14	0.054	1.91
LAKE WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLOATER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COHO SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHINOOK SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND WHITEFISH	1	1.41	0.460	65.16	--	--	--	--	--	--	--	--	5	1.04	1.085	43.19	--	--	--	--
BROWN TROUT	--	--	--	--	1	8.33	0.134	8.32	--	--	--	--	--	--	--	--	--	--	--	--
LAKE TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RAINBOW SMELT	32	45.07	0.161	22.80	1	8.33	0.004	0.25	5	41.67	0.019	4.75	390	80.91	1.220	48.57	5	35.71	0.010	0.35
CENTRAL MUDMINNOW	1	1.41	0.005	0.71	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON CARP	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GOLDEN SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SPOTTAIL SHINER	1	1.41	0.015	2.12	--	--	--	--	--	--	--	--	1	0.21	0.001	0.04	--	--	--	--
FATHEAD MINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE DACE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE SUCKER	--	--	--	--	1	8.33	0.185	11.48	--	--	--	--	--	--	--	--	--	--	--	--
WHITE SUCKER	--	--	--	--	1	8.33	1.080	67.04	--	--	--	--	--	--	--	--	1	7.14	0.300	10.64
BLACK BULLHEAD	--	--	--	--	1	8.33	0.199	12.35	1	8.33	0.210	52.50	--	--	--	--	1	7.14	0.240	8.51
CHANNEL CATFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TROUT-PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BURBOT	--	--	--	--	--	--	--	--	1	8.33	0.021	5.25	--	--	--	--	--	--	--	--
BROOK STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	2	0.41	0.005	0.20	--	--	--	--
THREESPINE STICKLEBACK	26	36.62	0.027	3.82	5	41.67	0.007	0.43	--	--	--	--	45	9.34	0.046	1.83	--	--	--	--
NINESPINE STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
WHITE PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PUMPKINSEED	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLUEGILL	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SMALLMOUTH BASS	--	--	--	--	--	--	--	--	--	--	--	--	1	0.21	0.029	1.15	--	--	--	--
BLACK CRAPPIE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
YELLOW PERCH	8	11.27	0.024	3.40	1	8.33	0.002	0.12	2	16.67	0.008	2.00	35	7.26	0.113	4.50	3	21.43	0.010	0.35
FRESHWATER DRUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	7.14	2.200	78.01
ROUND GOBY	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MOTTLED SCULPIN	2	2.82	0.014	1.98	--	--	--	--	1	8.33	0.005	1.25	2	0.41	0.011	0.44	2	14.29	0.006	0.21
SLIMY SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID COTTUS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	71	100.00	0.706	100.00	12	100.00	1.611	100.00	12	100.00	0.400	100.00	482	100.00	2.512	100.00	14	100.00	2.820	100.00

APPENDIX C (cont.)

SPECIES	15-16FEB06				22-23FEB06				01-02MAR06				08-09MAR06				15-16MAR06			
	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%
GREAT LAKES CRAYFISH	--	--	--	--	5	3.05	0.017	0.76	1	5.26	0.004	1.93	1	1.12	0.007	0.11	--	--	--	--
LAKE STURGEON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE type	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GIZZARD SHAD	--	--	--	--	--	--	--	--	1	5.26	0.079	38.16	65	73.03	2.904	46.60	--	--	--	--
LAKE WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLOATER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COHO SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHINOOK SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND WHITEFISH	--	--	--	--	2	1.22	1.250	56.10	--	--	--	--	2	2.25	0.940	15.08	1	5.26	0.420	81.71
BROWN TROUT	--	--	--	--	1	0.61	0.170	7.63	--	--	--	--	--	--	--	--	--	--	--	--
LAKE TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RAINBOW SMELT	--	--	--	--	109	66.46	0.437	19.61	--	--	--	--	--	--	--	--	5	26.32	0.055	10.70
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON CARP	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GOLDEN SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SPOTTAIL SHINER	1	6.25	0.005	0.22	1	0.61	0.008	0.36	--	--	--	--	1	1.12	0.001	0.02	1	5.26	0.005	0.97
FATHEAD MINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE DACE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE SUCKER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
WHITE SUCKER	1	6.25	1.800	79.33	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLACK BULLHEAD	1	6.25	0.194	8.55	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHANNEL CATFISH	--	--	--	--	--	--	--	--	--	--	--	--	2	2.25	1.560	25.03	--	--	--	--
TROUT-PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BURBOT	1	6.25	0.232	10.22	--	--	--	--	--	--	--	--	2	2.25	0.324	5.20	--	--	--	--
BROOK STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	5	31.25	0.005	0.22	27	16.46	0.028	1.26	--	--	--	--	1	1.12	0.001	0.02	8	42.11	0.009	1.75
NINESPINE STICKLEBACK	--	--	--	--	1	0.61	0.002	0.09	--	--	--	--	--	--	--	--	1	5.26	0.002	0.39
WHITE PERCH	--	--	--	--	1	0.61	0.225	10.10	--	--	--	--	--	--	--	--	--	--	--	--
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PUMPKINSEED	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLUEGILL	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SMALLMOUTH BASS	--	--	--	--	--	--	--	--	--	--	--	--	1	1.12	0.400	6.42	--	--	--	--
BLACK CRAPPIE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
YELLOW PERCH	3	18.75	0.009	0.40	7	4.27	0.027	1.21	2	10.53	0.010	4.83	--	--	--	--	--	--	--	--
FRESHWATER DRUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND GOBY	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MOTTLED SCULPIN	3	18.75	0.017	0.75	6	3.66	0.033	1.48	8	42.11	0.056	27.05	6	6.74	0.038	0.61	2	10.53	0.015	2.92
SLIMY SCULPIN	1	6.25	0.007	0.31	4	2.44	0.031	1.39	7	36.84	0.058	28.02	8	8.99	0.057	0.91	1	5.26	0.008	1.56
UNID COTTUS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	16	100.00	2.269	100.00	164	100.00	2.228	100.00	19	100.00	0.207	100.00	89	100.00	6.232	100.00	19	100.00	0.514	100.00

APPENDIX C (cont.)

SPECIES	22-23MAR06				29-30MAR06				05-06APR06				12-13APR06				19-20APR06			
	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%
GREAT LAKES CRAYFISH	--	--	--	--	--	--	--	--	--	--	--	--	1	1.41	0.006	0.18	1	2.70	0.003	1.07
LAKE STURGEON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	--	--	--	--	--	--	--	--	--	--	--	--	28	39.44	0.073	2.17	12	32.43	0.039	13.88
ALEWIFE type	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2	5.41	0.002	0.71
GIZZARD SHAD	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LAKE WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLOATER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COHO SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHINOOK SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND WHITEFISH	1	100.00	0.530	100.00	1	11.11	0.600	17.14	--	--	--	--	--	--	--	--	--	--	--	--
BROWN TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LAKE TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RAINBOW SMELT	--	--	--	--	2	22.22	0.017	0.49	4	80.00	0.044	78.57	20	28.17	0.113	3.36	4	10.81	0.027	9.61
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON CARP	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GOLDEN SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SPOTTAIL SHINER	--	--	--	--	--	--	--	--	1	20.00	0.012	21.43	--	--	--	--	--	--	--	--
FATHEAD MINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE DACE	--	--	--	--	--	--	--	--	--	--	--	--	1	1.41	0.007	0.21	--	--	--	--
LONGNOSE SUCKER	--	--	--	--	1	11.11	2.000	57.14	--	--	--	--	--	--	--	--	--	--	--	--
WHITE SUCKER	--	--	--	--	1	11.11	0.740	21.14	--	--	--	--	1	1.41	1.400	41.68	--	--	--	--
BLACK BULLHEAD	--	--	--	--	--	--	--	--	--	--	--	--	1	1.41	0.100	2.98	--	--	--	--
CHANNEL CATFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TROUT-PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BURBOT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	2.70	0.162	57.65
BROOK STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	--	--	--	--	1	11.11	0.001	0.03	--	--	--	--	14	19.72	0.018	0.54	10	27.03	0.016	5.69
NINESPINE STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	1	1.41	0.003	0.09	3	8.11	0.008	2.85
WHITE PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PUMPKINSEED	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLUEGILL	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SMALLMOUTH BASS	--	--	--	--	1	11.11	0.132	3.77	--	--	--	--	1	1.41	1.600	47.63	--	--	--	--
BLACK CRAPPIE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
YELLOW PERCH	--	--	--	--	--	--	--	--	--	--	--	--	1	1.41	0.004	0.12	--	--	--	--
FRESHWATER DRUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND GOBY	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MOTTLED SCULPIN	--	--	--	--	2	22.22	0.010	0.29	--	--	--	--	1	1.41	0.010	0.30	1	2.70	0.007	2.49
SLIMY SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--	1	1.41	0.025	0.74	3	8.11	0.017	6.05
UNID COTTUS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	1	100.00	0.530	100.00	9	100.00	3.500	100.00	5	100.00	0.056	100.00	71	100.00	3.359	100.00	37	100.00	0.281	100.00

APPENDIX C (cont.)

SPECIES	26-27APR06				03-04MAY06				10-11MAY06				15-16MAY06				17-18MAY06			
	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%
GREAT LAKES CRAYFISH	--	--	--	--	1	0.00	0.001	0.00	1	0.01	0.002	0.01	2	0.03	0.005	0.02	2	0.01	0.009	0.01
LAKE STURGEON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	48,620	99.49	175.040	99.70	37,380	98.24	141.583	95.83	9,551	99.39	34.384	98.56	7,339	96.16	27.162	95.56	26,256	99.30	63.480	98.49
ALEWIFE type	191	0.39	0.350	0.20	594	1.56	2.000	1.35	--	--	--	--	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GIZZARD SHAD	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LAKE WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLOATER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COHO SALMON	--	--	--	--	--	--	--	--	--	--	--	--	1	0.01	0.006	0.02	--	--	--	--
CHINOOK SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BROWN TROUT	--	--	--	--	1	0.00	2.000	1.35	--	--	--	--	1	0.01	0.085	0.30	--	--	--	--
LAKE TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RAINBOW SMELT	4	0.01	0.024	0.01	53	0.14	0.430	0.29	45	0.47	0.449	1.29	131	1.72	0.830	2.92	99	0.37	0.709	1.10
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON CARP	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GOLDEN SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SPOTTAIL SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
FATHEAD MINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE DACE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE SUCKER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
WHITE SUCKER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLACK BULLHEAD	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHANNEL CATFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TROUT-PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BURBOT	--	--	--	--	2	0.01	1.600	1.08	--	--	--	--	--	--	--	--	--	--	--	--
BROOK STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	16	0.03	0.020	0.01	3	0.01	0.007	0.00	2	0.02	0.004	0.01	63	0.83	0.109	0.38	33	0.12	0.060	0.09
NINESPINE STICKLEBACK	17	0.03	0.039	0.02	9	0.02	0.022	0.01	4	0.04	0.011	0.03	84	1.10	0.171	0.60	30	0.11	0.077	0.12
WHITE PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PUMPKINSEED	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLUEGILL	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SMALLMOUTH BASS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLACK CRAPPIE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
YELLOW PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
FRESHWATER DRUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND GOBY	--	--	--	--	1	0.00	0.085	0.06	--	--	--	--	--	--	--	--	--	--	--	--
MOTTLED SCULPIN	12	0.02	0.048	0.03	3	0.01	0.020	0.01	6	0.06	0.032	0.09	11	0.14	0.055	0.19	16	0.06	0.088	0.14
SLIMY SCULPIN	8	0.02	0.044	0.03	--	--	--	--	1	0.01	0.003	0.01	--	--	--	--	5	0.02	0.028	0.04
UNID COTTUS	--	--	--	--	1	0.00	0.003	0.00	--	--	--	--	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	48,868	100.00	175.565	100.00	38,048	100.00	147.751	100.00	9,610	100.00	34.885	100.00	7,632	100.00	28.423	100.00	26,441	100.00	64.451	100.00

APPENDIX C (cont.)

SPECIES	22-23MAY06				24-25MAY06				29-30MAY06				31MAY-01JUN06				05-06JUN06			
	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%
GREAT LAKES CRAYFISH	4	0.01	0.018	0.02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LAKE STURGEON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	26,605	99.52	93.114	99.00	155890	99.66	342.943	99.17	215030	99.87	881.696	99.55	193483	99.93	948.021	99.87	170207	99.99	476.551	99.98
ALEWIFE type	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GIZZARD SHAD	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LAKE WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLOATER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COHO SALMON	--	--	--	--	1	0.00	0.007	0.00	--	--	--	--	--	--	--	--	--	--	--	--
CHINOOK SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BROWN TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LAKE TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RAINBOW SMELT	91	0.34	0.771	0.82	443	0.28	2.626	0.76	244	0.11	1.704	0.19	117	0.06	0.876	0.09	4	0.00	0.022	0.00
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON CARP	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GOLDEN SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SPOTTAIL SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
FATHEAD MINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE DACE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	0.00	0.013	0.00
LONGNOSE SUCKER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
WHITE SUCKER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLACK BULLHEAD	--	--	--	--	--	--	--	--	2	0.00	0.291	0.03	1	0.00	0.190	0.02	--	--	--	--
CHANNEL CATFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TROUT-PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BURBOT	--	--	--	--	--	--	--	--	1	0.00	1.945	0.22	--	--	--	--	--	--	--	--
BROOK STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	1	0.00	0.002	0.00	18	0.01	0.018	0.01	3	0.00	0.004	0.00	6	0.00	0.008	0.00	3	0.00	0.003	0.00
NINESPINE STICKLEBACK	13	0.05	0.038	0.04	41	0.03	0.106	0.03	13	0.01	0.029	0.00	13	0.01	0.035	0.00	7	0.00	0.018	0.00
WHITE PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PUMPKINSEED	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLUEGILL	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SMALLMOUTH BASS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLACK CRAPPIE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
YELLOW PERCH	--	--	--	--	--	--	--	--	--	--	--	--	1	0.00	0.003	0.00	--	--	--	--
FRESHWATER DRUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND GOBY	--	--	--	--	--	--	--	--	--	--	--	--	2	0.00	0.129	0.01	--	--	--	--
MOTTLED SCULPIN	2	0.01	0.011	0.01	10	0.01	0.069	0.02	5	0.00	0.024	0.00	2	0.00	0.008	0.00	8	0.00	0.056	0.01
SLIMY SCULPIN	18	0.07	0.098	0.10	12	0.01	0.053	0.02	5	0.00	0.031	0.00	--	--	--	--	1	0.00	0.007	0.00
UNID COTTUS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	26,734	100.00	94.052	100.00	156414	100.00	345.821	100.00	215303	100.00	885.724	100.00	193625	100.00	949.270	100.00	170231	100.00	476.670	100.00

APPENDIX C (cont.)

SPECIES	07-08JUN06				12-13JUN06				14-15JUN06				19-20JUN06				21-22JUN06			
	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%
GREAT LAKES CRAYFISH	--	--	--	--	2	0.01	--	--	3	0.02	0.005	0.01	--	--	--	--	--	--	--	--
LAKE STURGEON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	59,786	99.87	197.300	99.00	15,064	98.92	52.718	96.88	13,807	99.37	52.476	96.18	158030	99.97	489.862	99.50	180163	99.92	573.478	99.73
ALEWIFE type	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GIZZARD SHAD	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LAKE WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLOATER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COHO SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHINOOK SALMON	--	--	--	--	1	0.01	0.006	0.01	--	--	--	--	--	--	--	--	--	--	--	--
ROUND WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BROWN TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LAKE TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RAINBOW SMELT	59	0.10	0.469	0.24	74	0.49	0.414	0.76	34	0.24	0.195	0.36	18	0.01	0.097	0.02	122	0.07	0.802	0.14
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON CARP	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GOLDEN SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SPOTTAIL SHINER	--	--	--	--	1	0.01	0.010	0.02	1	0.01	0.012	0.02	--	--	--	--	--	--	--	--
FATHEAD MINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE DACE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE SUCKER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	0.00	0.700	0.12
WHITE SUCKER	1	0.00	1.200	0.60	1	0.01	0.900	1.65	--	--	--	--	2	0.00	2.250	0.46	--	--	--	--
BLACK BULLHEAD	1	0.00	0.021	0.01	1	0.01	0.110	0.20	--	--	--	--	--	--	--	--	--	--	--	--
CHANNEL CATFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TROUT-PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BURBOT	--	--	--	--	--	--	--	--	1	0.01	1.700	3.12	--	--	--	--	--	--	--	--
BROOK STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	5	0.01	0.009	0.00	15	0.10	0.023	0.04	5	0.04	0.009	0.02	1	0.00	0.002	0.00	2	0.00	0.003	0.00
NINESPINE STICKLEBACK	9	0.02	0.018	0.01	49	0.32	0.113	0.21	33	0.24	0.090	0.16	18	0.01	0.054	0.01	11	0.01	0.029	0.01
WHITE PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PUMPKINSEED	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLUEGILL	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SMALLMOUTH BASS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLACK CRAPPIE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
YELLOW PERCH	1	0.00	0.250	0.13	1	0.01	0.008	0.01	--	--	--	--	--	--	--	--	--	--	--	--
FRESHWATER DRUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND GOBY	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MOTTLED SCULPIN	3	0.01	0.019	0.01	17	0.11	0.104	0.19	8	0.06	0.065	0.12	8	0.01	0.043	0.01	2	0.00	0.012	0.00
SLIMY SCULPIN	--	--	--	--	2	0.01	0.012	0.02	2	0.01	0.010	0.02	--	--	--	--	--	--	--	--
UNID COTTUS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	59,865	100.00	199.286	100.00	15,228	100.00	54.418	100.00	13,894	100.00	54.562	100.00	158077	100.00	492.308	100.00	180301	100.00	575.024	100.00

APPENDIX C (cont.)

SPECIES	26-27JUN06				28-29JUN06				03JUL06				05-06JUL06				10-11JUL06			
	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%
GREAT LAKES CRAYFISH	--	--	--	--	1	0.01	0.003	0.01	2	0.01	0.006	0.01	--	--	--	--	1	0.00	0.004	0.00
LAKE STURGEON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	17,216	99.38	44.761	96.76	12,112	99.56	46.027	91.21	21,262	99.95	74.430	99.90	--	--	--	--	24,510	99.50	88.239	97.28
ALEWIFE type	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GIZZARD SHAD	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LAKE WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLOATER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2	0.01	0.009	0.01
COHO SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	0.00	0.008	0.01
CHINOOK SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BROWN TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LAKE TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RAINBOW SMELT	29	0.17	0.172	0.37	18	0.15	0.122	0.24	8	0.04	0.068	0.09	--	--	--	--	48	0.19	0.267	0.29
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON CARP	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GOLDEN SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SPOTTAIL SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	0.00	0.009	0.01
FATHEAD MINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE DACE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE SUCKER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	0.00	0.102	0.11
WHITE SUCKER	1	0.01	0.725	1.57	--	--	--	--	--	--	--	--	--	--	--	--	1	0.00	1.650	1.82
BLACK BULLHEAD	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHANNEL CATFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TROUT-PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BURBOT	--	--	--	--	2	0.02	4.200	8.32	--	--	--	--	--	--	--	--	--	--	--	--
BROOK STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	28	0.16	0.046	0.10	7	0.06	0.012	0.02	--	--	--	--	--	--	--	--	22	0.09	0.042	0.05
NINESPINE STICKLEBACK	29	0.17	0.066	0.14	16	0.13	0.040	0.08	1	0.00	0.003	0.00	--	--	--	--	39	0.16	0.080	0.09
WHITE PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PUMPKINSEED	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLUEGILL	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SMALLMOUTH BASS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLACK CRAPPIE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
YELLOW PERCH	2	0.01	0.401	0.87	1	0.01	0.004	0.01	--	--	--	--	--	--	--	--	1	0.00	0.242	0.27
FRESHWATER DRUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND GOBY	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MOTTLED SCULPIN	15	0.09	0.053	0.11	6	0.05	0.034	0.07	--	--	--	--	--	--	--	--	6	0.02	0.050	0.06
SLIMY SCULPIN	4	0.02	0.034	0.07	2	0.02	0.022	0.04	--	--	--	--	--	--	--	--	1	0.00	0.004	0.00
UNID COTTUS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	17,324	100.00	46.258	100.00	12,165	100.00	50.464	100.00	21,273	100.00	74.507	100.00	--	--	--	--	24,634	100.00	90.706	100.00

APPENDIX C (cont.)

SPECIES	12-13JUL06				17-18JUL06				19-20JUL06				24-25JUL06				26-27JUL06			
	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%
GREAT LAKES CRAYFISH	--	--	--	--	2	0.01	0.005	0.01	1	0.00	0.003	0.00	4	0.05	0.017	0.05	1	0.02	--	--
LAKE STURGEON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	8,802	99.65	36.091	94.40	25,382	99.20	98.986	99.05	30,388	99.81	106.358	98.22	8,044	99.41	30.572	86.46	6,413	99.70	23.089	89.43
ALEWIFE type	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GIZZARD SHAD	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LAKE WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLOATER	--	--	--	--	--	--	--	--	--	--	--	--	1	0.01	0.005	0.01	--	--	--	--
COHO SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHINOOK SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BROWN TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LAKE TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RAINBOW SMELT	11	0.12	0.066	0.17	149	0.58	0.652	0.65	33	0.11	0.215	0.20	8	0.10	0.036	0.10	5	0.08	0.030	0.12
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON CARP	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	0.02	0.096	0.37
GOLDEN SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SPOTTAIL SHINER	--	--	--	--	1	0.00	0.007	0.01	2	0.01	0.025	0.02	--	--	--	--	--	--	--	--
FATHEAD MINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE DACE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE SUCKER	2	0.02	1.280	3.35	1	0.00	0.163	0.16	3	0.01	0.340	0.31	2	0.02	1.020	2.88	--	--	--	--
WHITE SUCKER	--	--	--	--	--	--	--	--	1	0.00	1.100	1.02	2	0.02	2.800	7.92	2	0.03	1.800	6.97
BLACK BULLHEAD	1	0.01	0.250	0.65	--	--	--	--	1	0.00	0.154	0.14	1	0.01	0.178	0.50	--	--	--	--
CHANNEL CATFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TROUT-PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BURBOT	1	0.01	0.500	1.31	--	--	--	--	--	--	--	--	1	0.01	0.500	1.41	--	--	--	--
BROOK STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	5	0.06	0.009	0.02	15	0.06	0.027	0.03	1	0.00	0.002	0.00	5	0.06	0.009	0.03	2	0.03	0.002	0.01
NINESPINE STICKLEBACK	6	0.07	0.015	0.04	31	0.12	0.066	0.07	5	0.02	0.013	0.01	17	0.21	0.035	0.10	3	0.05	0.006	0.02
WHITE PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PUMPKINSEED	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLUEGILL	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SMALLMOUTH BASS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLACK CRAPPIE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
YELLOW PERCH	--	--	--	--	1	0.00	0.002	0.00	--	--	--	--	1	0.01	0.168	0.48	2	0.03	0.784	3.04
FRESHWATER DRUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND GOBY	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MOTTLED SCULPIN	5	0.06	0.020	0.05	3	0.01	0.016	0.02	11	0.04	0.074	0.07	5	0.06	0.014	0.04	3	0.05	0.010	0.04
SLIMY SCULPIN	--	--	--	--	1	0.00	0.007	0.01	--	--	--	--	1	0.01	0.006	0.02	--	--	--	--
UNID COTTUS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	8,833	100.00	38.231	100.00	25,586	100.00	99.931	100.00	30,446	100.00	108.284	100.00	8,092	100.00	35.360	100.00	6,432	100.00	25.817	100.00

APPENDIX C (cont.)

SPECIES	31JUL-01AUG06				02-03AUG06				07-08AUG06				09-10AUG06				14-15AUG06			
	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%
GREAT LAKES CRAYFISH	1	0.02	0.006	0.03	2	0.10	0.008	0.06	5	1.45	0.017	0.30	9	2.20	0.025	0.24	21	4.82	0.072	0.24
LAKE STURGEON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	6,413	99.44	22.579	98.23	1,890	96.58	9.985	71.74	329	95.36	2.360	42.31	367	89.51	1.941	18.77	358	82.11	2.140	7.03
ALEWIFE type	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GIZZARD SHAD	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LAKE WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLOATER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COHO SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHINOOK SALMON	--	--	--	--	2	0.10	0.049	0.35	--	--	--	--	--	--	--	--	--	--	--	--
ROUND WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	1	0.24	0.450	4.35	--	--	--	--
BROWN TROUT	--	--	--	--	1	0.05	0.400	2.87	--	--	--	--	--	--	--	--	--	--	--	--
LAKE TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	0.23	4.100	13.46
RAINBOW SMELT	22	0.34	0.106	0.46	12	0.61	0.046	0.33	--	--	--	--	--	--	--	--	2	0.46	0.008	0.03
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON CARP	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GOLDEN SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SPOTTAIL SHINER	1	0.02	0.012	0.05	--	--	--	--	2	0.58	0.029	0.52	1	0.24	0.008	0.08	4	0.92	0.036	0.12
FATHEAD MINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE DACE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5	1.15	0.060	0.20
LONGNOSE SUCKER	1	0.02	0.240	1.04	--	--	--	--	2	0.58	1.006	18.04	1	0.24	0.150	1.45	7	1.61	3.908	12.83
WHITE SUCKER	--	--	--	--	2	0.10	1.800	12.93	1	0.29	1.000	17.93	6	1.46	5.700	55.12	16	3.67	19.760	64.88
BLACK BULLHEAD	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHANNEL CATFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TROUT-PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BURBOT	--	--	--	--	1	0.05	1.500	10.78	1	0.29	1.150	20.62	3	0.73	0.936	9.05	--	--	--	--
BROOK STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	2	0.03	0.003	0.01	9	0.46	0.017	0.12	--	--	--	--	--	--	--	--	--	--	--	--
NINESPINE STICKLEBACK	3	0.05	0.008	0.03	26	1.33	0.053	0.38	2	0.58	0.003	0.05	1	0.24	0.002	0.02	--	--	--	--
WHITE PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PUMPKINSEED	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLUEGILL	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	0.23	0.002	0.01
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SMALLMOUTH BASS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLACK CRAPPIE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
YELLOW PERCH	--	--	--	--	7	0.36	0.032	0.23	1	0.29	0.004	0.07	9	2.20	1.074	10.38	2	0.46	0.275	0.90
FRESHWATER DRUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND GOBY	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MOTTLED SCULPIN	6	0.09	0.031	0.13	5	0.26	0.028	0.20	2	0.58	0.009	0.16	12	2.93	0.056	0.54	19	4.36	0.096	0.32
SLIMY SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID COTTUS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	6,449	100.00	22.985	100.00	1,957	100.00	13.918	100.00	345	100.00	5.578	100.00	410	100.00	10.342	100.00	436	100.00	30.457	100.00

APPENDIX C (cont.)

SPECIES	16-17AUG06				21-22AUG06				23-24AUG06				28-29AUG06				30-31AUG06			
	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%
GREAT LAKES CRAYFISH	20	3.64	0.074	0.19	14	16.47	0.054	0.42	16	19.28	0.056	0.56	8	10.81	0.035	0.50	9	3.10	0.029	0.30
LAKE STURGEON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	470	85.61	4.048	10.18	52	61.18	0.417	3.27	41	49.40	0.406	4.08	26	35.14	0.248	3.53	77	26.55	0.583	5.98
ALEWIFE type	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GIZZARD SHAD	--	--	--	--	--	--	--	--	--	--	--	--	14	18.92	0.098	1.40	6	2.07	0.039	0.40
LAKE WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLOATER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COHO SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHINOOK SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	0.34	0.038	0.39
ROUND WHITEFISH	1	0.18	0.600	1.51	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BROWN TROUT	1	0.18	4.650	11.70	1	1.18	5.012	39.26	--	--	--	--	--	--	--	--	--	--	--	--
LAKE TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RAINBOW SMELT	2	0.36	0.007	0.02	--	--	--	--	--	--	--	--	1	1.35	0.010	0.14	11	3.79	0.050	0.51
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON CARP	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GOLDEN SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SPOTTAIL SHINER	1	0.18	0.012	0.03	1	1.18	0.004	0.03	--	--	--	--	3	4.05	0.015	0.21	33	11.38	0.178	1.83
FATHEAD MINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE DACE	5	0.91	0.065	0.16	5	5.88	0.061	0.48	--	--	--	--	--	--	--	--	9	3.10	0.101	1.04
LONGNOSE SUCKER	2	0.36	0.409	1.03	--	--	--	--	3	3.61	1.710	17.17	3	4.05	1.035	14.74	2	0.69	0.300	3.08
WHITE SUCKER	28	5.10	28.915	72.73	7	8.24	6.693	52.43	7	8.43	7.700	77.31	5	6.76	5.450	77.61	9	3.10	7.189	73.73
BLACK BULLHEAD	--	--	--	--	1	1.18	0.294	2.30	--	--	--	--	--	--	--	--	--	--	--	--
CHANNEL CATFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TROUT-PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	0.34	0.013	0.13
BURBOT	--	--	--	--	1	1.18	0.219	1.72	--	--	--	--	--	--	--	--	--	--	--	--
BROOK STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	1	0.18	0.002	0.01	--	--	--	--	1	1.20	0.002	0.02	--	--	--	--	4	1.38	0.008	0.08
NINESPINE STICKLEBACK	--	--	--	--	--	--	--	--	1	1.20	0.002	0.02	1	1.35	0.002	0.03	5	1.72	0.008	0.08
WHITE PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PUMPKINSEED	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLUEGILL	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	0.34	0.009	0.09
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SMALLMOUTH BASS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLACK CRAPPIE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
YELLOW PERCH	3	0.55	0.865	2.18	--	--	--	--	--	--	--	--	3	4.05	0.076	1.08	37	12.76	0.665	6.82
FRESHWATER DRUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND GOBY	--	--	--	--	--	--	--	--	1	1.20	0.009	0.09	--	--	--	--	1	0.34	0.003	0.03
MOTTLED SCULPIN	15	2.73	0.111	0.28	3	3.53	0.012	0.09	13	15.66	0.075	0.75	10	13.51	0.053	0.75	79	27.24	0.517	5.30
SLIMY SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5	1.72	0.021	0.22
UNID COTTUS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	549	100.00	39.758	100.00	85	100.00	12.766	100.00	83	100.00	9.960	100.00	74	100.00	7.022	100.00	290	100.00	9.751	100.00

APPENDIX C (cont.)

SPECIES	04-05SEP06				06-07SEP06				11-12SEP06				13-14SEP06				18-19SEP06			
	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%
GREAT LAKES CRAYFISH	1	1.41	0.005	0.01	5	6.41	0.020	0.10	3	1.90	0.012	0.42	--	--	--	--	1	0.07	0.004	0.02
LAKE STURGEON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	11	15.49	0.153	0.37	11	14.10	0.097	0.46	59	37.34	0.817	28.45	36	25.17	0.514	7.98	1,098	76.30	3.298	20.03
ALEWIFE type	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GIZZARD SHAD	--	--	--	--	--	--	--	--	2	1.27	--	--	2	1.40	0.015	0.23	9	0.63	0.745	4.53
LAKE WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLOATER	--	--	--	--	--	--	--	--	5	3.16	0.026	0.91	10	6.99	0.045	0.70	6	0.42	0.033	0.20
COHO SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHINOOK SALMON	--	--	--	--	1	1.28	0.065	0.31	--	--	--	--	--	--	--	--	--	--	--	--
ROUND WHITEFISH	1	1.41	1.150	2.81	--	--	--	--	2	1.27	1.300	45.26	--	--	--	--	--	--	--	--
BROWN TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LAKE TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RAINBOW SMELT	--	--	--	--	1	1.28	0.009	0.04	35	22.15	0.182	6.34	25	17.48	0.103	1.60	143	9.94	0.670	4.07
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON CARP	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GOLDEN SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	0.07	0.005	0.03
COMMON SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SPOTTAIL SHINER	5	7.04	0.054	0.13	7	8.97	0.053	0.25	17	10.76	0.134	4.67	5	3.50	0.032	0.50	101	7.02	0.513	3.12
FATHEAD MINNOW	--	--	--	--	--	--	--	--	--	--	--	--	1	0.70	0.004	0.06	1	0.07	0.003	0.02
LONGNOSE DACE	4	5.63	0.040	0.10	--	--	--	--	--	--	--	--	4	2.80	0.038	0.59	4	0.28	0.021	0.13
LONGNOSE SUCKER	3	4.23	0.707	1.73	4	5.13	1.470	7.02	1	0.63	0.195	6.79	1	0.70	0.400	6.21	--	--	--	--
WHITE SUCKER	31	43.66	34.860	85.25	19	24.36	18.760	89.60	--	--	--	--	5	3.50	4.444	69.03	5	0.35	3.985	24.21
BLACK BULLHEAD	4	5.63	0.953	2.33	1	1.28	0.305	1.46	--	--	--	--	--	--	--	--	3	0.21	0.383	2.33
CHANNEL CATFISH	--	--	--	--	--	--	--	--	--	--	--	--	1	0.70	0.052	0.81	1	0.07	0.119	0.72
TROUT-PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BURBOT	1	1.41	2.410	5.89	--	--	--	--	--	--	--	--	1	0.70	0.022	0.34	3	0.21	1.145	6.95
BROOK STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	4	2.80	0.007	0.11	--	--	--	--
NINESPINE STICKLEBACK	--	--	--	--	1	1.28	0.003	0.01	1	0.63	0.002	0.07	1	0.70	0.001	0.02	3	0.21	0.006	0.04
WHITE PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	0.07	0.003	0.02
PUMPKINSEED	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2	0.14	0.056	0.34
BLUEGILL	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	0.07	0.015	0.09
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	0.07	0.002	0.01
SMALLMOUTH BASS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLACK CRAPPIE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
YELLOW PERCH	3	4.23	0.514	1.26	2	2.56	0.020	0.10	--	--	--	--	2	1.40	0.453	7.04	29	2.02	0.270	1.64
FRESHWATER DRUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7	0.49	5.092	30.93
ROUND GOBY	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MOTTLED SCULPIN	7	9.86	0.045	0.11	20	25.64	0.107	0.51	29	18.35	0.179	6.23	40	27.97	0.280	4.35	19	1.32	0.095	0.58
SLIMY SCULPIN	--	--	--	--	6	7.69	0.028	0.13	4	2.53	0.025	0.87	5	3.50	0.028	0.43	--	--	--	--
UNID COTTUS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	71	100.00	40.891	100.00	78	100.00	20.937	100.00	158	100.00	2.872	100.00	143	100.00	6.438	100.00	1,439	100.00	16.463	100.00

APPENDIX C (cont.)

SPECIES	20-21SEP06				25-26SEP06				27-28SEP06				02-03OCT06				04-05OCT06			
	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%
GREAT LAKES CRAYFISH	2	0.34	0.009	0.12	--	--	--	--	3	0.42	0.013	0.16	1	0.01	0.003	0.01	4	0.07	0.016	0.04
LAKE STURGEON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	500	85.76	5.195	66.66	631	85.85	7.576	81.50	575	80.20	4.730	58.59	4,305	61.11	29.273	56.96	4,622	82.15	30.115	76.99
ALEWIFE type	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GIZZARD SHAD	--	--	--	--	7	0.95	0.039	0.42	1	0.14	0.005	0.06	6	0.09	0.043	0.08	2	0.04	0.224	0.57
LAKE WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLOATER	1	0.17	0.004	0.05	8	1.09	0.035	0.38	7	0.98	0.025	0.31	35	0.50	0.155	0.30	10	0.18	0.053	0.14
COHO SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHINOOK SALMON	--	--	--	--	--	--	--	--	--	--	--	--	2	0.03	2.756	5.36	--	--	--	--
ROUND WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	2	0.03	0.135	0.26	1	0.02	0.600	1.53
BROWN TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LAKE TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RAINBOW SMELT	31	5.32	0.117	1.50	69	9.39	0.465	5.00	34	4.74	0.202	2.50	2,418	34.32	11.855	23.07	795	14.13	5.085	13.00
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON CARP	--	--	--	--	--	--	--	--	--	--	--	--	1	0.01	0.018	0.04	--	--	--	--
GOLDEN SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON SHINER	--	--	--	--	1	0.14	0.014	0.15	--	--	--	--	--	--	--	--	--	--	--	--
SPOTTAIL SHINER	19	3.26	0.112	1.44	1	0.14	0.008	0.09	63	8.79	0.465	5.76	210	2.98	1.530	2.98	155	2.76	1.001	2.56
FATHEAD MINNOW	--	--	--	--	--	--	--	--	--	--	--	--	1	0.01	0.004	0.01	--	--	--	--
LONGNOSE DACE	5	0.86	0.049	0.63	2	0.27	0.027	0.29	1	0.14	0.026	0.32	3	0.04	0.023	0.04	1	0.02	0.009	0.02
LONGNOSE SUCKER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	0.02	1.000	2.56
WHITE SUCKER	1	0.17	0.134	1.72	1	0.14	0.115	1.24	1	0.14	0.550	6.81	1	0.01	1.000	1.95	2	0.04	0.695	1.78
BLACK BULLHEAD	--	--	--	--	1	0.14	0.346	3.72	--	--	--	--	1	0.01	0.212	0.41	--	--	--	--
CHANNEL CATFISH	--	--	--	--	--	--	--	--	--	--	--	--	1	0.01	0.002	0.00	--	--	--	--
TROUT-PERCH	--	--	--	--	--	--	--	--	--	--	--	--	1	0.01	0.011	0.02	--	--	--	--
BURBOT	1	0.17	0.950	12.19	2	0.27	0.588	6.33	--	--	--	--	2	0.03	4.006	7.79	--	--	--	--
BROOK STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	--	--	--	--	--	--	--	--	1	0.14	0.001	0.01	--	--	--	--	--	--	--	--
NINESPINE STICKLEBACK	1	0.17	0.001	0.01	--	--	--	--	--	--	--	--	4	0.06	0.008	0.02	--	--	--	--
WHITE PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PUMPKINSEED	1	0.17	0.030	0.38	--	--	--	--	1	0.14	0.002	0.02	1	0.01	0.001	0.00	--	--	--	--
BLUEGILL	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SMALLMOUTH BASS	2	0.34	1.110	14.24	--	--	--	--	1	0.14	0.110	1.36	1	0.01	0.012	0.02	--	--	--	--
BLACK CRAPPIE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
YELLOW PERCH	6	1.03	0.019	0.24	1	0.14	0.031	0.33	10	1.39	0.049	0.61	17	0.24	0.169	0.33	13	0.23	0.090	0.23
FRESHWATER DRUM	--	--	--	--	--	--	--	--	1	0.14	1.800	22.30	--	--	--	--	--	--	--	--
ROUND GOBY	--	--	--	--	--	--	--	--	--	--	--	--	1	0.01	0.005	0.01	1	0.02	0.101	0.26
MOTTLED SCULPIN	13	2.23	0.063	0.81	11	1.50	0.052	0.56	16	2.23	0.086	1.07	30	0.43	0.166	0.32	18	0.32	0.120	0.31
SLIMY SCULPIN	--	--	--	--	--	--	--	--	2	0.28	0.009	0.11	1	0.01	0.008	0.02	1	0.02	0.006	0.02
UNID COTTUS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	583	100.00	7.793	100.00	735	100.00	9.296	100.00	717	100.00	8.073	100.00	7,045	100.00	51.395	100.00	5,626	100.00	39.115	100.00

APPENDIX C (cont.)

SPECIES	09-10OCT06				11-12OCT06				16-17OCT06				18-19OCT06				23-24OCT06			
	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%
GREAT LAKES CRAYFISH	--	--	--	--	--	--	--	--	1	0.03	0.004	0.01	--	--	--	--	--	--	--	--
LAKE STURGEON	1	0.03	0.239	0.80	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	2,016	54.65	10.477	34.88	207	79.01	2.018	26.15	2,532	74.58	17.095	58.78	126	77.30	0.704	12.66	232	85.93	3.720	34.61
ALEWIFE type	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GIZZARD SHAD	13	0.35	0.093	0.31	1	0.38	0.004	0.05	27	0.80	0.127	0.44	--	--	--	--	29	10.74	0.430	4.00
LAKE WHITEFISH	2	0.05	0.105	0.35	--	--	--	--	1	0.03	0.034	0.12	--	--	--	--	--	--	--	--
BLOATER	--	--	--	--	--	--	--	--	13	0.38	0.056	0.19	--	--	--	--	--	--	--	--
COHO SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHINOOK SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND WHITEFISH	3	0.08	1.125	3.75	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BROWN TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LAKE TROUT	1	0.03	3.800	12.65	--	--	--	--	--	--	--	--	1	0.61	2.750	49.45	1	0.37	3.500	32.57
RAINBOW SMELT	1,401	37.98	8.676	28.88	39	14.89	0.287	3.72	563	16.58	3.269	11.24	25	15.34	0.179	3.22	5	1.85	0.038	0.35
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON CARP	--	--	--	--	--	--	--	--	1	0.03	0.007	0.02	--	--	--	--	--	--	--	--
GOLDEN SHINER	--	--	--	--	--	--	--	--	1	0.03	0.004	0.01	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SPOTTAIL SHINER	164	4.45	0.906	3.02	--	--	--	--	179	5.27	1.320	4.54	7	4.29	0.049	0.88	1	0.37	0.009	0.08
FATHEAD MINNOW	1	0.03	0.005	0.02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE DACE	1	0.03	0.011	0.04	--	--	--	--	1	0.03	0.008	0.03	--	--	--	--	--	--	--	--
LONGNOSE SUCKER	--	--	--	--	1	0.38	0.286	3.71	--	--	--	--	--	--	--	--	--	--	--	--
WHITE SUCKER	3	0.08	2.328	7.75	5	1.91	4.180	54.16	8	0.24	5.900	20.29	1	0.61	1.000	17.98	2	0.74	3.050	28.38
BLACK BULLHEAD	--	--	--	--	1	0.38	0.313	4.06	1	0.03	0.071	0.24	1	0.61	0.380	6.83	--	--	--	--
CHANNEL CATFISH	1	0.03	0.003	0.01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TROUT-PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BURBOT	1	0.03	0.054	0.18	2	0.76	0.561	7.27	1	0.03	0.850	2.92	1	0.61	0.480	8.63	--	--	--	--
BROOK STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
NINESPINE STICKLEBACK	--	--	--	--	--	--	--	--	1	0.03	0.002	0.01	--	--	--	--	--	--	--	--
WHITE PERCH	1	0.03	0.014	0.05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PUMPKINSEED	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLUEGILL	--	--	--	--	--	--	--	--	2	0.06	0.040	0.14	--	--	--	--	--	--	--	--
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SMALLMOUTH BASS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLACK CRAPPIE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
YELLOW PERCH	56	1.52	0.506	1.68	5	1.91	0.064	0.83	57	1.68	0.257	0.88	1	0.61	0.019	0.34	--	--	--	--
FRESHWATER DRUM	1	0.03	1.550	5.16	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND GOBY	1	0.03	0.038	0.13	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MOTTLED SCULPIN	22	0.60	0.108	0.36	1	0.38	0.005	0.06	6	0.18	0.040	0.14	--	--	--	--	--	--	--	--
SLIMY SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID COTTUS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	3,689	100.00	30.038	100.00	262	100.00	7.718	100.00	3,395	100.00	29.084	100.00	163	100.00	5.561	100.00	270	100.00	10.747	100.00

APPENDIX C (cont.)

SPECIES	25-26OCT06				30-31OCT06				01-02NOV06				06-07NOV06				08-09NOV06			
	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%
GREAT LAKES CRAYFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LAKE STURGEON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	867	79.40	4.479	37.14	728	95.54	4.195	49.23	128	87.07	0.834	37.89	734	91.52	3.658	69.29	263	88.85	1.299	57.78
ALEWIFE type	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GIZZARD SHAD	216	19.78	2.405	19.94	6	0.79	0.061	0.72	16	10.88	0.148	6.72	9	1.12	1.123	21.27	6	2.03	0.057	2.54
LAKE WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLOATER	--	--	--	--	--	--	--	--	--	--	--	--	3	0.37	0.014	0.27	2	0.68	0.007	0.31
COHO SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHINOOK SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BROWN TROUT	--	--	--	--	1	0.13	0.071	0.83	--	--	--	--	--	--	--	--	--	--	--	--
LAKE TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RAINBOW SMELT	--	--	--	--	9	1.18	0.122	1.43	--	--	--	--	42	5.24	0.197	3.73	9	3.04	0.062	2.76
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON CARP	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GOLDEN SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON SHINER	--	--	--	--	1	0.13	0.063	0.74	--	--	--	--	--	--	--	--	--	--	--	--
SPOTTAIL SHINER	1	0.09	0.005	0.04	3	0.39	0.017	0.20	1	0.68	0.007	0.32	4	0.50	0.026	0.49	3	1.01	0.025	1.11
FATHEAD MINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE DACE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE SUCKER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
WHITE SUCKER	3	0.27	3.900	32.34	4	0.52	3.650	42.84	1	0.68	1.150	52.25	--	--	--	--	1	0.34	0.550	24.47
BLACK BULLHEAD	--	--	--	--	1	0.13	0.224	2.63	--	--	--	--	1	0.12	0.172	3.26	--	--	--	--
CHANNEL CATFISH	1	0.09	0.212	1.76	1	0.13	0.006	0.07	--	--	--	--	--	--	--	--	2	0.68	0.043	1.91
TROUT-PERCH	--	--	--	--	--	--	--	--	--	--	--	--	1	0.12	0.011	0.21	--	--	--	--
BURBOT	1	0.09	1.050	8.71	--	--	--	--	--	--	--	--	1	0.12	0.044	0.83	1	0.34	0.058	2.58
BROOK STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	1	0.12	0.001	0.02	--	--	--	--
NINESPINE STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
WHITE PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PUMPKINSEED	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLUEGILL	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SMALLMOUTH BASS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLACK CRAPPIE	--	--	--	--	1	0.13	0.013	0.15	--	--	--	--	--	--	--	--	--	--	--	--
YELLOW PERCH	2	0.18	0.005	0.04	4	0.52	0.080	0.94	1	0.68	0.062	2.82	4	0.50	0.014	0.27	7	2.36	0.138	6.14
FRESHWATER DRUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND GOBY	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MOTTLED SCULPIN	1	0.09	0.004	0.03	3	0.39	0.019	0.22	--	--	--	--	1	0.12	0.006	0.11	1	0.34	0.005	0.22
SLIMY SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID COTTUS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--	1	0.12	0.013	0.25	1	0.34	0.004	0.18
TOTAL SHELLFISH AND FISH	1,092	100.00	12.060	100.00	762	100.00	8.521	100.00	147	100.00	2.201	100.00	802	100.00	5.279	100.00	296	100.00	2.248	100.00

APPENDIX C (cont.)

SPECIES	13-14NOV06				15-16NOV06				19-20NOV06				21-22NOV06				27-28NOV06			
	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%
GREAT LAKES CRAYFISH	--	--	--	--	--	--	--	--	--	--	--	--	1	0.02	0.005	0.01	--	--	--	--
LAKE STURGEON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	12,147	99.63	50.929	99.08	4,651	99.57	22.010	74.65	121	88.97	0.563	18.23	4,119	72.85	24.336	64.37	71,339	99.92	322.979	99.38
ALEWIFE type	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GIZZARD SHAD	20	0.16	0.277	0.54	3	0.06	1.169	3.96	2	1.47	0.023	0.74	239	4.23	2.417	6.39	6	0.01	0.055	0.02
LAKE WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLOATER	--	--	--	--	1	0.02	0.005	0.02	--	--	--	--	1	0.02	0.003	0.01	--	--	--	--
COHO SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHINOOK SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	1	0.02	0.800	2.12	2	0.00	0.227	0.07
BROWN TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LAKE TROUT	--	--	--	--	1	0.02	1.900	6.44	--	--	--	--	2	0.04	0.014	0.04	2	0.00	0.013	0.00
RAINBOW SMELT	5	0.04	0.034	0.07	--	--	--	--	--	--	--	--	918	16.24	4.932	13.05	18	0.03	0.209	0.06
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON CARP	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GOLDEN SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON SHINER	--	--	--	--	--	--	--	--	--	--	--	--	1	0.02	0.028	0.07	--	--	--	--
SPOTTAIL SHINER	7	0.06	0.041	0.08	5	0.11	0.026	0.09	--	--	--	--	246	4.35	1.540	4.07	4	0.01	0.025	0.01
FATHEAD MINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE DACE	--	--	--	--	1	0.02	0.008	0.03	--	--	--	--	3	0.05	0.022	0.06	--	--	--	--
LONGNOSE SUCKER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
WHITE SUCKER	--	--	--	--	1	0.02	1.200	4.07	1	0.74	1.240	40.16	2	0.04	3.150	8.33	1	0.00	1.300	0.40
BLACK BULLHEAD	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHANNEL CATFISH	--	--	--	--	--	--	--	--	--	--	--	--	5	0.09	0.047	0.12	--	--	--	--
TROUT-PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BURBOT	--	--	--	--	2	0.04	3.150	10.68	--	--	--	--	--	--	--	--	4	0.01	0.085	0.03
BROOK STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	1	0.01	0.001	0.00	3	0.06	0.003	0.01	11	8.09	0.012	0.39	34	0.60	0.035	0.09	6	0.01	0.007	0.00
NINESPINE STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
WHITE PERCH	--	--	--	--	--	--	--	--	--	--	--	--	2	0.04	0.133	0.35	--	--	--	--
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PUMPKINSEED	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLUEGILL	--	--	--	--	--	--	--	--	--	--	--	--	2	0.04	0.012	0.03	--	--	--	--
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SMALLMOUTH BASS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLACK CRAPPIE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
YELLOW PERCH	10	0.08	0.100	0.19	2	0.04	0.006	0.02	--	--	--	--	73	1.29	0.302	0.80	7	0.01	0.031	0.01
FRESHWATER DRUM	--	--	--	--	--	--	--	--	1	0.74	1.250	40.48	--	--	--	--	--	--	--	--
ROUND GOBY	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	0.00	0.035	0.01
MOTTLED SCULPIN	2	0.02	0.018	0.04	1	0.02	0.006	0.02	--	--	--	--	5	0.09	0.028	0.07	3	0.00	0.024	0.01
SLIMY SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2	0.00	0.014	0.00
UNID COTTUS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	12,192	100.00	51.400	100.00	4,671	100.00	29.483	100.00	136	100.00	3.088	100.00	5,654	100.00	37.804	100.00	71,395	100.00	325.004	100.00

APPENDIX C (cont.)

SPECIES	29-30NOV06			
	#	%	KG	%
GREAT LAKES CRAYFISH	1	0.06	0.003	0.03
LAKE STURGEON	--	--	--	--
ALEWIFE	1,553	96.04	8.307	94.90
ALEWIFE type	--	--	--	--
UNID ALOSA	--	--	--	--
GIZZARD SHAD	9	0.56	0.071	0.81
LAKE WHITEFISH	--	--	--	--
BLOATER	--	--	--	--
COHO SALMON	--	--	--	--
CHINOOK SALMON	--	--	--	--
ROUND WHITEFISH	--	--	--	--
BROWN TROUT	--	--	--	--
LAKE TROUT	--	--	--	--
RAINBOW SMELT	25	1.55	0.209	2.39
CENTRAL MUDMINNOW	--	--	--	--
COMMON CARP	--	--	--	--
GOLDEN SHINER	--	--	--	--
EMERALD SHINER	--	--	--	--
COMMON SHINER	--	--	--	--
SPOTTAIL SHINER	1	0.06	0.005	0.06
FATHEAD MINNOW	--	--	--	--
LONGNOSE DACE	--	--	--	--
LONGNOSE SUCKER	1	0.06	0.103	1.18
WHITE SUCKER	--	--	--	--
BLACK BULLHEAD	--	--	--	--
CHANNEL CATFISH	--	--	--	--
TROUT-PERCH	--	--	--	--
BURBOT	--	--	--	--
BROOK STICKLEBACK	--	--	--	--
THREESPINE STICKLEBACK	23	1.42	0.023	0.26
NINESPINE STICKLEBACK	--	--	--	--
WHITE PERCH	1	0.06	0.007	0.08
GREEN SUNFISH	--	--	--	--
PUMPKINSEED	--	--	--	--
BLUEGILL	--	--	--	--
UNID LEPOMIS	--	--	--	--
SMALLMOUTH BASS	1	0.06	0.016	0.18
BLACK CRAPPIE	--	--	--	--
YELLOW PERCH	--	--	--	--
FRESHWATER DRUM	--	--	--	--
ROUND GOBY	--	--	--	--
MOTTLED SCULPIN	2	0.12	0.009	0.10
SLIMY SCULPIN	--	--	--	--
UNID COTTUS	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--
TOTAL SHELLFISH AND FISH	1,617	100.00	8.753	100.00

APPENDIX D

APPENDIX D. CPE BY NUMBER (No. per million gallons) AND WEIGHT (Kg. per million gallons) FOR SHELLFISH AND FISH COLLECTED DURING IMPINGEMENT AT POINT BEACH NUCLEAR PLANT BY SAMPLING DATE, DECEMBER 2005 - NOVEMBER 2006.

SPECIES	07-08DEC05		14-15DEC05		21-22DEC05		28-29DEC05		04-05JAN06		11-12JAN06	
	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG
GREAT LAKES CRAYFISH	0.0017715	--	--	--	--	--	--	--	--	--	--	--
LAKE STURGEON	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE type	--	--	--	--	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--
GIZZARD SHAD	0.0017715	0.0000106	0.0354756	0.0014287	--	--	0.0088577	0.0002693	--	--	--	--
LAKE WHITEFISH	--	--	0.0032251	0.0000258	--	--	--	--	--	--	--	--
BLOATER	--	--	--	--	--	--	--	--	--	--	--	--
COHO SALMON	--	--	--	--	--	--	--	--	--	--	--	--
CHINOOK SALMON	--	--	--	--	--	--	--	--	--	--	--	--
ROUND WHITEFISH	--	--	0.0096752	0.0060760	0.0053146	0.0025687	0.0017715	0.0011869	0.0053146	0.0025510	0.0017715	0.0008149
BROWN TROUT	--	--	0.0161253	0.0024768	0.0017715	0.0001683	--	--	0.0017715	0.0018601	--	--
LAKE TROUT	--	--	--	--	--	--	--	--	--	--	--	--
RAINBOW SMELT	0.0035431	0.0000089	0.0096752	0.0000129	0.0035431	0.0000248	0.0921202	0.0001098	0.0017715	0.0000071	0.0566893	0.0002852
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	0.0017715	0.0000089
COMMON CARP	--	--	0.0096752	0.0000935	--	--	--	--	--	--	--	--
GOLDEN SHINER	--	--	--	--	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	--	--
COMMON SHINER	--	--	--	--	--	--	--	--	--	--	--	--
SPOTTAIL SHINER	--	--	0.0258005	0.0001709	--	--	--	--	--	--	0.0017715	0.0000266
FATHEAD MINNOW	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE DACE	--	--	0.0032251	0.0000065	--	--	--	--	--	--	--	--
LONGNOSE SUCKER	--	--	0.0032251	0.0032251	--	--	--	--	0.0017715	0.0016121	--	--
WHITE SUCKER	0.0017715	0.0017715	--	--	0.0017715	0.0002427	--	--	--	--	--	--
BLACK BULLHEAD	0.0017715	0.0003366	0.0032251	0.0003386	0.0017715	0.0003189	--	--	--	--	--	--
CHANNEL CATFISH	0.0017715	0.0025687	0.0225754	0.0039023	0.0070862	0.0001027	--	--	--	--	--	--
TROUT-PERCH	--	--	--	--	--	--	--	--	--	--	--	--
BURBOT	0.0035431	0.0001240	0.0225754	0.0001838	--	--	0.0035431	0.0000177	0.0017715	0.0002799	--	--
BROOK STICKLEBACK	--	--	0.0032251	0.0000032	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	--	--	--	--	0.0017715	0.0000018	0.0124008	0.0000142	0.0088577	0.0000089	0.0460601	0.0000478
NINESPINE STICKLEBACK	--	--	--	--	0.0017715	0.0000035	--	--	--	--	--	--
WHITE PERCH	--	--	--	--	--	--	--	--	--	--	--	--
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--
PUMPKINSEED	--	--	0.0032251	0.0000258	--	--	--	--	--	--	--	--
BLUEGILL	--	--	--	--	--	--	--	--	--	--	--	--
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	--	--
SMALLMOUTH BASS	0.0035431	0.0001506	0.0032251	0.0007740	--	--	--	--	--	--	--	--
BLACK CRAPPIE	--	--	--	--	--	--	--	--	--	--	--	--
YELLOW PERCH	0.0053146	0.0000213	0.2999303	0.0009772	0.0035431	0.0000195	0.0584609	0.0001169	0.0017715	0.0000035	0.0141723	0.0000425
FRESHWATER DRUM	--	--	0.0129002	0.0114490	0.0017715	0.0036317	--	--	--	--	--	--
ROUND GOBY	--	--	--	--	--	--	--	--	--	--	--	--
MOTTLED SCULPIN	--	--	0.0096752	0.0000645	0.0017715	0.0000053	0.0070862	0.0000407	0.0017715	0.0000124	0.0035431	0.0000248
SLIMY SCULPIN	0.0124008	0.0000655	0.0290255	0.0001580	0.0053146	0.0000354	0.0017715	0.0000089	0.0017715	0.0000089	--	--
UNID COTTUS	--	--	--	--	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	0.0032251	0.0000323	--	--	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	0.0372024	0.0050578	0.5289094	0.0314250	0.0372024	0.0071234	0.1860119	0.0017645	0.0265731	0.0063439	0.1257795	0.0012507

APPENDIX D (cont.)

SPECIES	18-19JAN06		25-26JAN06		01-02FEB06		08-09FEB06		15-16FEB06		22-23FEB06	
	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG
GREAT LAKES CRAYFISH	0.0017715	--	--	--	0.0017765	--	--	--	--	--	0.0088577	--
LAKE STURGEON	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE type	--	--	--	--	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--
GIZZARD SHAD	--	--	0.0050020	0.0003426	--	--	0.0017715	0.0000957	--	--	--	--
LAKE WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--
BLOATER	--	--	--	--	--	--	--	--	--	--	--	--
COHO SALMON	--	--	--	--	--	--	--	--	--	--	--	--
CHINOOK SALMON	--	--	--	--	--	--	--	--	--	--	--	--
ROUND WHITEFISH	--	--	--	--	0.0088824	0.0019275	--	--	--	--	0.0035431	0.0022144
BROWN TROUT	0.0017715	0.0002374	--	--	--	--	--	--	--	--	0.0017715	0.0003012
LAKE TROUT	--	--	--	--	--	--	--	--	--	--	--	--
RAINBOW SMELT	0.0017715	0.0000071	0.0125050	0.0000475	0.6928259	0.0021673	0.0088577	0.0000177	--	--	0.1930981	0.0007742
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	--	--
COMMON CARP	--	--	--	--	--	--	--	--	--	--	--	--
GOLDEN SHINER	--	--	--	--	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	--	--
COMMON SHINER	--	--	--	--	--	--	--	--	--	--	--	--
SPOTTAIL SHINER	--	--	--	--	0.0017765	0.0000018	--	--	0.0017902	0.0000090	0.0017715	0.0000142
FATHEAD MINNOW	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE DACE	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE SUCKER	0.0017715	0.0003277	--	--	--	--	--	--	--	--	--	--
WHITE SUCKER	0.0017715	0.0019133	--	--	--	--	0.0017715	0.0005315	0.0017902	0.0032223	--	--
BLACK BULLHEAD	0.0017715	0.0003525	0.0025010	0.0005252	--	--	0.0017715	0.0004252	0.0017902	0.0003473	--	--
CHANNEL CATFISH	--	--	--	--	--	--	--	--	--	--	--	--
TROUT-PERCH	--	--	--	--	--	--	--	--	--	--	--	--
BURBOT	--	--	0.0025010	0.0000525	--	--	--	--	0.0017902	0.0004153	--	--
BROOK STICKLEBACK	--	--	--	--	0.0035530	0.0000089	--	--	--	--	--	--
THREESPINE STICKLEBACK	0.0088577	0.0000124	--	--	0.0799414	0.0000817	--	--	0.0089509	0.0000090	0.0478316	0.0000496
NINESPINE STICKLEBACK	--	--	--	--	--	--	--	--	--	--	0.0017715	0.0000035
WHITE PERCH	--	--	--	--	--	--	--	--	--	--	0.0017715	0.0003986
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--
PUMPKINSEED	--	--	--	--	--	--	--	--	--	--	--	--
BLUEGILL	--	--	--	--	--	--	--	--	--	--	--	--
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	--	--
SMALLMOUTH BASS	--	--	--	--	0.0017765	0.0000515	--	--	--	--	--	--
BLACK CRAPPIE	--	--	--	--	--	--	--	--	--	--	--	--
YELLOW PERCH	0.0017715	0.0000035	0.0050020	0.0000200	0.0621767	0.0002007	0.0053146	0.0000177	0.0053706	0.0000161	0.0124008	0.0000478
FRESHWATER DRUM	--	--	--	--	--	--	0.0017715	0.0038974	--	--	--	--
ROUND GOBY	--	--	--	--	--	--	--	--	--	--	--	--
MOTTLED SCULPIN	--	--	0.0025010	0.0000125	0.0035530	0.0000195	0.0035431	0.0000106	0.0053706	0.0000304	0.0106293	0.0000585
SLIMY SCULPIN	--	--	--	--	--	--	--	--	0.0017902	0.0000125	0.0070862	0.0000549
UNID COTTUS	--	--	--	--	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	0.0212585	0.0028540	0.0300120	0.0010004	0.8562617	0.0044590	0.0248016	0.0049957	0.0286430	0.0040619	0.2905329	0.0039169

APPENDIX D (cont.)

SPECIES	01-02MAR06		08-09MAR06		15-16MAR06		22-23MAR06		29-30MAR06		05-06APR06	
	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG
GREAT LAKES CRAYFISH	0.0017715	--	0.0017902	--	--	--	--	--	--	--	--	--
LAKE STURGEON	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE type	--	--	--	--	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--
GIZZARD SHAD	0.0017715	0.0001400	0.1163623	0.0051987	--	--	--	--	--	--	--	--
LAKE WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--
BLOATER	--	--	--	--	--	--	--	--	--	--	--	--
COHO SALMON	--	--	--	--	--	--	--	--	--	--	--	--
CHINOOK SALMON	--	--	--	--	--	--	--	--	--	--	--	--
ROUND WHITEFISH	--	--	0.0035804	0.0016828	0.0010618	0.0004460	0.0017533	0.0009292	0.0010656	0.0006394	--	--
BROWN TROUT	--	--	--	--	--	--	--	--	--	--	--	--
LAKE TROUT	--	--	--	--	--	--	--	--	--	--	--	--
RAINBOW SMELT	--	--	--	--	0.0053090	0.0000584	--	--	0.0021313	0.0000181	0.0040708	0.0000448
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	--	--
COMMON CARP	--	--	--	--	--	--	--	--	--	--	--	--
GOLDEN SHINER	--	--	--	--	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	--	--
COMMON SHINER	--	--	--	--	--	--	--	--	--	--	--	--
SPOTTAIL SHINER	--	--	0.0017902	0.0000018	0.0010618	0.0000053	--	--	--	--	0.0010177	0.0000122
FATHEAD MINNOW	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE DACE	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE SUCKER	--	--	--	--	--	--	--	--	0.0010656	0.0021313	--	--
WHITE SUCKER	--	--	--	--	--	--	--	--	0.0010656	0.0007886	--	--
BLACK BULLHEAD	--	--	--	--	--	--	--	--	--	--	--	--
CHANNEL CATFISH	--	--	0.0035804	0.0027927	--	--	--	--	--	--	--	--
TROUT-PERCH	--	--	--	--	--	--	--	--	--	--	--	--
BURBOT	--	--	0.0035804	0.0005800	--	--	--	--	--	--	--	--
BROOK STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	--	--	0.0017902	0.0000018	0.0084944	0.0000096	--	--	0.0010656	0.0000011	--	--
NINESPINE STICKLEBACK	--	--	--	--	0.0010618	0.0000021	--	--	--	--	--	--
WHITE PERCH	--	--	--	--	--	--	--	--	--	--	--	--
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--
PUMPKINSEED	--	--	--	--	--	--	--	--	--	--	--	--
BLUEGILL	--	--	--	--	--	--	--	--	--	--	--	--
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	--	--
SMALLMOUTH BASS	--	--	0.0017902	0.0007161	--	--	--	--	0.0010656	0.0001407	--	--
BLACK CRAPPIE	--	--	--	--	--	--	--	--	--	--	--	--
YELLOW PERCH	0.0035431	0.0000177	--	--	--	--	--	--	--	--	--	--
FRESHWATER DRUM	--	--	--	--	--	--	--	--	--	--	--	--
ROUND GOBY	--	--	--	--	--	--	--	--	--	--	--	--
MOTTLED SCULPIN	0.0141723	0.0000992	0.0107411	0.0000680	0.0021236	0.0000159	--	--	0.0021313	0.0000107	--	--
SLIMY SCULPIN	0.0124008	0.0001027	0.0143215	0.0001020	0.0010618	0.0000085	--	--	--	--	--	--
UNID COTTUS	--	--	--	--	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	0.0336593	0.0003596	0.1593269	0.0111439	0.0201741	0.0005458	0.0017533	0.0009292	0.0095908	0.0037298	0.0050885	0.0000570

APPENDIX D (cont.)

SPECIES	12-13APR06		19-20APR06		26-27APR06		03-04MAY06		10-11MAY06		15-16MAY06	
	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG
GREAT LAKES CRAYFISH	0.0010598	--	0.0010708	--	--	--	0.0012903	--	0.0021884	--	0.0036857	--
LAKE STURGEON	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	0.0296746	0.0000774	0.0128497	0.0000418	59.3360996	0.2136197	48.2297688	0.1826783	20.9011730	0.0752451	13.5246204	0.0500553
ALEWIFE type	--	--	--	--	0.2330974	0.0004271	0.7664121	0.0025805	--	--	--	--
UNID ALOSA	--	--	0.0021416	0.0000021	--	--	--	--	--	--	--	--
GIZZARD SHAD	--	--	--	--	--	--	--	--	--	--	--	--
LAKE WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--
BLOATER	--	--	--	--	--	--	--	--	--	--	--	--
COHO SALMON	--	--	--	--	--	--	--	--	--	--	0.0018428	0.0000111
CHINOOK SALMON	--	--	--	--	--	--	--	--	--	--	--	--
ROUND WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--
BROWN TROUT	--	--	--	--	--	--	0.0012903	0.0025805	--	--	0.0018428	0.0001566
LAKE TROUT	--	--	--	--	--	--	--	--	--	--	--	--
RAINBOW SMELT	0.0211961	0.0001198	0.0042832	0.0000289	0.0048816	0.0000293	0.0683836	0.0005548	0.0984769	0.0009826	0.2414124	0.0015296
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	--	--
COMMON CARP	--	--	--	--	--	--	--	--	--	--	--	--
GOLDEN SHINER	--	--	--	--	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	--	--
COMMON SHINER	--	--	--	--	--	--	--	--	--	--	--	--
SPOTTAIL SHINER	--	--	--	--	--	--	--	--	--	--	--	--
FATHEAD MINNOW	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE DACE	0.0010598	0.0000074	--	--	--	--	--	--	--	--	--	--
LONGNOSE SUCKER	--	--	--	--	--	--	--	--	--	--	--	--
WHITE SUCKER	0.0010598	0.0014837	--	--	--	--	--	--	--	--	--	--
BLACK BULLHEAD	0.0010598	0.0001060	--	--	--	--	--	--	--	--	--	--
CHANNEL CATFISH	--	--	--	--	--	--	--	--	--	--	--	--
TROUT-PERCH	--	--	--	--	--	--	--	--	--	--	--	--
BURBOT	--	--	0.0010708	0.0001735	--	--	0.0025805	0.0020644	--	--	--	--
BROOK STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	0.0148373	0.0000191	0.0107081	0.0000171	0.0195265	0.0000244	0.0038708	0.0000090	0.0043768	0.0000088	0.1160991	0.0002009
NINESPINE STICKLEBACK	0.0010598	0.0000032	0.0032124	0.0000086	0.0207469	0.0000476	0.0116123	0.0000284	0.0087535	0.0000241	0.1547988	0.0003151
WHITE PERCH	--	--	--	--	--	--	--	--	--	--	--	--
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--
PUMPKINSEED	--	--	--	--	--	--	--	--	--	--	--	--
BLUEGILL	--	--	--	--	--	--	--	--	--	--	--	--
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	--	--
SMALLMOUTH BASS	0.0010598	0.0016957	--	--	--	--	--	--	--	--	--	--
BLACK CRAPPIE	--	--	--	--	--	--	--	--	--	--	--	--
YELLOW PERCH	0.0010598	0.0000042	--	--	--	--	--	--	--	--	--	--
FRESHWATER DRUM	--	--	--	--	--	--	--	--	--	--	--	--
ROUND GOBY	--	--	--	--	--	--	0.0012903	0.0001097	--	--	--	--
MOTTLED SCULPIN	0.0010598	0.0000106	0.0010708	0.0000075	0.0146449	0.0000586	0.0038708	0.0000258	0.0131303	0.0000700	0.0202713	0.0001014
SLIMY SCULPIN	0.0010598	0.0000265	0.0032124	0.0000182	0.0097632	0.0000537	--	--	0.0021884	0.0000066	--	--
UNID COTTUS	--	--	--	--	--	--	0.0012903	0.0000039	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	0.0752462	0.0035535	0.0396200	0.0002977	59.6387601	0.2142604	49.0916598	0.1906353	21.0302871	0.0763371	14.0645732	0.0523699

APPENDIX D (cont.)

SPECIES	17-18MAY06		22-23MAY06		24-25MAY06		29-30MAY06		31MAY-01JUN06		05-06JUN06	
	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG
GREAT LAKES CRAYFISH	0.0024551	--	0.0040793	--	--	--	--	--	--	--	--	--
LAKE STURGEON	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	32.2301876	0.0779240	27.1329546	0.0949598	205.0534042	0.4510989	284.3715616	1.1660183	210.7655347	1.0327026	203.5000000	0.5697647
ALEWIFE type	--	--	--	--	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--
GIZZARD SHAD	--	--	--	--	--	--	--	--	--	--	--	--
LAKE WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--
BLOATER	--	--	--	--	--	--	--	--	--	--	--	--
COHO SALMON	--	--	--	--	0.0013154	0.0000092	--	--	--	--	--	--
CHINOOK SALMON	--	--	--	--	--	--	--	--	--	--	--	--
ROUND WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--
BROWN TROUT	--	--	--	--	--	--	--	--	--	--	--	--
LAKE TROUT	--	--	--	--	--	--	--	--	--	--	--	--
RAINBOW SMELT	0.1215261	0.0008703	0.0928041	0.0007863	0.5820530	0.0034535	0.3226830	0.0022535	0.1274510	0.0009542	0.0047824	0.0000263
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	--	--
COMMON CARP	--	--	--	--	--	--	--	--	--	--	--	--
GOLDEN SHINER	--	--	--	--	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	--	--
COMMON SHINER	--	--	--	--	--	--	--	--	--	--	--	--
SPOTTAIL SHINER	--	--	--	--	--	--	--	--	--	--	--	--
FATHEAD MINNOW	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE DACE	--	--	--	--	--	--	--	--	--	--	0.0011956	0.0000155
LONGNOSE SUCKER	--	--	--	--	--	--	--	--	--	--	--	--
WHITE SUCKER	--	--	--	--	--	--	--	--	--	--	--	--
BLACK BULLHEAD	--	--	--	--	--	--	0.0026449	0.0003848	0.0010893	0.0002070	--	--
CHANNEL CATFISH	--	--	--	--	--	--	--	--	--	--	--	--
TROUT-PERCH	--	--	--	--	--	--	--	--	--	--	--	--
BURBOT	--	--	--	--	--	--	0.0013225	0.0025722	--	--	--	--
BROOK STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	0.0405087	0.0000737	0.0010198	0.0000020	0.0232821	0.0000233	0.0039674	0.0000053	0.0065359	0.0000087	0.0035868	0.0000036
NINESPINE STICKLEBACK	0.0368261	0.0000945	0.0132577	0.0000388	0.0543250	0.0001397	0.0171921	0.0000384	0.0141612	0.0000381	0.0083692	0.0000215
WHITE PERCH	--	--	--	--	--	--	--	--	--	--	--	--
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--
PUMPKINSEED	--	--	--	--	--	--	--	--	--	--	--	--
BLUEGILL	--	--	--	--	--	--	--	--	--	--	--	--
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	--	--
SMALLMOUTH BASS	--	--	--	--	--	--	--	--	--	--	--	--
BLACK CRAPPIE	--	--	--	--	--	--	--	--	--	--	--	--
YELLOW PERCH	--	--	--	--	--	--	--	--	0.0010893	0.0000033	--	--
FRESHWATER DRUM	--	--	--	--	--	--	--	--	--	--	--	--
ROUND GOBY	--	--	--	--	--	--	--	--	0.0021786	0.0001405	--	--
MOTTLED SCULPIN	0.0196406	0.0001080	0.0020397	0.0000112	0.0130222	0.0000901	0.0066124	0.0000317	0.0021786	0.0000087	0.0095648	0.0000670
SLIMY SCULPIN	0.0061377	0.0000344	0.0183569	0.0000999	0.0155214	0.0000698	0.0066124	0.0000410	--	--	0.0011956	0.0000084
UNID COTTUS	--	--	--	--	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	32.4572817	0.0791049	27.2645121	0.0958981	205.7429233	0.4548845	284.7325963	1.1713452	210.9202188	1.0340632	203.5286944	0.5699070

APPENDIX D (cont.)

SPECIES	07-08JUN06		12-13JUN06		14-15JUN06		19-20JUN06		21-22JUN06		26-27JUN06	
	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG
GREAT LAKES CRAYFISH	--	--	0.0024799	--	0.0030489	--	--	--	--	--	--	--
LAKE STURGEON	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	450.8748115	1.4879336	18.6787025	0.0653680	14.0320745	0.0533314	171.7645428	0.5324355	196.1107241	0.6242413	17.5329966	0.0455852
ALEWIFE type	--	--	--	--	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--
GIZZARD SHAD	--	--	--	--	--	--	--	--	--	--	--	--
LAKE WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--
BLOATER	--	--	--	--	--	--	--	--	--	--	--	--
COHO SALMON	--	--	--	--	--	--	--	--	--	--	--	--
CHINOOK SALMON	--	--	0.0012400	0.0000074	--	--	--	--	--	--	--	--
ROUND WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--
BROWN TROUT	--	--	--	--	--	--	--	--	--	--	--	--
LAKE TROUT	--	--	--	--	--	--	--	--	--	--	--	--
RAINBOW SMELT	0.4449472	0.0035370	0.0917568	0.0005133	0.0345543	0.0001982	0.0195644	0.0001054	0.1327992	0.0008730	0.0295340	0.0001752
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	--	--
COMMON CARP	--	--	--	--	--	--	--	--	--	--	--	--
GOLDEN SHINER	--	--	--	--	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	--	--
COMMON SHINER	--	--	--	--	--	--	--	--	--	--	--	--
SPOTTAIL SHINER	--	--	0.0012400	0.0000124	0.0010163	0.0000122	--	--	--	--	--	--
FATHEAD MINNOW	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE DACE	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE SUCKER	--	--	--	--	--	--	--	--	0.0010885	0.0007620	--	--
WHITE SUCKER	0.0075415	0.0090498	0.0012400	0.0011160	--	--	0.0021738	0.0024455	--	--	0.0010184	0.0007383
BLACK BULLHEAD	0.0075415	0.0001584	0.0012400	0.0001364	--	--	--	--	--	--	--	--
CHANNEL CATFISH	--	--	--	--	--	--	--	--	--	--	--	--
TROUT-PERCH	--	--	--	--	--	--	--	--	--	--	--	--
BURBOT	--	--	--	--	0.0010163	0.0017277	--	--	--	--	--	--
BROOK STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	0.0377074	0.0000679	0.0185993	0.0000285	0.0050815	0.0000091	0.0010869	0.0000022	0.0021770	0.0000033	0.0285156	0.0000468
NINESPINE STICKLEBACK	0.0678733	0.0001357	0.0607579	0.0001401	0.0335379	0.0000915	0.0195644	0.0000587	0.0119737	0.0000316	0.0295340	0.0000672
WHITE PERCH	--	--	--	--	--	--	--	--	--	--	--	--
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--
PUMPKINSEED	--	--	--	--	--	--	--	--	--	--	--	--
BLUEGILL	--	--	--	--	--	--	--	--	--	--	--	--
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	--	--
SMALLMOUTH BASS	--	--	--	--	--	--	--	--	--	--	--	--
BLACK CRAPPIE	--	--	--	--	--	--	--	--	--	--	--	--
YELLOW PERCH	0.0075415	0.0018854	0.0012400	0.0000099	--	--	--	--	--	--	0.0020368	0.0004084
FRESHWATER DRUM	--	--	--	--	--	--	--	--	--	--	--	--
ROUND GOBY	--	--	--	--	--	--	--	--	--	--	--	--
MOTTLED SCULPIN	0.0226244	0.0001433	0.0210793	0.0001290	0.0081304	0.0000661	0.0086953	0.0000467	0.0021770	0.0000131	0.0152762	0.0000540
SLIMY SCULPIN	--	--	0.0024799	0.0000149	0.0020326	0.0000102	--	--	--	--	0.0040737	0.0000346
UNID COTTUS	--	--	--	--	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	451.4705882	1.5029110	18.8820554	0.0674759	14.1204927	0.0554464	171.8156276	0.5350941	196.2609396	0.6259242	17.6429852	0.0471097

APPENDIX D (cont.)

SPECIES	28-29JUN06		03JUL06		05-06JUL06		10-11JUL06		12-13JUL06		17-18JUL06	
	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG
GREAT LAKES CRAYFISH	0.0010191	--	0.0060024	--	--	--	0.0012204	--	--	--	0.0022164	--
LAKE STURGEON	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	12.3435653	0.0469070	63.8115246	0.2233794	--	--	29.9121308	0.1076873	8.9702825	0.0367810	28.1284631	0.1096968
ALEWIFE type	--	--	--	--	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--
GIZZARD SHAD	--	--	--	--	--	--	--	--	--	--	--	--
LAKE WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--
BLOATER	--	--	--	--	--	--	0.0024408	0.0000110	--	--	--	--
COHO SALMON	--	--	--	--	--	--	0.0012204	0.0000098	--	--	--	--
CHINOOK SALMON	--	--	--	--	--	--	--	--	--	--	--	--
ROUND WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--
BROWN TROUT	--	--	--	--	--	--	--	--	--	--	--	--
LAKE TROUT	--	--	--	--	--	--	--	--	--	--	--	--
RAINBOW SMELT	0.0183441	0.0001243	0.0240096	0.0002041	--	--	0.0585794	0.0003258	0.0112103	0.0000673	0.1651226	0.0007225
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	--	--
COMMON CARP	--	--	--	--	--	--	--	--	--	--	--	--
GOLDEN SHINER	--	--	--	--	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	--	--
COMMON SHINER	--	--	--	--	--	--	--	--	--	--	--	--
SPOTTAIL SHINER	--	--	--	--	--	--	0.0012204	0.0000110	--	--	0.0011082	0.0000078
FATHEAD MINNOW	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE DACE	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE SUCKER	--	--	--	--	--	--	0.0012204	0.0001245	0.0020382	0.0013045	0.0011082	0.0001806
WHITE SUCKER	--	--	--	--	--	--	0.0012204	0.0020137	--	--	--	--
BLACK BULLHEAD	--	--	--	--	--	--	--	--	0.0010191	0.0002548	--	--
CHANNEL CATFISH	--	--	--	--	--	--	--	--	--	--	--	--
TROUT-PERCH	--	--	--	--	--	--	--	--	--	--	--	--
BURBOT	0.0020382	0.0042803	--	--	--	--	--	--	0.0010191	0.0005096	--	--
BROOK STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	0.0071338	0.0000122	--	--	--	--	0.0268489	0.0000513	0.0050956	0.0000092	0.0166231	0.0000299
NINESPINE STICKLEBACK	0.0163059	0.0000408	0.0030012	0.0000090	--	--	0.0475958	0.0000976	0.0061147	0.0000153	0.0343544	0.0000731
WHITE PERCH	--	--	--	--	--	--	--	--	--	--	--	--
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--
PUMPKINSEED	--	--	--	--	--	--	--	--	--	--	--	--
BLUEGILL	--	--	--	--	--	--	--	--	--	--	--	--
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	--	--
SMALLMOUTH BASS	--	--	--	--	--	--	--	--	--	--	--	--
BLACK CRAPPIE	--	--	--	--	--	--	--	--	--	--	--	--
YELLOW PERCH	0.0010191	0.0000041	--	--	--	--	0.0012204	0.0002953	--	--	0.0011082	0.0000022
FRESHWATER DRUM	--	--	--	--	--	--	--	--	--	--	--	--
ROUND GOBY	--	--	--	--	--	--	--	--	--	--	--	--
MOTTLED SCULPIN	0.0061147	0.0000347	--	--	--	--	0.0073224	0.0000610	0.0050956	0.0000204	0.0033246	0.0000177
SLIMY SCULPIN	0.0020382	0.0000224	--	--	--	--	0.0012204	0.0000049	--	--	0.0011082	0.0000078
UNID COTTUS	--	--	--	--	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	12.3975786	0.0514257	63.8445378	0.2235924	--	--	30.0634611	0.1106932	9.0018752	0.0389619	28.3545370	0.1107385

APPENDIX D (cont.)

SPECIES	19-20JUL06		24-25JUL06		26-27JUL06		31JUL-01AUG06		02-03AUG06		07-08AUG06	
	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG
GREAT LAKES CRAYFISH	0.0010298	--	0.0040878	--	0.0010284	--	0.0010327	--	0.0023159	--	0.0076196	--
LAKE STURGEON	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	31.2942824	0.1095300	8.2205780	0.0312431	6.5950226	0.0237443	6.6228106	0.0233177	2.1885132	0.0115621	0.5013715	0.0035965
ALEWIFE type	--	--	--	--	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--
GIZZARD SHAD	--	--	--	--	--	--	--	--	--	--	--	--
LAKE WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--
BLOATER	--	--	0.0010220	0.0000051	--	--	--	--	--	--	--	--
COHO SALMON	--	--	--	--	--	--	--	--	--	--	--	--
CHINOOK SALMON	--	--	--	--	--	--	--	--	0.0023159	0.0000567	--	--
ROUND WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--
BROWN TROUT	--	--	--	--	--	--	--	--	0.0011579	0.0004632	--	--
LAKE TROUT	--	--	--	--	--	--	--	--	--	--	--	--
RAINBOW SMELT	0.0339842	0.0002214	0.0081756	0.0000368	0.0051419	0.0000309	0.0227198	0.0001095	0.0138953	0.0000533	--	--
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	--	--
COMMON CARP	--	--	--	--	0.0010284	0.0000987	--	--	--	--	--	--
GOLDEN SHINER	--	--	--	--	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	--	--
COMMON SHINER	--	--	--	--	--	--	--	--	--	--	--	--
SPOTTAIL SHINER	0.0020596	0.0000257	--	--	--	--	0.0010327	0.0000124	--	--	0.0030479	0.0000442
FATHEAD MINNOW	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE DACE	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE SUCKER	0.0030895	0.0003501	0.0020439	0.0010424	--	--	0.0010327	0.0002479	--	--	0.0030479	0.0015331
WHITE SUCKER	0.0010298	0.0011328	0.0020439	0.0028615	0.0020568	0.0018511	--	--	0.0023159	0.0020843	0.0015239	0.0015239
BLACK BULLHEAD	0.0010298	0.0001586	0.0010220	0.0001819	--	--	--	--	--	--	--	--
CHANNEL CATFISH	--	--	--	--	--	--	--	--	--	--	--	--
TROUT-PERCH	--	--	--	--	--	--	--	--	--	--	--	--
BURBOT	--	--	0.0010220	0.0005110	--	--	--	--	0.0011579	0.0017369	0.0015239	0.0017525
BROOK STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	0.0010298	0.0000021	0.0051098	0.0000092	0.0020568	0.0000021	0.0020654	0.0000031	0.0104215	0.0000197	--	--
NINESPINE STICKLEBACK	0.0051491	0.0000134	0.0173732	0.0000358	0.0030852	0.0000062	0.0030981	0.0000083	0.0301065	0.0000614	0.0030479	0.0000046
WHITE PERCH	--	--	--	--	--	--	--	--	--	--	--	--
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--
PUMPKINSEED	--	--	--	--	--	--	--	--	--	--	--	--
BLUEGILL	--	--	--	--	--	--	--	--	--	--	--	--
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	--	--
SMALLMOUTH BASS	--	--	--	--	--	--	--	--	--	--	--	--
BLACK CRAPPIE	--	--	--	--	--	--	--	--	--	--	--	--
YELLOW PERCH	--	--	0.0010220	0.0001717	0.0020568	0.0008063	--	--	0.0081056	0.0000371	0.0015239	0.0000061
FRESHWATER DRUM	--	--	--	--	--	--	--	--	--	--	--	--
ROUND GOBY	--	--	--	--	--	--	--	--	--	--	--	--
MOTTLED SCULPIN	0.0113281	0.0000762	0.0051098	0.0000143	0.0030852	0.0000103	0.0061963	0.0000320	0.0057897	0.0000324	0.0030479	0.0000137
SLIMY SCULPIN	--	--	0.0010220	0.0000061	--	--	--	--	--	--	--	--
UNID COTTUS	--	--	--	--	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	31.3540122	0.1115103	8.2696317	0.0361188	6.6145619	0.0265498	6.6599884	0.0237308	2.2660954	0.0161070	0.5257543	0.0084746

APPENDIX D (cont.)

SPECIES	09-10AUG06		14-15AUG06		16-17AUG06		21-22AUG06		23-24AUG06		28-29AUG06	
	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG
GREAT LAKES CRAYFISH	0.0092555	--	0.0214163	--	0.0201450	--	0.0141988	--	0.0163172	--	0.0081699	--
LAKE STURGEON	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	0.3774167	0.0019961	0.3650975	0.0021824	0.4734085	0.0040774	0.0527383	0.0004229	0.0418128	0.0004140	0.0265523	0.0002533
ALEWIFE type	--	--	--	--	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--
GIZZARD SHAD	--	--	--	--	--	--	--	--	--	--	0.0142974	0.0001001
LAKE WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--
BLOATER	--	--	--	--	--	--	--	--	--	--	--	--
COHO SALMON	--	--	--	--	--	--	--	--	--	--	--	--
CHINOOK SALMON	--	--	--	--	--	--	--	--	--	--	--	--
ROUND WHITEFISH	0.0010284	0.0004628	--	--	0.0010073	0.0006044	--	--	--	--	--	--
BROWN TROUT	--	--	--	--	0.0010073	0.0046837	0.0010142	0.0050832	--	--	--	--
LAKE TROUT	--	--	0.0010198	0.0041813	--	--	--	--	--	--	--	--
RAINBOW SMELT	--	--	0.0020397	0.0000082	0.0020145	0.0000071	--	--	--	--	0.0010212	0.0000102
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	--	--
COMMON CARP	--	--	--	--	--	--	--	--	--	--	--	--
GOLDEN SHINER	--	--	--	--	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	--	--
COMMON SHINER	--	--	--	--	--	--	--	--	--	--	--	--
SPOTTAIL SHINER	0.0010284	0.0000082	0.0040793	0.0000367	0.0010073	0.0000121	0.0010142	0.0000041	--	--	0.0030637	0.0000153
FATHEAD MINNOW	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE DACE	--	--	0.0050991	0.0000612	0.0050363	0.0000655	0.0050710	0.0000619	--	--	--	--
LONGNOSE SUCKER	0.0010284	0.0001543	0.0071388	0.0039855	0.0020145	0.0004120	--	--	0.0030595	0.0017439	0.0030637	0.0010570
WHITE SUCKER	0.0061703	0.0058618	0.0163172	0.0201518	0.0282031	0.0291247	0.0070994	0.0067880	0.0071388	0.0078527	0.0051062	0.0055658
BLACK BULLHEAD	--	--	--	--	--	--	0.0010142	0.0002982	--	--	--	--
CHANNEL CATFISH	--	--	--	--	--	--	--	--	--	--	--	--
TROUT-PERCH	--	--	--	--	--	--	--	--	--	--	--	--
BURBOT	0.0030852	0.0009626	--	--	--	--	0.0010142	0.0002221	--	--	--	--
BROOK STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	--	--	--	--	0.0010073	0.0000020	--	--	0.0010198	0.0000020	--	--
NINESPINE STICKLEBACK	0.0010284	0.0000021	--	--	--	--	--	--	0.0010198	0.0000020	0.0010212	0.0000020
WHITE PERCH	--	--	--	--	--	--	--	--	--	--	--	--
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--
PUMPKINSEED	--	--	--	--	--	--	--	--	--	--	--	--
BLUEGILL	--	--	0.0010198	0.0000020	--	--	--	--	--	--	--	--
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	--	--
SMALLMOUTH BASS	--	--	--	--	--	--	--	--	--	--	--	--
BLACK CRAPPIE	--	--	--	--	--	--	--	--	--	--	--	--
YELLOW PERCH	0.0092555	0.0011045	0.0020397	0.0002805	0.0030218	0.0008713	--	--	--	--	0.0030637	0.0000776
FRESHWATER DRUM	--	--	--	--	--	--	--	--	--	--	--	--
ROUND GOBY	--	--	--	--	--	--	--	--	0.0010198	0.0000092	--	--
MOTTLED SCULPIN	0.0123406	0.0000576	0.0193767	0.0000979	0.0151088	0.0001118	0.0030426	0.0000122	0.0132577	0.0000765	0.0102124	0.0000541
SLIMY SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--
UNID COTTUS	--	--	--	--	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	0.4216372	0.0106098	0.4446439	0.0309874	0.5529815	0.0399718	0.0862069	0.0128925	0.0846455	0.0101004	0.0755719	0.0071354

APPENDIX D (cont.)

SPECIES	30-31AUG06		04-05SEP06		06-07SEP06		11-12SEP06		13-14SEP06		18-19SEP06	
	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG
GREAT LAKES CRAYFISH	0.0091721	--	0.0010284	--	0.0051491	--	0.0037547	--	--	--	0.0011444	--
LAKE STURGEON	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	0.0784721	0.0005941	0.0113122	0.0001573	0.0113281	0.0000999	0.0738423	0.0010225	0.0361867	0.0005167	1.2565805	0.0037743
ALEWIFE type	--	--	--	--	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--
GIZZARD SHAD	0.0061147	0.0000397	--	--	--	--	0.0025031	0.0000000	0.0020104	0.0000151	0.0102998	0.0008526
LAKE WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--
BLOATER	--	--	--	--	--	--	0.0062578	0.0000325	0.0100519	0.0000452	0.0068666	0.0000378
COHO SALMON	--	--	--	--	--	--	--	--	--	--	--	--
CHINOOK SALMON	0.0010191	0.0000387	--	--	0.0010298	0.0000669	--	--	--	--	--	--
ROUND WHITEFISH	--	--	0.0010284	0.0011826	--	--	0.0025031	0.0016270	--	--	--	--
BROWN TROUT	--	--	--	--	--	--	--	--	--	--	--	--
LAKE TROUT	--	--	--	--	--	--	--	--	--	--	--	--
RAINBOW SMELT	0.0112103	0.0000510	--	--	0.0010298	0.0000093	0.0438048	0.0002278	0.0251297	0.0001035	0.1636530	0.0007668
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	--	--
COMMON CARP	--	--	--	--	--	--	--	--	--	--	--	--
GOLDEN SHINER	--	--	--	--	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	0.0011444	0.0000057
COMMON SHINER	--	--	--	--	--	--	--	--	--	--	--	--
SPOTTAIL SHINER	0.0336309	0.0001814	0.0051419	0.0000555	0.0072088	0.0000546	0.0212766	0.0001677	0.0050259	0.0000322	0.1155871	0.0005871
FATHEAD MINNOW	--	--	--	--	--	--	--	--	0.0010052	0.0000040	0.0011444	0.0000034
LONGNOSE DACE	0.0091721	0.0001029	0.0041135	0.0000411	--	--	--	--	0.0040207	0.0000382	0.0045777	0.0000240
LONGNOSE SUCKER	0.0020382	0.0003057	0.0030852	0.0007271	0.0041193	0.0015138	0.0012516	0.0002441	0.0010052	0.0004021	--	--
WHITE SUCKER	0.0091721	0.0073264	0.0318799	0.0358494	0.0195667	0.0193195	--	--	0.0050259	0.0044670	0.0057221	0.0045605
BLACK BULLHEAD	--	--	0.0041135	0.0009800	0.0010298	0.0003141	--	--	--	--	0.0034333	0.0004383
CHANNEL CATFISH	--	--	--	--	--	--	--	--	0.0010052	0.0000523	0.0011444	0.0001362
TROUT-PERCH	0.0010191	0.0000132	--	--	--	--	--	--	--	--	--	--
BURBOT	--	--	0.0010284	0.0024784	--	--	--	--	0.0010052	0.0000221	0.0034333	0.0013104
BROOK STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	0.0040765	0.0000082	--	--	--	--	--	--	0.0040207	0.0000070	--	--
NINESPINE STICKLEBACK	0.0050956	0.0000082	--	--	0.0010298	0.0000031	0.0012516	0.0000025	0.0010052	0.0000010	0.0034333	0.0000069
WHITE PERCH	--	--	--	--	--	--	--	--	--	--	--	--
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	0.0011444	0.0000034
PUMPKINSEED	--	--	--	--	--	--	--	--	--	--	0.0022889	0.0000641
BLUEGILL	0.0010191	0.0000092	--	--	--	--	--	--	--	--	0.0011444	0.0000172
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	0.0011444	0.0000023
SMALLMOUTH BASS	--	--	--	--	--	--	--	--	--	--	--	--
BLACK CRAPPIE	--	--	--	--	--	--	--	--	--	--	--	--
YELLOW PERCH	0.0377074	0.0006777	0.0030852	0.0005286	0.0020596	0.0000206	--	--	0.0020104	0.0004553	0.0331884	0.0003090
FRESHWATER DRUM	--	--	--	--	--	--	--	--	--	--	0.0080110	0.0058274
ROUND GOBY	0.0010191	0.0000031	--	--	--	--	--	--	--	--	--	--
MOTTLED SCULPIN	0.0805104	0.0005269	0.0071987	0.0000463	0.0205965	0.0001102	0.0362954	0.0002240	0.0402075	0.0002815	0.0217441	0.0001087
SLIMY SCULPIN	0.0050956	0.0000214	--	--	0.0061789	0.0000288	0.0050063	0.0000313	0.0050259	0.0000281	--	--
UNID COTTUS	--	--	--	--	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	0.2955444	0.0099079	0.0730152	0.0420465	0.0803262	0.0215408	0.1977472	0.0035795	0.1437417	0.0064714	1.6468299	0.0188361

APPENDIX D (cont.)

SPECIES	20-21SEP06		25-26SEP06		27-28SEP06		02-03OCT06		04-05OCT06		09-10OCT06	
	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG
GREAT LAKES CRAYFISH	0.0025208	--	--	--	0.0030744	--	0.0011166	--	0.0055599	--	--	--
LAKE STURGEON	--	--	--	--	--	--	--	--	--	--	0.0010128	0.0002421
ALEWIFE	0.6301964	0.0065477	0.6435098	0.0077262	0.5892601	0.0048473	4.8070481	0.0326868	6.4244412	0.0418589	2.0418085	0.0106111
ALEWIFE type	--	--	--	--	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--
GIZZARD SHAD	--	--	0.0071388	0.0000398	0.0010248	0.0000051	0.0066997	0.0000480	0.0027799	0.0003114	0.0131664	0.0000942
LAKE WHITEFISH	--	--	--	--	--	--	--	--	--	--	0.0020256	0.0001063
BLOATER	0.0012604	0.0000050	0.0081586	0.0000357	0.0071736	0.0000256	0.0390817	0.0001731	0.0138997	0.0000737	--	--
COHO SALMON	--	--	--	--	--	--	--	--	--	--	--	--
CHINOOK SALMON	--	--	--	--	--	--	0.0022332	0.0030774	--	--	--	--
ROUND WHITEFISH	--	--	--	--	--	--	0.0022332	0.0001507	0.0013900	0.0008340	0.0030384	0.0011394
BROWN TROUT	--	--	--	--	--	--	--	--	--	--	--	--
LAKE TROUT	--	--	--	--	--	--	--	--	--	--	0.0010128	0.0038486
RAINBOW SMELT	0.0390722	0.0001475	0.0703680	0.0004742	0.0348432	0.0002070	2.6999866	0.0132375	1.1050261	0.0070680	1.4189353	0.0087871
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	--	--
COMMON CARP	--	--	--	--	--	--	0.0011166	0.0000201	--	--	--	--
GOLDEN SHINER	--	--	--	--	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	--	--
COMMON SHINER	--	--	0.0010198	0.0000143	--	--	--	--	--	--	--	--
SPOTTAIL SHINER	0.0239475	0.0001412	0.0010198	0.0000082	0.0645624	0.0004765	0.2344902	0.0017084	0.2154453	0.0013914	0.1660995	0.0009176
FATHEAD MINNOW	--	--	--	--	--	--	0.0011166	0.0000045	--	--	0.0010128	0.0000051
LONGNOSE DACE	0.0063020	0.0000618	0.0020397	0.0000275	0.0010248	0.0000266	0.0033499	0.0000257	0.0013900	0.0000125	0.0010128	0.0000111
LONGNOSE SUCKER	--	--	--	--	--	--	--	--	0.0013900	0.0013900	--	--
WHITE SUCKER	0.0012604	0.0001689	0.0010198	0.0001173	0.0010248	0.0005636	0.0011166	0.0011166	0.0027799	0.0009660	0.0030384	0.0023578
BLACK BULLHEAD	--	--	0.0010198	0.0003529	--	--	0.0011166	0.0002367	--	--	--	--
CHANNEL CATFISH	--	--	--	--	--	--	0.0011166	0.0000022	--	--	0.0010128	0.0000030
TROUT-PERCH	--	--	--	--	--	--	0.0011166	0.0000123	--	--	--	--
BURBOT	0.0012604	0.0011974	0.0020397	0.0005997	--	--	0.0022332	0.0044732	--	--	0.0010128	0.0000547
BROOK STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	--	--	--	--	0.0010248	0.0000010	--	--	--	--	--	--
NINESPINE STICKLEBACK	0.0012604	0.0000013	--	--	--	--	0.0044665	0.0000089	--	--	--	--
WHITE PERCH	--	--	--	--	--	--	--	--	--	--	0.0010128	0.0000142
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--
PUMPKINSEED	0.0012604	0.0000378	--	--	0.0010248	0.0000020	0.0011166	0.0000011	--	--	--	--
BLUEGILL	--	--	--	--	--	--	--	--	--	--	--	--
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	--	--
SMALLMOUTH BASS	0.0025208	0.0013990	--	--	0.0010248	0.0001127	0.0011166	0.0000134	--	--	--	--
BLACK CRAPPIE	--	--	--	--	--	--	--	--	--	--	--	--
YELLOW PERCH	0.0075624	0.0000239	0.0010198	0.0000316	0.0102480	0.0000502	0.0189825	0.0001887	0.0180696	0.0001251	0.0567169	0.0005125
FRESHWATER DRUM	--	--	--	--	0.0010248	0.0018446	--	--	--	--	0.0010128	0.0015698
ROUND GOBY	--	--	--	--	--	--	0.0011166	0.0000056	0.0013900	0.0001404	0.0010128	0.0000385
MOTTLED SCULPIN	0.0163851	0.0000794	0.0112181	0.0000530	0.0163968	0.0000881	0.0334986	0.0001854	0.0250195	0.0001668	0.0222816	0.0001094
SLIMY SCULPIN	--	--	--	--	0.0020496	0.0000092	0.0011166	0.0000089	0.0013900	0.0000083	--	--
UNID COTTUS	--	--	--	--	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	0.7348090	0.0098109	0.7495717	0.0094803	0.7347817	0.0082599	7.8665863	0.0573853	7.8199711	0.0543464	3.7362259	0.0304225

APPENDIX D (cont.)

SPECIES	11-12OCT06		16-17OCT06		18-19OCT06		23-24OCT06		25-26OCT06		30-31OCT06	
	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG
GREAT LAKES CRAYFISH	--	--	0.0016248	--	--	--	--	--	--	--	--	--
LAKE STURGEON	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	0.2113971	0.0020609	4.1139105	0.0277754	0.2500000	0.0013968	0.6196581	0.0099359	1.6920375	0.0087412	1.4444444	0.0083234
ALEWIFE type	--	--	--	--	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--
GIZZARD SHAD	0.0010212	0.0000041	0.0438687	0.0002063	--	--	0.0774573	0.0011485	0.4215457	0.0046936	0.0119048	0.0001210
LAKE WHITEFISH	--	--	0.0016248	0.0000552	--	--	--	--	--	--	--	--
BLOATER	--	--	0.0211220	0.0000910	--	--	--	--	--	--	--	--
COHO SALMON	--	--	--	--	--	--	--	--	--	--	--	--
CHINOOK SALMON	--	--	--	--	--	--	--	--	--	--	--	--
ROUND WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--
BROWN TROUT	--	--	--	--	--	--	--	--	--	--	0.0019841	0.0001409
LAKE TROUT	--	--	--	--	0.0019841	0.0054563	0.0026709	0.0093483	--	--	--	--
RAINBOW SMELT	0.0398284	0.0002931	0.9147439	0.0053114	0.0496032	0.0003552	0.0133547	0.0001015	--	--	0.0178571	0.0002421
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	--	--
COMMON CARP	--	--	0.0016248	0.0000114	--	--	--	--	--	--	--	--
GOLDEN SHINER	--	--	0.0016248	0.0000065	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	--	--
COMMON SHINER	--	--	--	--	--	--	--	--	--	--	0.0019841	0.0001250
SPOTTAIL SHINER	--	--	0.2908333	0.0021447	0.0138889	0.0000972	0.0026709	0.0000240	0.0019516	0.0000098	0.0059524	0.0000337
FATHEAD MINNOW	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE DACE	--	--	0.0016248	0.0000130	--	--	--	--	--	--	--	--
LONGNOSE SUCKER	0.0010212	0.0002921	--	--	--	--	--	--	--	--	--	--
WHITE SUCKER	0.0051062	0.0042688	0.0129981	0.0095861	0.0019841	0.0019841	0.0053419	0.0081464	0.0058548	0.0076112	0.0079365	0.0072421
BLACK BULLHEAD	0.0010212	0.0003196	0.0016248	0.0001154	0.0019841	0.0007540	--	--	--	--	0.0019841	0.0004444
CHANNEL CATFISH	--	--	--	--	--	--	--	--	0.0019516	0.0004137	0.0019841	0.0000119
TROUT-PERCH	--	--	--	--	--	--	--	--	--	--	--	--
BURBOT	0.0020425	0.0005729	0.0016248	0.0013811	0.0019841	0.0009524	--	--	0.0019516	0.0020492	--	--
BROOK STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--
NINESPINE STICKLEBACK	--	--	0.0016248	0.0000032	--	--	--	--	--	--	--	--
WHITE PERCH	--	--	--	--	--	--	--	--	--	--	--	--
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--
PUMPKINSEED	--	--	--	--	--	--	--	--	--	--	--	--
BLUEGILL	--	--	0.0032495	0.0000650	--	--	--	--	--	--	--	--
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	--	--
SMALLMOUTH BASS	--	--	--	--	--	--	--	--	--	--	--	--
BLACK CRAPPIE	--	--	--	--	--	--	--	--	--	--	0.0019841	0.0000258
YELLOW PERCH	0.0051062	0.0000654	0.0926117	0.0004176	0.0019841	0.0000377	--	--	0.0039032	0.0000098	0.0079365	0.0001587
FRESHWATER DRUM	--	--	--	--	--	--	--	--	--	--	--	--
ROUND GOBY	--	--	--	--	--	--	--	--	--	--	--	--
MOTTLED SCULPIN	0.0010212	0.0000051	0.0097486	0.0000650	--	--	--	--	0.0019516	0.0000078	0.0059524	0.0000377
SLIMY SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--
UNID COTTUS	--	--	--	--	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	0.2675654	0.0078819	5.5160845	0.0472482	0.3234127	0.0110337	0.7211538	0.0287046	2.1311475	0.0235363	1.5119048	0.0169067

APPENDIX D (cont.)

SPECIES	01-02NOV06		06-07NOV06		08-09NOV06		13-14NOV06		15-16NOV06		19-20NOV06	
	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG
GREAT LAKES CRAYFISH	--	--	--	--	--	--	--	--	--	--	--	--
LAKE STURGEON	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	0.2561024	0.0016687	1.4334538	0.0071438	0.5211016	0.0025738	24.1179390	0.1011198	6.0604086	0.0286798	0.1585430	0.0007377
ALEWIFE type	--	--	--	--	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--
GIZZARD SHAD	0.0320128	0.0002961	0.0175764	0.0021931	0.0118883	0.0001129	0.0397101	0.0005500	0.0039091	0.0015232	0.0026205	0.0000301
LAKE WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--
BLOATER	--	--	0.0058588	0.0000273	0.0039628	0.0000139	--	--	0.0013030	0.0000065	--	--
COHO SALMON	--	--	--	--	--	--	--	--	--	--	--	--
CHINOOK SALMON	--	--	--	--	--	--	--	--	--	--	--	--
ROUND WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--
BROWN TROUT	--	--	--	--	--	--	--	--	--	--	--	--
LAKE TROUT	--	--	--	--	--	--	--	--	0.0013030	0.0024758	--	--
RAINBOW SMELT	--	--	0.0820232	0.0003847	0.0178324	0.0001228	0.0099275	0.0000675	--	--	--	--
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	--	--
COMMON CARP	--	--	--	--	--	--	--	--	--	--	--	--
GOLDEN SHINER	--	--	--	--	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	--	--
COMMON SHINER	--	--	--	--	--	--	--	--	--	--	--	--
SPOTTAIL SHINER	0.0020008	0.0000140	0.0078117	0.0000508	0.0059441	0.0000495	0.0138985	0.0000814	0.0065152	0.0000339	--	--
FATHEAD MINNOW	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE DACE	--	--	--	--	--	--	--	--	0.0013030	0.0000104	--	--
LONGNOSE SUCKER	--	--	--	--	--	--	--	--	--	--	--	--
WHITE SUCKER	0.0020008	0.0023009	--	--	0.0019814	0.0010898	--	--	0.0013030	0.0015636	0.0013103	0.0016247
BLACK BULLHEAD	--	--	0.0019529	0.0003359	--	--	--	--	--	--	--	--
CHANNEL CATFISH	--	--	--	--	0.0039628	0.0000852	--	--	--	--	--	--
TROUT-PERCH	--	--	0.0019529	0.0000215	--	--	--	--	--	--	--	--
BURBOT	--	--	0.0019529	0.0000859	0.0019814	0.0001149	--	--	0.0026061	0.0041046	--	--
BROOK STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	--	--	0.0019529	0.0000020	--	--	0.0019855	0.0000020	0.0039091	0.0000039	0.0144130	0.0000157
NINESPINE STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--
WHITE PERCH	--	--	--	--	--	--	--	--	--	--	--	--
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--
PUMPKINSEED	--	--	--	--	--	--	--	--	--	--	--	--
BLUEGILL	--	--	--	--	--	--	--	--	--	--	--	--
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	--	--
SMALLMOUTH BASS	--	--	--	--	--	--	--	--	--	--	--	--
BLACK CRAPPIE	--	--	--	--	--	--	--	--	--	--	--	--
YELLOW PERCH	0.0020008	0.0001240	0.0078117	0.0000273	0.0138696	0.0002734	0.0198551	0.0001986	0.0026061	0.0000078	--	--
FRESHWATER DRUM	--	--	--	--	--	--	--	--	--	--	0.0013103	0.0016378
ROUND GOBY	--	--	--	--	--	--	--	--	--	--	--	--
MOTTLED SCULPIN	--	--	0.0019529	0.0000117	0.0019814	0.0000099	0.0039710	0.0000357	0.0013030	0.0000078	--	--
SLIMY SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--
UNID COTTUS	--	--	--	--	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	0.0019529	0.0000254	0.0019814	0.0000079	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	0.2941176	0.0044038	1.5662533	0.0103095	0.5864870	0.0044541	24.2072868	0.1020550	6.0864693	0.0384173	0.1781971	0.0040461

APPENDIX D (cont.)

SPECIES	21-22NOV06		27-28NOV06		29-30NOV06	
	#/MG	KG/MG	#/MG	KG/MG	#/MG	KG/MG
GREAT LAKES CRAYFISH	0.0010212	--	--	--	0.0010212	--
LAKE STURGEON	--	--	--	--	--	--
ALEWIFE	4.2064951	0.0248529	73.0064677	0.3305283	1.5859886	0.0084835
ALEWIFE type	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--
GIZZARD SHAD	0.2440768	0.0024683	0.0061402	0.0000563	0.0091912	0.0000725
LAKE WHITEFISH	--	--	--	--	--	--
BLOATER	0.0010212	0.0000031	--	--	--	--
COHO SALMON	--	--	--	--	--	--
CHINOOK SALMON	--	--	--	--	--	--
ROUND WHITEFISH	0.0010212	0.0008170	0.0020467	0.0002323	--	--
BROWN TROUT	--	--	--	--	--	--
LAKE TROUT	0.0020425	0.0000143	0.0020467	0.0000133	--	--
RAINBOW SMELT	0.9375000	0.0050368	0.0184207	0.0002139	0.0255310	0.0002134
CENTRAL MUDMINNOW	--	--	--	--	--	--
COMMON CARP	--	--	--	--	--	--
GOLDEN SHINER	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--
COMMON SHINER	0.0010212	0.0000286	--	--	--	--
SPOTTAIL SHINER	0.2512255	0.0015727	0.0040935	0.0000256	0.0010212	0.0000051
FATHEAD MINNOW	--	--	--	--	--	--
LONGNOSE DACE	0.0030637	0.0000225	--	--	--	--
LONGNOSE SUCKER	--	--	--	--	0.0010212	0.0001052
WHITE SUCKER	0.0020425	0.0032169	0.0010234	0.0013304	--	--
BLACK BULLHEAD	--	--	--	--	--	--
CHANNEL CATFISH	0.0051062	0.0000480	--	--	--	--
TROUT-PERCH	--	--	--	--	--	--
BURBOT	--	--	0.0040935	0.0000870	--	--
BROOK STICKLEBACK	--	--	--	--	--	--
THREESPINE STICKLEBACK	0.0347222	0.0000357	0.0061402	0.0000072	0.0234886	0.0000235
NINESPINE STICKLEBACK	--	--	--	--	--	--
WHITE PERCH	0.0020425	0.0001358	--	--	0.0010212	0.0000071
GREEN SUNFISH	--	--	--	--	--	--
PUMPKINSEED	--	--	--	--	--	--
BLUEGILL	0.0020425	0.0000123	--	--	--	--
UNID LEPOMIS	--	--	--	--	--	--
SMALLMOUTH BASS	--	--	--	--	0.0010212	0.0000163
BLACK CRAPPIE	--	--	--	--	--	--
YELLOW PERCH	0.0745507	0.0003084	0.0071636	0.0000317	--	--
FRESHWATER DRUM	--	--	--	--	--	--
ROUND GOBY	--	--	0.0010234	0.0000358	--	--
MOTTLED SCULPIN	0.0051062	0.0000286	0.0030701	0.0000246	0.0020425	0.0000092
SLIMY SCULPIN	--	--	0.0020467	0.0000143	--	--
UNID COTTUS	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	5.7741013	0.0386019	73.0637767	0.3326006	1.6513480	0.0089359

APPENDIX D (cont.)

SPECIES	TRIPS COMBINED #/MG	TRIPS COMBINED KG/MG
GREAT LAKES CRAYFISH	0.00271881	0.00000000
LAKE STURGEON	0.00001628	0.00000389
ALEWIFE	25.96728560	0.09283912
ALEWIFE type	0.01278002	0.00003826
UNID ALOSA	0.00003256	0.00000003
GIZZARD SHAD	0.01199856	0.00021886
LAKE WHITEFISH	0.00006512	0.00000239
BLOATER	0.00170943	0.00000773
COHO SALMON	0.00004884	0.00000034
CHINOOK SALMON	0.00011396	0.00004744
ROUND WHITEFISH	0.00060237	0.00027865
BROWN TROUT	0.00024420	0.00023501
LAKE TROUT	0.00014652	0.00026174
RAINBOW SMELT	0.14885870	0.00083633
CENTRAL MUDMINNOW	0.00001628	0.00000008
COMMON CARP	0.00009768	0.00000244
GOLDEN SHINER	0.00001628	0.00000007
EMERALD SHINER	0.00001628	0.00000008
COMMON SHINER	0.00004884	0.00000171
SPOTTAIL SHINER	0.02077363	0.00013610
FATHEAD MINNOW	0.00006512	0.00000026
LONGNOSE DACE	0.00092798	0.00000962
LONGNOSE SUCKER	0.00076517	0.00033568
WHITE SUCKER	0.00322349	0.00325980
BLACK BULLHEAD	0.00052097	0.00010200
CHANNEL CATFISH	0.00043957	0.00007753
TROUT-PERCH	0.00004884	0.00000057
BURBOT	0.00089542	0.00050041
BROOK STICKLEBACK	0.00004884	0.00000010
THREESPINE STICKLEBACK	0.00841202	0.00001178
NINESPINE STICKLEBACK	0.00905672	0.00002104
WHITE PERCH	0.00008140	0.00000617
GREEN SUNFISH	0.00001628	0.00000005
PUMPKINSEED	0.00009768	0.00000158
BLUEGILL	0.00011396	0.00000127
UNID LEPOMIS	0.00001628	0.00000003
SMALLMOUTH BASS	0.00019536	0.00006079
BLACK CRAPPIE	0.00001628	0.00000021
YELLOW PERCH	0.00942628	0.00014087
FRESHWATER DRUM	0.00026048	0.00028477
ROUND GOBY	0.00014652	0.00000659
MOTTLED SCULPIN	0.01020610	0.00005946
SLIMY SCULPIN	0.00219458	0.00001330
UNID COTTUS	0.00001628	0.00000005
DEEPWATER SCULPIN	0.00004884	0.00000044
TOTAL SHELLFISH AND FISH	26.21483044	0.09980465

APPENDIX E

APPENDIX E. ESTIMATES OF THE NUMBER AND BIOMASS OF SHELLFISH AND FISH IMPINGED DURING EACH EXTRAPOLATION PERIOD AT POINT BEACH NUCLEAR PLANT, DECEMBER 2005 - NOVEMBER 2006.

SPECIES	04-10DEC05				11-17DEC05				18-24DEC05				25-31DEC05			
	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%
GREAT LAKES CRAYFISH	7	4.76	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LAKE STURGEON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE type	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GIZZARD SHAD	7	4.76	0.04	0.21	133	6.71	5.34	4.55	--	--	--	--	35	4.76	1.06	15.26
LAKE WHITEFISH	--	--	--	--	12	0.61	0.10	0.08	--	--	--	--	--	--	--	--
BLOATER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COHO SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHINOOK SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND WHITEFISH	--	--	--	--	36	1.83	22.72	19.33	21	14.29	10.15	36.06	7	0.95	4.69	67.27
BROWN TROUT	--	--	--	--	60	3.05	9.26	7.88	7	4.76	0.67	2.36	--	--	--	--
LAKE TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RAINBOW SMELT	14	9.52	0.04	0.18	36	1.83	0.05	0.04	14	9.52	0.10	0.35	364	49.52	0.43	6.22
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON CARP	--	--	--	--	36	1.83	0.35	0.30	--	--	--	--	--	--	--	--
GOLDEN SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SPOTTAIL SHINER	--	--	--	--	96	4.88	0.64	0.54	--	--	--	--	--	--	--	--
FATHEAD MINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE DACE	--	--	--	--	12	0.61	0.02	0.02	--	--	--	--	--	--	--	--
LONGNOSE SUCKER	--	--	--	--	12	0.61	12.06	10.26	--	--	--	--	--	--	--	--
WHITE SUCKER	7	4.76	7.00	35.03	--	--	--	--	7	4.76	0.96	3.41	--	--	--	--
BLACK BULLHEAD	7	4.76	1.33	6.65	12	0.61	1.27	1.08	7	4.76	1.26	4.48	--	--	--	--
CHANNEL CATFISH	7	4.76	10.15	50.79	84	4.27	14.59	12.42	28	19.05	0.41	1.44	--	--	--	--
TROUT-PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BURBOT	14	9.52	0.49	2.45	84	4.27	0.69	0.58	--	--	--	--	14	1.90	0.07	1.00
BROOK STICKLEBACK	--	--	--	--	12	0.61	0.01	0.01	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	--	--	--	--	--	--	--	--	7	4.76	0.01	0.02	49	6.67	0.06	0.80
NINESPINE STICKLEBACK	--	--	--	--	--	--	--	--	7	4.76	0.01	0.05	--	--	--	--
WHITE PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PUMPKINSEED	--	--	--	--	12	0.61	0.10	0.08	--	--	--	--	--	--	--	--
BLUEGILL	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SMALLMOUTH BASS	14	9.52	0.60	2.98	12	0.61	2.89	2.46	--	--	--	--	--	--	--	--
BLACK CRAPPIE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
YELLOW PERCH	21	14.29	0.08	0.42	1,122	56.71	3.65	3.11	14	9.52	0.08	0.27	231	31.43	0.46	6.63
FRESHWATER DRUM	--	--	--	--	48	2.44	42.81	36.43	7	4.76	14.35	50.98	--	--	--	--
ROUND GOBY	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MOTTLED SCULPIN	--	--	--	--	36	1.83	0.24	0.21	7	4.76	0.02	0.07	28	3.81	0.16	2.31
SLIMY SCULPIN	49	33.33	0.26	1.30	109	5.49	0.59	0.50	21	14.29	0.14	0.50	7	0.95	0.04	0.50
UNID COTTUS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--	12	0.61	0.12	0.10	--	--	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	147	100.00	19.99	100.00	1,978	100.00	117.51	100.00	147	100.00	28.15	100.00	735	100.00	6.97	100.00

APPENDIX E (cont.)

SPECIES	01-07JAN06				08-14JAN06				15-21JAN06				22-28JAN06			
	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%
GREAT LAKES CRAYFISH	--	--	--	--	--	--	--	--	7	8.33	--	--	--	--	--	--
LAKE STURGEON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE type	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GIZZARD SHAD	--	--	--	--	--	--	--	--	--	--	--	--	20	16.67	1.35	34.25
LAKE WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLOATER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COHO SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHINOOK SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND WHITEFISH	21	20.00	10.08	40.21	7	1.41	3.22	65.16	--	--	--	--	--	--	--	--
BROWN TROUT	7	6.67	7.35	29.32	--	--	--	--	7	8.33	0.94	8.32	--	--	--	--
LAKE TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RAINBOW SMELT	7	6.67	0.03	0.11	224	45.07	1.13	22.80	7	8.33	0.03	0.25	49	41.67	0.19	4.75
CENTRAL MUDMINNOW	--	--	--	--	7	1.41	0.04	0.71	--	--	--	--	--	--	--	--
COMMON CARP	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GOLDEN SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SPOTTAIL SHINER	--	--	--	--	7	1.41	0.11	2.12	--	--	--	--	--	--	--	--
FATHEAD MINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE DACE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE SUCKER	7	6.67	6.37	25.41	--	--	--	--	7	8.33	1.30	11.48	--	--	--	--
WHITE SUCKER	--	--	--	--	--	--	--	--	7	8.33	7.56	67.04	--	--	--	--
BLACK BULLHEAD	--	--	--	--	--	--	--	--	7	8.33	1.39	12.35	10	8.33	2.08	52.50
CHANNEL CATFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TROUT-PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BURBOT	7	6.67	1.11	4.41	--	--	--	--	--	--	--	--	10	8.33	0.21	5.25
BROOK STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	35	33.33	0.04	0.14	182	36.62	0.19	3.82	35	41.67	0.05	0.43	--	--	--	--
NINESPINE STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
WHITE PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PUMPKINSEED	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLUEGILL	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SMALLMOUTH BASS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLACK CRAPPIE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
YELLOW PERCH	7	6.67	0.01	0.06	56	11.27	0.17	3.40	7	8.33	0.01	0.12	20	16.67	0.08	2.00
FRESHWATER DRUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND GOBY	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MOTTLED SCULPIN	7	6.67	0.05	0.20	14	2.82	0.10	1.98	--	--	--	--	10	8.33	0.05	1.25
SLIMY SCULPIN	7	6.67	0.04	0.14	--	--	--	--	--	--	--	--	--	--	--	--
UNID COTTUS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	105	100.00	25.07	100.00	497	100.00	4.94	100.00	84	100.00	11.28	100.00	119	100.00	3.95	100.00

APPENDIX E (cont.)

SPECIES	29JAN-04FEB06				05-11FEB06				12-18FEB06				19-25FEB06			
	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%
GREAT LAKES CRAYFISH	7	0.21	--	--	--	--	--	--	--	--	--	--	35	3.05	--	--
LAKE STURGEON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE type	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GIZZARD SHAD	--	--	--	--	7	7.14	0.38	1.91	--	--	--	--	--	--	--	--
LAKE WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLOATER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COHO SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHINOOK SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND WHITEFISH	36	1.04	7.73	43.23	--	--	--	--	--	--	--	--	14	1.22	8.75	56.54
BROWN TROUT	--	--	--	--	--	--	--	--	--	--	--	--	7	0.61	1.19	7.69
LAKE TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RAINBOW SMELT	2,778	80.91	8.69	48.61	35	35.71	0.07	0.35	--	--	--	--	763	66.46	3.06	19.76
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON CARP	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GOLDEN SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SPOTTAIL SHINER	7	0.21	0.01	0.04	--	--	--	--	7	6.25	0.04	0.22	7	0.61	0.06	0.36
FATHEAD MINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE DACE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE SUCKER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
WHITE SUCKER	--	--	--	--	7	7.14	2.10	10.64	7	6.25	12.73	79.33	--	--	--	--
BLACK BULLHEAD	--	--	--	--	7	7.14	1.68	8.51	7	6.25	1.37	8.55	--	--	--	--
CHANNEL CATFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TROUT-PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BURBOT	--	--	--	--	--	--	--	--	7	6.25	1.64	10.22	--	--	--	--
BROOK STICKLEBACK	14	0.41	0.04	0.20	--	--	--	--	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	321	9.34	0.33	1.83	--	--	--	--	35	31.25	0.04	0.22	189	16.46	0.20	1.27
NINESPINE STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	7	0.61	0.01	0.09
WHITE PERCH	--	--	--	--	--	--	--	--	--	--	--	--	7	0.61	1.58	10.18
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PUMPKINSEED	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLUEGILL	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SMALLMOUTH BASS	7	0.21	0.21	1.16	--	--	--	--	--	--	--	--	--	--	--	--
BLACK CRAPPIE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
YELLOW PERCH	249	7.26	0.80	4.50	21	21.43	0.07	0.35	21	18.75	0.06	0.40	49	4.27	0.19	1.22
FRESHWATER DRUM	--	--	--	--	7	7.14	15.40	78.01	--	--	--	--	--	--	--	--
ROUND GOBY	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MOTTLED SCULPIN	14	0.41	0.08	0.44	14	14.29	0.04	0.21	21	18.75	0.12	0.75	42	3.66	0.23	1.49
SLIMY SCULPIN	--	--	--	--	--	--	--	--	7	6.25	0.05	0.31	28	2.44	0.22	1.40
UNID COTTUS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	3,433	100.00	17.88	100.00	98	100.00	19.74	100.00	113	100.00	16.05	100.00	1,148	100.00	15.48	100.00

APPENDIX E (cont.)

SPECIES	26FEB-04MAR06				05-11MAR06				12-18MAR06				19-25MAR06			
	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%
GREAT LAKES CRAYFISH	7	5.26	--	--	7	1.12	--	--	--	--	--	--	--	--	--	--
LAKE STURGEON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE type	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GIZZARD SHAD	7	5.26	0.55	38.92	460	73.03	20.54	46.65	--	--	--	--	--	--	--	--
LAKE WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLOATER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COHO SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHINOOK SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND WHITEFISH	--	--	--	--	14	2.25	6.65	15.10	6	5.26	2.62	81.71	7	100.00	3.67	100.00
BROWN TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LAKE TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RAINBOW SMELT	--	--	--	--	--	--	--	--	31	26.32	0.34	10.70	--	--	--	--
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON CARP	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GOLDEN SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SPOTTAIL SHINER	--	--	--	--	7	1.12	0.01	0.02	6	5.26	0.03	0.97	--	--	--	--
FATHEAD MINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE DACE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE SUCKER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
WHITE SUCKER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLACK BULLHEAD	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHANNEL CATFISH	--	--	--	--	14	2.25	11.04	25.06	--	--	--	--	--	--	--	--
TROUT-PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BURBOT	--	--	--	--	14	2.25	2.29	5.20	--	--	--	--	--	--	--	--
BROOK STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	--	--	--	--	7	1.12	0.01	0.02	50	42.11	0.06	1.75	--	--	--	--
NINESPINE STICKLEBACK	--	--	--	--	--	--	--	--	6	5.26	0.01	0.39	--	--	--	--
WHITE PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PUMPKINSEED	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLUEGILL	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SMALLMOUTH BASS	--	--	--	--	7	1.12	2.83	6.43	--	--	--	--	--	--	--	--
BLACK CRAPPIE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
YELLOW PERCH	14	10.53	0.07	4.93	--	--	--	--	--	--	--	--	--	--	--	--
FRESHWATER DRUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND GOBY	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MOTTLED SCULPIN	56	42.11	0.39	27.59	42	6.74	0.27	0.61	12	10.53	0.09	2.92	--	--	--	--
SLIMY SCULPIN	49	36.84	0.41	28.57	57	8.99	0.40	0.92	6	5.26	0.05	1.56	--	--	--	--
UNID COTTUS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	133	100.00	1.42	100.00	630	100.00	44.04	100.00	118	100.00	3.20	100.00	7	100.00	3.67	100.00

APPENDIX E (cont.)

SPECIES	26MAR-01APR06				02-08APR06				09-15APR06				16-22APR06			
	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%
GREAT LAKES CRAYFISH	--	--	--	--	--	--	--	--	7	1.41	--	--	7	2.70	--	--
LAKE STURGEON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	--	--	--	--	--	--	--	--	189	39.44	0.49	2.18	87	32.43	0.28	14.03
ALEWIFE type	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--	15	5.41	0.01	0.72
GIZZARD SHAD	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LAKE WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLOATER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COHO SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHINOOK SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND WHITEFISH	6	11.11	3.82	17.14	--	--	--	--	--	--	--	--	--	--	--	--
BROWN TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LAKE TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RAINBOW SMELT	13	22.22	0.11	0.49	28	80.00	0.31	78.57	135	28.17	0.76	3.37	29	10.81	0.20	9.71
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON CARP	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GOLDEN SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SPOTTAIL SHINER	--	--	--	--	7	20.00	0.08	21.43	--	--	--	--	--	--	--	--
FATHEAD MINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE DACE	--	--	--	--	--	--	--	--	7	1.41	0.05	0.21	--	--	--	--
LONGNOSE SUCKER	6	11.11	12.73	57.14	--	--	--	--	--	--	--	--	--	--	--	--
WHITE SUCKER	6	11.11	4.71	21.14	--	--	--	--	7	1.41	9.45	41.75	--	--	--	--
BLACK BULLHEAD	--	--	--	--	--	--	--	--	7	1.41	0.67	2.98	--	--	--	--
CHANNEL CATFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TROUT-PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BURBOT	--	--	--	--	--	--	--	--	--	--	--	--	7	2.70	1.18	58.27
BROOK STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	6	11.11	0.01	0.03	--	--	--	--	94	19.72	0.12	0.54	73	27.03	0.12	5.76
NINESPINE STICKLEBACK	--	--	--	--	--	--	--	--	7	1.41	0.02	0.09	22	8.11	0.06	2.88
WHITE PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PUMPKINSEED	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLUEGILL	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SMALLMOUTH BASS	6	11.11	0.84	3.77	--	--	--	--	7	1.41	10.80	47.72	--	--	--	--
BLACK CRAPPIE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
YELLOW PERCH	--	--	--	--	--	--	--	--	7	1.41	0.03	0.12	--	--	--	--
FRESHWATER DRUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND GOBY	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MOTTLED SCULPIN	13	22.22	0.06	0.29	--	--	--	--	7	1.41	0.07	0.30	7	2.70	0.05	2.52
SLIMY SCULPIN	--	--	--	--	--	--	--	--	7	1.41	0.17	0.75	22	8.11	0.12	6.12
UNID COTTUS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	57	100.00	22.28	100.00	35	100.00	0.39	100.00	479	100.00	22.63	100.00	269	100.00	2.02	100.00

APPENDIX E (cont.)

SPECIES	23-29APR06				30APR-06MAY06				07-13MAY06				14-16MAY06			
	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%
GREAT LAKES CRAYFISH	--	--	--	--	8	0.00	--	--	15	0.01	--	--	11	0.03	--	--
LAKE STURGEON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	406,713	99.49	1,464.24	99.70	298,084	98.24	1,129.04	95.83	143,265	99.39	515.76	98.57	39,730	96.16	147.04	95.58
ALEWIFE type	1,598	0.39	2.93	0.20	4,737	1.56	15.95	1.35	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GIZZARD SHAD	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LAKE WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLOATER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COHO SALMON	--	--	--	--	--	--	--	--	--	--	--	--	5	0.01	0.03	0.02
CHINOOK SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BROWN TROUT	--	--	--	--	8	0.00	15.95	1.35	--	--	--	--	5	0.01	0.46	0.30
LAKE TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RAINBOW SMELT	33	0.01	0.20	0.01	423	0.14	3.43	0.29	675	0.47	6.74	1.29	709	1.72	4.49	2.92
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON CARP	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GOLDEN SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SPOTTAIL SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
FATHEAD MINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE DACE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE SUCKER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
WHITE SUCKER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLACK BULLHEAD	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHANNEL CATFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TROUT-PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BURBOT	--	--	--	--	16	0.01	12.76	1.08	--	--	--	--	--	--	--	--
BROOK STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	134	0.03	0.17	0.01	24	0.01	0.06	0.00	30	0.02	0.06	0.01	341	0.83	0.59	0.38
NINESPINE STICKLEBACK	142	0.03	0.33	0.02	72	0.02	0.18	0.01	60	0.04	0.17	0.03	455	1.10	0.93	0.60
WHITE PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PUMPKINSEED	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLUEGILL	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SMALLMOUTH BASS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLACK CRAPPIE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
YELLOW PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
FRESHWATER DRUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND GOBY	--	--	--	--	8	0.00	0.68	0.06	--	--	--	--	--	--	--	--
MOTTLED SCULPIN	100	0.02	0.40	0.03	24	0.01	0.16	0.01	90	0.06	0.48	0.09	60	0.14	0.30	0.19
SLIMY SCULPIN	67	0.02	0.37	0.03	--	--	--	--	15	0.01	0.05	0.01	--	--	--	--
UNID COTTUS	--	--	--	--	8	0.00	0.02	0.00	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	408,788	100.00	1,468.63	100.00	303,411	100.00	1,178.22	100.00	144,150	100.00	523.25	100.00	41,316	100.00	153.84	100.00

APPENDIX E (cont.)

SPECIES	17-20MAY06				21-23MAY06				24-27MAY06				28-30MAY06			
	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%
GREAT LAKES CRAYFISH	10	0.01	--	--	12	0.01	--	--	--	--	--	--	--	--	--	--
LAKE STURGEON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	126,239	99.30	305.21	98.51	79,706	99.52	278.95	99.02	803,153	99.66	1,766.86	99.17	835,370	99.87	3,425.30	99.55
ALEWIFE type	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GIZZARD SHAD	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LAKE WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLOATER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COHO SALMON	--	--	--	--	--	--	--	--	5	0.00	0.04	0.00	--	--	--	--
CHINOOK SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BROWN TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LAKE TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RAINBOW SMELT	476	0.37	3.41	1.10	273	0.34	2.31	0.82	2,280	0.28	13.53	0.76	948	0.11	6.62	0.19
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON CARP	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GOLDEN SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SPOTTAIL SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
FATHEAD MINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE DACE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE SUCKER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
WHITE SUCKER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLACK BULLHEAD	--	--	--	--	--	--	--	--	--	--	--	--	8	0.00	1.13	0.03
CHANNEL CATFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TROUT-PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BURBOT	--	--	--	--	--	--	--	--	--	--	--	--	4	0.00	7.56	0.22
BROOK STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	159	0.12	0.29	0.09	3	0.00	0.01	0.00	91	0.01	0.09	0.01	12	0.00	0.02	0.00
NINESPINE STICKLEBACK	144	0.11	0.37	0.12	39	0.05	0.11	0.04	213	0.03	0.55	0.03	51	0.01	0.11	0.00
WHITE PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PUMPKINSEED	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLUEGILL	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SMALLMOUTH BASS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLACK CRAPPIE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
YELLOW PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
FRESHWATER DRUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND GOBY	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MOTTLED SCULPIN	77	0.06	0.42	0.14	6	0.01	0.03	0.01	51	0.01	0.35	0.02	19	0.00	0.09	0.00
SLIMY SCULPIN	24	0.02	0.13	0.04	54	0.07	0.29	0.10	61	0.01	0.27	0.02	19	0.00	0.12	0.00
UNID COTTUS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	127,129	100.00	309.84	100.00	80,092	100.00	281.71	100.00	805,854	100.00	1,781.69	100.00	836,430	100.00	3,440.94	100.00

APPENDIX E (cont.)

SPECIES	31MAY-03JUN06				04-06JUN06				07-10JUN06				11-13JUN06			
	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%
GREAT LAKES CRAYFISH	--	--	--	--	--	--	--	--	--	--	--	--	7	0.01	--	--
LAKE STURGEON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	825,526	99.93	4,044.89	99.87	597,802	99.99	1,673.74	99.98	1,765,986	99.87	5,827.94	99.00	54,871	98.92	192.03	96.88
ALEWIFE type	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GIZZARD SHAD	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LAKE WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLOATER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COHO SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHINOOK SALMON	--	--	--	--	--	--	--	--	--	--	--	--	4	0.01	0.02	0.01
ROUND WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BROWN TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LAKE TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RAINBOW SMELT	499	0.06	3.74	0.09	14	0.00	0.08	0.00	1,743	0.10	13.85	0.24	270	0.49	1.51	0.76
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON CARP	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GOLDEN SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SPOTTAIL SHINER	--	--	--	--	--	--	--	--	--	--	--	--	4	0.01	0.04	0.02
FATHEAD MINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE DACE	--	--	--	--	4	0.00	0.05	0.00	--	--	--	--	--	--	--	--
LONGNOSE SUCKER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
WHITE SUCKER	--	--	--	--	--	--	--	--	30	0.00	35.45	0.60	4	0.01	3.28	1.65
BLACK BULLHEAD	4	0.00	0.81	0.02	--	--	--	--	30	0.00	0.62	0.01	4	0.01	0.40	0.20
CHANNEL CATFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TROUT-PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BURBOT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BROOK STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	26	0.00	0.03	0.00	11	0.00	0.01	0.00	148	0.01	0.27	0.00	55	0.10	0.08	0.04
NINESPINE STICKLEBACK	55	0.01	0.15	0.00	25	0.00	0.06	0.00	266	0.02	0.53	0.01	178	0.32	0.41	0.21
WHITE PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PUMPKINSEED	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLUEGILL	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SMALLMOUTH BASS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLACK CRAPPIE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
YELLOW PERCH	4	0.00	0.01	0.00	--	--	--	--	30	0.00	7.38	0.13	4	0.01	0.03	0.01
FRESHWATER DRUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND GOBY	9	0.00	0.55	0.01	--	--	--	--	--	--	--	--	--	--	--	--
MOTTLED SCULPIN	9	0.00	0.03	0.00	28	0.00	0.20	0.01	89	0.01	0.56	0.01	62	0.11	0.38	0.19
SLIMY SCULPIN	--	--	--	--	4	0.00	0.02	0.00	--	--	--	--	7	0.01	0.04	0.02
UNID COTTUS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	826,132	100.00	4,050.22	100.00	597,886	100.00	1,674.16	100.00	1,768,320	100.00	5,886.60	100.00	55,468	100.00	198.22	100.00

APPENDIX E (cont.)

SPECIES	14-17JUN06				18-20JUN06				21-24JUN06				25-27JUN06			
	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%
GREAT LAKES CRAYFISH	12	0.02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LAKE STURGEON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	54,961	99.37	208.89	96.19	504,576	99.97	1,564.08	99.50	768,126	99.92	2,445.03	99.73	51,505	99.38	133.91	96.76
ALEWIFE type	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GIZZARD SHAD	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LAKE WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLOATER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COHO SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHINOOK SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BROWN TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LAKE TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RAINBOW SMELT	135	0.24	0.78	0.36	57	0.01	0.31	0.02	520	0.07	3.42	0.14	87	0.17	0.51	0.37
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON CARP	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GOLDEN SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SPOTTAIL SHINER	4	0.01	0.05	0.02	--	--	--	--	--	--	--	--	--	--	--	--
FATHEAD MINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE DACE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE SUCKER	--	--	--	--	--	--	--	--	4	0.00	2.98	0.12	--	--	--	--
WHITE SUCKER	--	--	--	--	6	0.00	7.18	0.46	--	--	--	--	3	0.01	2.17	1.57
BLACK BULLHEAD	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHANNEL CATFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TROUT-PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BURBOT	4	0.01	6.77	3.12	--	--	--	--	--	--	--	--	--	--	--	--
BROOK STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	20	0.04	0.04	0.02	3	0.00	0.01	0.00	9	0.00	0.01	0.00	84	0.16	0.14	0.10
NINESPINE STICKLEBACK	131	0.24	0.36	0.16	57	0.01	0.17	0.01	47	0.01	0.12	0.01	87	0.17	0.20	0.14
WHITE PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PUMPKINSEED	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLUEGILL	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SMALLMOUTH BASS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLACK CRAPPIE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
YELLOW PERCH	--	--	--	--	--	--	--	--	--	--	--	--	6	0.01	1.20	0.87
FRESHWATER DRUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND GOBY	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MOTTLED SCULPIN	32	0.06	0.26	0.12	26	0.01	0.14	0.01	9	0.00	0.05	0.00	45	0.09	0.16	0.11
SLIMY SCULPIN	8	0.01	0.04	0.02	--	--	--	--	--	--	--	--	12	0.02	0.10	0.07
UNID COTTUS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	55,307	100.00	217.17	100.00	504,726	100.00	1,571.89	100.00	768,715	100.00	2,451.62	100.00	51,828	100.00	138.39	100.00

APPENDIX E (cont.)

SPECIES	28JUN-01JUL06				02-08JUL06				09-11JUL06				12-15JUL06			
	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%
GREAT LAKES CRAYFISH	4	0.01	--	--	41	0.01	--	--	4	0.00	--	--	--	--	--	--
LAKE STURGEON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	48,347	99.56	183.73	91.21	437,390	99.95	1,531.13	99.90	87,870	99.50	316.34	97.28	35,135	99.65	144.06	94.40
ALEWIFE type	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GIZZARD SHAD	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LAKE WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLOATER	--	--	--	--	--	--	--	--	7	0.01	0.03	0.01	--	--	--	--
COHO SALMON	--	--	--	--	--	--	--	--	4	0.00	0.03	0.01	--	--	--	--
CHINOOK SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BROWN TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LAKE TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RAINBOW SMELT	72	0.15	0.49	0.24	165	0.04	1.40	0.09	172	0.19	0.96	0.29	44	0.12	0.26	0.17
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON CARP	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GOLDEN SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SPOTTAIL SHINER	--	--	--	--	--	--	--	--	4	0.00	0.03	0.01	--	--	--	--
FATHEAD MINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE DACE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE SUCKER	--	--	--	--	--	--	--	--	4	0.00	0.37	0.11	8	0.02	5.11	3.35
WHITE SUCKER	--	--	--	--	--	--	--	--	4	0.00	5.92	1.82	--	--	--	--
BLACK BULLHEAD	--	--	--	--	--	--	--	--	--	--	--	--	4	0.01	1.00	0.65
CHANNEL CATFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TROUT-PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BURBOT	8	0.02	16.77	8.32	--	--	--	--	--	--	--	--	4	0.01	2.00	1.31
BROOK STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	28	0.06	0.05	0.02	--	--	--	--	79	0.09	0.15	0.05	20	0.06	0.04	0.02
NINESPINE STICKLEBACK	64	0.13	0.16	0.08	21	0.00	0.06	0.00	140	0.16	0.29	0.09	24	0.07	0.06	0.04
WHITE PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PUMPKINSEED	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLUEGILL	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SMALLMOUTH BASS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLACK CRAPPIE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
YELLOW PERCH	4	0.01	0.02	0.01	--	--	--	--	4	0.00	0.87	0.27	--	--	--	--
FRESHWATER DRUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND GOBY	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MOTTLED SCULPIN	24	0.05	0.14	0.07	--	--	--	--	22	0.02	0.18	0.06	20	0.06	0.08	0.05
SLIMY SCULPIN	8	0.02	0.09	0.04	--	--	--	--	4	0.00	0.01	0.00	--	--	--	--
UNID COTTUS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	48,559	100.00	201.42	100.00	437,616	100.00	1,532.59	100.00	88,314	100.00	325.17	100.00	35,259	100.00	152.61	100.00

APPENDIX E (cont.)

SPECIES	16-18JUL06				19-22JUL06				23-25JUL06				26-29JUL06			
	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%
GREAT LAKES CRAYFISH	7	0.01	--	--	4	0.00	--	--	12	0.05	--	--	4	0.02	--	--
LAKE STURGEON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	82,630	99.20	322.25	99.06	122,573	99.81	429.01	98.22	24,149	99.41	91.78	86.50	25,831	99.70	93.00	89.43
ALEWIFE type	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GIZZARD SHAD	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LAKE WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLOATER	--	--	--	--	--	--	--	--	3	0.01	0.02	0.01	--	--	--	--
COHO SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHINOOK SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BROWN TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LAKE TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RAINBOW SMELT	485	0.58	2.12	0.65	133	0.11	0.87	0.20	24	0.10	0.11	0.10	20	0.08	0.12	0.12
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON CARP	--	--	--	--	--	--	--	--	--	--	--	--	4	0.02	0.39	0.37
GOLDEN SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SPOTTAIL SHINER	3	0.00	0.02	0.01	8	0.01	0.10	0.02	--	--	--	--	--	--	--	--
FATHEAD MINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE DACE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE SUCKER	3	0.00	0.53	0.16	12	0.01	1.37	0.31	6	0.02	3.06	2.89	--	--	--	--
WHITE SUCKER	--	--	--	--	4	0.00	4.44	1.02	6	0.02	8.41	7.92	8	0.03	7.25	6.97
BLACK BULLHEAD	--	--	--	--	4	0.00	0.62	0.14	3	0.01	0.53	0.50	--	--	--	--
CHANNEL CATFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TROUT-PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BURBOT	--	--	--	--	--	--	--	--	3	0.01	1.50	1.41	--	--	--	--
BROOK STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	49	0.06	0.09	0.03	4	0.00	0.01	0.00	15	0.06	0.03	0.03	8	0.03	0.01	0.01
NINESPINE STICKLEBACK	101	0.12	0.21	0.07	20	0.02	0.05	0.01	51	0.21	0.11	0.10	12	0.05	0.02	0.02
WHITE PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PUMPKINSEED	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLUEGILL	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SMALLMOUTH BASS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLACK CRAPPIE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
YELLOW PERCH	3	0.00	0.01	0.00	--	--	--	--	3	0.01	0.50	0.48	8	0.03	3.16	3.04
FRESHWATER DRUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND GOBY	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MOTTLED SCULPIN	10	0.01	0.05	0.02	44	0.04	0.30	0.07	15	0.06	0.04	0.04	12	0.05	0.04	0.04
SLIMY SCULPIN	3	0.00	0.02	0.01	--	--	--	--	3	0.01	0.02	0.02	--	--	--	--
UNID COTTUS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	83,294	100.00	325.31	100.00	122,807	100.00	436.76	100.00	24,293	100.00	106.10	100.00	25,908	100.00	103.99	100.00

APPENDIX E (cont.)

SPECIES	30JUL-01AUG06				02-05AUG06				06-08AUG06				09-12AUG06			
	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%
GREAT LAKES CRAYFISH	3	0.02	--	--	9	0.10	--	--	22	1.45	--	--	36	2.20	--	--
LAKE STURGEON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	19,455	99.44	68.50	98.26	8,572	96.58	45.29	71.78	1,473	95.36	10.56	42.44	1,478	89.51	7.82	18.81
ALEWIFE type	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GIZZARD SHAD	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LAKE WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLOATER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COHO SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHINOOK SALMON	--	--	--	--	9	0.10	0.22	0.35	--	--	--	--	--	--	--	--
ROUND WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	4	0.24	1.81	4.36
BROWN TROUT	--	--	--	--	5	0.05	1.81	2.88	--	--	--	--	--	--	--	--
LAKE TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RAINBOW SMELT	67	0.34	0.32	0.46	54	0.61	0.21	0.33	--	--	--	--	--	--	--	--
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON CARP	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GOLDEN SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SPOTTAIL SHINER	3	0.02	0.04	0.05	--	--	--	--	9	0.58	0.13	0.52	4	0.24	0.03	0.08
FATHEAD MINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE DACE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE SUCKER	3	0.02	0.73	1.04	--	--	--	--	9	0.58	4.50	18.09	4	0.24	0.60	1.45
WHITE SUCKER	--	--	--	--	9	0.10	8.16	12.94	4	0.29	4.48	17.98	24	1.46	22.96	55.25
BLACK BULLHEAD	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHANNEL CATFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TROUT-PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BURBOT	--	--	--	--	5	0.05	6.80	10.78	4	0.29	5.15	20.68	12	0.73	3.77	9.07
BROOK STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	6	0.03	0.01	0.01	41	0.46	0.08	0.12	--	--	--	--	--	--	--	--
NINESPINE STICKLEBACK	9	0.05	0.02	0.03	118	1.33	0.24	0.38	9	0.58	0.01	0.05	4	0.24	0.01	0.02
WHITE PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PUMPKINSEED	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLUEGILL	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SMALLMOUTH BASS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLACK CRAPPIE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
YELLOW PERCH	--	--	--	--	32	0.36	0.15	0.23	4	0.29	0.02	0.07	36	2.20	4.33	10.41
FRESHWATER DRUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND GOBY	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MOTTLED SCULPIN	18	0.09	0.09	0.13	23	0.26	0.13	0.20	9	0.58	0.04	0.16	48	2.93	0.23	0.54
SLIMY SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID COTTUS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	19,564	100.00	69.71	100.00	8,876	100.00	63.09	100.00	1,544	100.00	24.89	100.00	1,651	100.00	41.56	100.00

APPENDIX E (cont.)

SPECIES	13-15AUG06				16-19AUG06				20-22AUG06				23-26AUG06			
	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%
GREAT LAKES CRAYFISH	63	4.82	--	--	79	3.64	--	--	42	16.47	--	--	64	19.28	--	--
LAKE STURGEON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	1,073	82.11	6.41	7.04	1,854	85.61	15.97	10.20	155	61.18	1.24	3.28	164	49.40	1.62	4.10
ALEWIFE type	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GIZZARD SHAD	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LAKE WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLOATER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COHO SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHINOOK SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND WHITEFISH	--	--	--	--	4	0.18	2.37	1.51	--	--	--	--	--	--	--	--
BROWN TROUT	--	--	--	--	4	0.18	18.35	11.72	3	1.18	14.93	39.43	--	--	--	--
LAKE TROUT	3	0.23	12.28	13.49	--	--	--	--	--	--	--	--	--	--	--	--
RAINBOW SMELT	6	0.46	0.02	0.03	8	0.36	0.03	0.02	--	--	--	--	--	--	--	--
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON CARP	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GOLDEN SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SPOTTAIL SHINER	12	0.92	0.11	0.12	4	0.18	0.05	0.03	3	1.18	0.01	0.03	--	--	--	--
FATHEAD MINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE DACE	15	1.15	0.18	0.20	20	0.91	0.26	0.16	15	5.88	0.18	0.48	--	--	--	--
LONGNOSE SUCKER	21	1.61	11.71	12.86	8	0.36	1.61	1.03	--	--	--	--	12	3.61	6.83	17.27
WHITE SUCKER	48	3.67	59.20	65.03	110	5.10	114.08	72.86	21	8.24	19.94	52.65	28	8.43	30.76	77.75
BLACK BULLHEAD	--	--	--	--	--	--	--	--	3	1.18	0.88	2.31	--	--	--	--
CHANNEL CATFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TROUT-PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BURBOT	--	--	--	--	--	--	--	--	3	1.18	0.65	1.72	--	--	--	--
BROOK STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	--	--	--	--	4	0.18	0.01	0.01	--	--	--	--	4	1.20	0.01	0.02
NINESPINE STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	4	1.20	0.01	0.02
WHITE PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PUMPKINSEED	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLUEGILL	3	0.23	0.01	0.01	--	--	--	--	--	--	--	--	--	--	--	--
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SMALLMOUTH BASS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLACK CRAPPIE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
YELLOW PERCH	6	0.46	0.82	0.91	12	0.55	3.41	2.18	--	--	--	--	--	--	--	--
FRESHWATER DRUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND GOBY	--	--	--	--	--	--	--	--	--	--	--	--	4	1.20	0.04	0.09
MOTTLED SCULPIN	57	4.36	0.29	0.32	59	2.73	0.44	0.28	9	3.53	0.04	0.09	52	15.66	0.30	0.76
SLIMY SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID COTTUS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	1,306	100.00	91.03	100.00	2,166	100.00	156.56	100.00	253	100.00	37.87	100.00	332	100.00	39.56	100.00

APPENDIX E (cont.)

SPECIES	27-29AUG06				30AUG-02SEP06				03-05SEP06				06-09SEP06			
	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%
GREAT LAKES CRAYFISH	24	10.81	--	--	36	3.10	--	--	3	1.41	--	--	20	6.41	--	--
LAKE STURGEON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	78	35.14	0.74	3.55	307	26.55	2.33	6.00	33	15.49	0.46	0.37	44	14.10	0.39	0.46
ALEWIFE type	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GIZZARD SHAD	42	18.92	0.29	1.40	24	2.07	0.16	0.40	--	--	--	--	--	--	--	--
LAKE WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLOATER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COHO SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHINOOK SALMON	--	--	--	--	4	0.34	0.15	0.39	--	--	--	--	4	1.28	0.26	0.31
ROUND WHITEFISH	--	--	--	--	--	--	--	--	3	1.41	3.47	2.81	--	--	--	--
BROWN TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LAKE TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RAINBOW SMELT	3	1.35	0.03	0.14	44	3.79	0.20	0.51	--	--	--	--	4	1.28	0.04	0.04
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON CARP	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GOLDEN SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SPOTTAIL SHINER	9	4.05	0.05	0.21	132	11.38	0.71	1.83	15	7.04	0.16	0.13	28	8.97	0.21	0.25
FATHEAD MINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE DACE	--	--	--	--	36	3.10	0.40	1.04	12	5.63	0.12	0.10	--	--	--	--
LONGNOSE SUCKER	9	4.05	3.11	14.81	8	0.69	1.20	3.09	9	4.23	2.14	1.73	16	5.13	5.93	7.03
WHITE SUCKER	15	6.76	16.35	78.00	36	3.10	28.70	73.95	94	43.66	105.31	85.26	77	24.36	75.67	89.69
BLACK BULLHEAD	--	--	--	--	--	--	--	--	12	5.63	2.88	2.33	4	1.28	1.23	1.46
CHANNEL CATFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TROUT-PERCH	--	--	--	--	4	0.34	0.05	0.13	--	--	--	--	--	--	--	--
BURBOT	--	--	--	--	--	--	--	--	3	1.41	7.28	5.89	--	--	--	--
BROOK STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	--	--	--	--	16	1.38	0.03	0.08	--	--	--	--	--	--	--	--
NINESPINE STICKLEBACK	3	1.35	0.01	0.03	20	1.72	0.03	0.08	--	--	--	--	4	1.28	0.01	0.01
WHITE PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PUMPKINSEED	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLUEGILL	--	--	--	--	4	0.34	0.04	0.09	--	--	--	--	--	--	--	--
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SMALLMOUTH BASS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLACK CRAPPIE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
YELLOW PERCH	9	4.05	0.23	1.09	148	12.76	2.65	6.84	9	4.23	1.55	1.26	8	2.56	0.08	0.10
FRESHWATER DRUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND GOBY	--	--	--	--	4	0.34	0.01	0.03	--	--	--	--	--	--	--	--
MOTTLED SCULPIN	30	13.51	0.16	0.76	315	27.24	2.06	5.32	21	9.86	0.14	0.11	81	25.64	0.43	0.51
SLIMY SCULPIN	--	--	--	--	20	1.72	0.08	0.22	--	--	--	--	24	7.69	0.11	0.13
UNID COTTUS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	222	100.00	20.96	100.00	1,158	100.00	38.81	100.00	214	100.00	123.52	100.00	315	100.00	84.37	100.00

APPENDIX E (cont.)

SPECIES	10-12SEP06				13-16SEP06				17-19SEP06				20-23SEP06			
	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%
GREAT LAKES CRAYFISH	11	1.90	--	--	--	--	--	--	3	0.07	--	--	9	0.34	--	--
LAKE STURGEON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	217	37.34	3.00	28.57	142	25.17	2.02	7.98	3,691	76.30	11.09	20.04	2,294	85.76	23.83	66.74
ALEWIFE type	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GIZZARD SHAD	7	1.27	--	--	8	1.40	0.06	0.23	30	0.63	2.50	4.53	--	--	--	--
LAKE WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLOATER	18	3.16	0.10	0.91	39	6.99	0.18	0.70	20	0.42	0.11	0.20	5	0.17	0.02	0.05
COHO SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHINOOK SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND WHITEFISH	7	1.27	4.78	45.45	--	--	--	--	--	--	--	--	--	--	--	--
BROWN TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LAKE TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RAINBOW SMELT	129	22.15	0.67	6.36	98	17.48	0.41	1.60	481	9.94	2.25	4.07	142	5.32	0.54	1.50
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON CARP	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GOLDEN SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	3	0.07	0.02	0.03	--	--	--	--
COMMON SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SPOTTAIL SHINER	63	10.76	0.49	4.69	20	3.50	0.13	0.50	340	7.02	1.72	3.12	87	3.26	0.51	1.44
FATHEAD MINNOW	--	--	--	--	4	0.70	0.02	0.06	3	0.07	0.01	0.02	--	--	--	--
LONGNOSE DACE	--	--	--	--	16	2.80	0.15	0.59	13	0.28	0.07	0.13	23	0.86	0.22	0.63
LONGNOSE SUCKER	4	0.63	0.72	6.82	4	0.70	1.57	6.21	--	--	--	--	--	--	--	--
WHITE SUCKER	--	--	--	--	20	3.50	17.50	69.03	17	0.35	13.40	24.21	5	0.17	0.61	1.72
BLACK BULLHEAD	--	--	--	--	--	--	--	--	10	0.21	1.29	2.33	--	--	--	--
CHANNEL CATFISH	--	--	--	--	4	0.70	0.20	0.81	3	0.07	0.40	0.72	--	--	--	--
TROUT-PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BURBOT	--	--	--	--	4	0.70	0.09	0.34	10	0.21	3.85	6.96	5	0.17	4.36	12.20
BROOK STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	--	--	--	--	16	2.80	0.03	0.11	--	--	--	--	--	--	--	--
NINESPINE STICKLEBACK	4	0.63	0.01	0.07	4	0.70	0.00	0.02	10	0.21	0.02	0.04	5	0.17	0.00	0.01
WHITE PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GREEN SUNFISH	--	--	--	--	--	--	--	--	3	0.07	0.01	0.02	--	--	--	--
PUMPKINSEED	--	--	--	--	--	--	--	--	7	0.14	0.19	0.34	5	0.17	0.14	0.39
BLUEGILL	--	--	--	--	--	--	--	--	3	0.07	0.05	0.09	--	--	--	--
UNID LEPOMIS	--	--	--	--	--	--	--	--	3	0.07	0.01	0.01	--	--	--	--
SMALLMOUTH BASS	--	--	--	--	--	--	--	--	--	--	--	--	9	0.34	5.09	14.26
BLACK CRAPPIE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
YELLOW PERCH	--	--	--	--	8	1.40	1.78	7.04	97	2.02	0.91	1.64	28	1.03	0.09	0.24
FRESHWATER DRUM	--	--	--	--	--	--	--	--	24	0.49	17.12	30.94	--	--	--	--
ROUND GOBY	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MOTTLED SCULPIN	107	18.35	0.66	6.26	157	27.97	1.10	4.35	64	1.32	0.32	0.58	60	2.23	0.29	0.81
SLIMY SCULPIN	15	2.53	0.09	0.87	20	3.50	0.11	0.43	--	--	--	--	--	--	--	--
UNID COTTUS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	581	100.00	10.52	100.00	563	100.00	25.35	100.00	4,838	100.00	55.33	100.00	2,674	100.00	35.71	100.00

APPENDIX E (cont.)

SPECIES	24-26SEP06				27-30SEP06				01-03OCT06				04-07OCT06			
	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%
GREAT LAKES CRAYFISH	--	--	--	--	12	0.42	--	--	3	0.01	--	--	22	0.07	--	--
LAKE STURGEON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	1,890	85.85	22.70	81.50	2,308	80.20	18.99	58.68	14,121	61.11	96.02	56.96	25,163	82.15	163.95	77.02
ALEWIFE type	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GIZZARD SHAD	21	0.95	0.12	0.42	4	0.14	0.02	0.06	20	0.09	0.14	0.08	11	0.04	1.22	0.57
LAKE WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLOATER	24	1.09	0.10	0.38	28	0.98	0.10	0.31	115	0.50	0.51	0.30	54	0.18	0.29	0.14
COHO SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHINOOK SALMON	--	--	--	--	--	--	--	--	7	0.03	9.04	5.36	--	--	--	--
ROUND WHITEFISH	--	--	--	--	--	--	--	--	7	0.03	0.44	0.26	5	0.02	3.27	1.53
BROWN TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LAKE TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RAINBOW SMELT	207	9.39	1.39	5.00	136	4.74	0.81	2.51	7,931	34.32	38.89	23.07	4,328	14.13	27.68	13.01
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON CARP	--	--	--	--	--	--	--	--	3	0.01	0.06	0.04	--	--	--	--
GOLDEN SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON SHINER	3	0.14	0.04	0.15	--	--	--	--	--	--	--	--	--	--	--	--
SPOTTAIL SHINER	3	0.14	0.02	0.09	253	8.79	1.87	5.77	689	2.98	5.02	2.98	844	2.76	5.45	2.56
FATHEAD MINNOW	--	--	--	--	--	--	--	--	3	0.01	0.01	0.01	--	--	--	--
LONGNOSE DACE	6	0.27	0.08	0.29	4	0.14	0.10	0.32	10	0.04	0.08	0.04	5	0.02	0.05	0.02
LONGNOSE SUCKER	--	--	--	--	--	--	--	--	--	--	--	--	5	0.02	5.44	2.56
WHITE SUCKER	3	0.14	0.34	1.24	4	0.14	2.21	6.82	3	0.01	3.28	1.95	11	0.04	3.78	1.78
BLACK BULLHEAD	3	0.14	1.04	3.72	--	--	--	--	3	0.01	0.70	0.41	--	--	--	--
CHANNEL CATFISH	--	--	--	--	--	--	--	--	3	0.01	0.01	0.00	--	--	--	--
TROUT-PERCH	--	--	--	--	--	--	--	--	3	0.01	0.04	0.02	--	--	--	--
BURBOT	6	0.27	1.76	6.33	--	--	--	--	7	0.03	13.14	7.79	--	--	--	--
BROOK STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	--	--	--	--	4	0.14	0.00	0.01	--	--	--	--	--	--	--	--
NINESPINE STICKLEBACK	--	--	--	--	--	--	--	--	13	0.06	0.03	0.02	--	--	--	--
WHITE PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PUMPKINSEED	--	--	--	--	4	0.14	0.01	0.02	3	0.01	0.00	0.00	--	--	--	--
BLUEGILL	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SMALLMOUTH BASS	--	--	--	--	4	0.14	0.44	1.36	3	0.01	0.04	0.02	--	--	--	--
BLACK CRAPPIE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
YELLOW PERCH	3	0.14	0.09	0.33	40	1.39	0.20	0.61	56	0.24	0.55	0.33	71	0.23	0.49	0.23
FRESHWATER DRUM	--	--	--	--	4	0.14	7.23	22.33	--	--	--	--	--	--	--	--
ROUND GOBY	--	--	--	--	--	--	--	--	3	0.01	0.02	0.01	5	0.02	0.55	0.26
MOTTLED SCULPIN	33	1.50	0.16	0.56	64	2.23	0.35	1.07	98	0.43	0.54	0.32	98	0.32	0.65	0.31
SLIMY SCULPIN	--	--	--	--	8	0.28	0.04	0.11	3	0.01	0.03	0.02	5	0.02	0.03	0.02
UNID COTTUS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	2,202	100.00	27.85	100.00	2,878	100.00	32.35	100.00	23,109	100.00	168.58	100.00	30,629	100.00	212.86	100.00

APPENDIX E (cont.)

SPECIES	08-10OCT06				11-14OCT06				15-17OCT06				18-21OCT06			
	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%
GREAT LAKES CRAYFISH	--	--	--	--	--	--	--	--	3	0.03	--	--	--	--	--	--
LAKE STURGEON	3	0.03	0.71	0.80	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	5,998	54.65	31.17	34.88	828	79.01	8.07	26.15	8,220	74.58	55.50	58.79	444	77.30	2.48	12.66
ALEWIFE type	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GIZZARD SHAD	39	0.35	0.28	0.31	4	0.38	0.02	0.05	88	0.80	0.41	0.44	--	--	--	--
LAKE WHITEFISH	6	0.05	0.31	0.35	--	--	--	--	3	0.03	0.11	0.12	--	--	--	--
BLOATER	--	--	--	--	--	--	--	--	42	0.38	0.18	0.19	--	--	--	--
COHO SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHINOOK SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND WHITEFISH	9	0.08	3.35	3.75	--	--	--	--	--	--	--	--	--	--	--	--
BROWN TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LAKE TROUT	3	0.03	11.31	12.65	--	--	--	--	--	--	--	--	4	0.61	9.68	49.45
RAINBOW SMELT	4,168	37.98	25.81	28.88	156	14.89	1.15	3.72	1,828	16.58	10.61	11.24	88	15.34	0.63	3.22
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON CARP	--	--	--	--	--	--	--	--	3	0.03	0.02	0.02	--	--	--	--
GOLDEN SHINER	--	--	--	--	--	--	--	--	3	0.03	0.01	0.01	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SPOTTAIL SHINER	488	4.45	2.70	3.02	--	--	--	--	581	5.27	4.29	4.54	25	4.29	0.17	0.88
FATHEAD MINNOW	3	0.03	0.01	0.02	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE DACE	3	0.03	0.03	0.04	--	--	--	--	3	0.03	0.03	0.03	--	--	--	--
LONGNOSE SUCKER	--	--	--	--	4	0.38	1.14	3.71	--	--	--	--	--	--	--	--
WHITE SUCKER	9	0.08	6.93	7.75	20	1.91	16.72	54.16	26	0.24	19.15	20.29	4	0.61	3.52	17.98
BLACK BULLHEAD	--	--	--	--	4	0.38	1.25	4.06	3	0.03	0.23	0.24	4	0.61	1.34	6.83
CHANNEL CATFISH	3	0.03	0.01	0.01	--	--	--	--	--	--	--	--	--	--	--	--
TROUT-PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BURBOT	3	0.03	0.16	0.18	8	0.76	2.24	7.27	3	0.03	2.76	2.92	4	0.61	1.69	8.63
BROOK STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
NINESPINE STICKLEBACK	--	--	--	--	--	--	--	--	3	0.03	0.01	0.01	--	--	--	--
WHITE PERCH	3	0.03	0.04	0.05	--	--	--	--	--	--	--	--	--	--	--	--
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PUMPKINSEED	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLUEGILL	--	--	--	--	--	--	--	--	6	0.06	0.13	0.14	--	--	--	--
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SMALLMOUTH BASS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLACK CRAPPIE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
YELLOW PERCH	167	1.52	1.51	1.68	20	1.91	0.26	0.83	185	1.68	0.83	0.88	4	0.61	0.07	0.34
FRESHWATER DRUM	3	0.03	4.61	5.16	--	--	--	--	--	--	--	--	--	--	--	--
ROUND GOBY	3	0.03	0.11	0.13	--	--	--	--	--	--	--	--	--	--	--	--
MOTTLED SCULPIN	65	0.60	0.32	0.36	4	0.38	0.02	0.06	19	0.18	0.13	0.14	--	--	--	--
SLIMY SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID COTTUS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	10,976	100.00	89.37	100.00	1,048	100.00	30.87	100.00	11,021	100.00	94.40	100.00	574	100.00	19.57	100.00

APPENDIX E (cont.)

SPECIES	22-24OCT06				25-28OCT06				29-31OCT06				01-04NOV06			
	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%
GREAT LAKES CRAYFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LAKE STURGEON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	782	85.93	12.53	34.61	3,280	79.40	16.94	37.14	2,184	95.54	12.59	49.23	516	87.07	3.36	37.89
ALEWIFE type	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GIZZARD SHAD	98	10.74	1.45	4.00	817	19.78	9.10	19.94	18	0.79	0.18	0.72	65	10.88	0.60	6.72
LAKE WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLOATER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COHO SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHINOOK SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BROWN TROUT	--	--	--	--	--	--	--	--	3	0.13	0.21	0.83	--	--	--	--
LAKE TROUT	3	0.37	11.79	32.57	--	--	--	--	--	--	--	--	--	--	--	--
RAINBOW SMELT	17	1.85	0.13	0.35	--	--	--	--	27	1.18	0.37	1.43	--	--	--	--
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON CARP	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GOLDEN SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON SHINER	--	--	--	--	--	--	--	--	3	0.13	0.19	0.74	--	--	--	--
SPOTTAIL SHINER	3	0.37	0.03	0.08	4	0.09	0.02	0.04	9	0.39	0.05	0.20	4	0.68	0.03	0.32
FATHEAD MINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE DACE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE SUCKER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
WHITE SUCKER	7	0.74	10.28	28.38	11	0.27	14.75	32.34	12	0.52	10.95	42.84	4	0.68	4.64	52.25
BLACK BULLHEAD	--	--	--	--	--	--	--	--	3	0.13	0.67	2.63	--	--	--	--
CHANNEL CATFISH	--	--	--	--	4	0.09	0.80	1.76	3	0.13	0.02	0.07	--	--	--	--
TROUT-PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BURBOT	--	--	--	--	4	0.09	3.97	8.71	--	--	--	--	--	--	--	--
BROOK STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
NINESPINE STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
WHITE PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PUMPKINSEED	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLUEGILL	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SMALLMOUTH BASS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLACK CRAPPIE	--	--	--	--	--	--	--	--	3	0.13	0.04	0.15	--	--	--	--
YELLOW PERCH	--	--	--	--	8	0.18	0.02	0.04	12	0.52	0.24	0.94	4	0.68	0.25	2.82
FRESHWATER DRUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND GOBY	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MOTTLED SCULPIN	--	--	--	--	4	0.09	0.02	0.03	9	0.39	0.06	0.22	--	--	--	--
SLIMY SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID COTTUS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	910	100.00	36.21	100.00	4,131	100.00	45.62	100.00	2,286	100.00	25.56	100.00	593	100.00	8.88	100.00

APPENDIX E (cont.)

SPECIES	05-07NOV06				08-11NOV06				12-14NOV06				15-18NOV06			
	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%
GREAT LAKES CRAYFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LAKE STURGEON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	2,167	91.52	10.80	69.29	1,051	88.85	5.19	57.78	38,550	99.63	161.63	99.08	18,501	99.57	87.55	74.65
ALEWIFE type	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GIZZARD SHAD	27	1.12	3.32	21.27	24	2.03	0.23	2.54	63	0.16	0.88	0.54	12	0.06	4.65	3.96
LAKE WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLOATER	9	0.37	0.04	0.27	8	0.68	0.03	0.31	--	--	--	--	4	0.02	0.02	0.02
COHO SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHINOOK SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BROWN TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LAKE TROUT	--	--	--	--	--	--	--	--	--	--	--	--	4	0.02	7.56	6.44
RAINBOW SMELT	124	5.24	0.58	3.73	36	3.04	0.25	2.76	16	0.04	0.11	0.07	--	--	--	--
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON CARP	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GOLDEN SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SPOTTAIL SHINER	12	0.50	0.08	0.49	12	1.01	0.10	1.11	22	0.06	0.13	0.08	20	0.11	0.10	0.09
FATHEAD MINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE DACE	--	--	--	--	--	--	--	--	--	--	--	--	4	0.02	0.03	0.03
LONGNOSE SUCKER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
WHITE SUCKER	--	--	--	--	4	0.34	2.20	24.47	--	--	--	--	4	0.02	4.77	4.07
BLACK BULLHEAD	3	0.12	0.51	3.26	--	--	--	--	--	--	--	--	--	--	--	--
CHANNEL CATFISH	--	--	--	--	8	0.68	0.17	1.91	--	--	--	--	--	--	--	--
TROUT-PERCH	3	0.12	0.03	0.21	--	--	--	--	--	--	--	--	--	--	--	--
BURBOT	3	0.12	0.13	0.83	4	0.34	0.23	2.58	--	--	--	--	8	0.04	12.53	10.68
BROOK STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	3	0.12	0.00	0.02	--	--	--	--	3	0.01	0.00	0.00	12	0.06	0.01	0.01
NINESPINE STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
WHITE PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PUMPKINSEED	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLUEGILL	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SMALLMOUTH BASS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLACK CRAPPIE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
YELLOW PERCH	12	0.50	0.04	0.27	28	2.36	0.55	6.14	32	0.08	0.32	0.19	8	0.04	0.02	0.02
FRESHWATER DRUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND GOBY	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MOTTLED SCULPIN	3	0.12	0.02	0.11	4	0.34	0.02	0.22	6	0.02	0.06	0.04	4	0.02	0.02	0.02
SLIMY SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID COTTUS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	3	0.12	0.04	0.25	4	0.34	0.02	0.18	--	--	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	2,368	100.00	15.59	100.00	1,182	100.00	8.98	100.00	38,693	100.00	163.12	100.00	18,581	100.00	117.28	100.00

APPENDIX E (cont.)

SPECIES	19-21NOV06				22-25NOV06				26-28NOV06				29NOV-02DEC06			
	#	%	KG	%	#	%	KG	%	#	%	KG	%	#	%	KG	%
GREAT LAKES CRAYFISH	--	--	--	--	4	0.02	--	--	--	--	--	--	4	0.06	--	--
LAKE STURGEON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ALEWIFE	384	88.97	1.79	18.23	16,476	72.85	97.34	64.38	214,464	99.92	970.96	99.38	6,212	96.04	33.23	94.94
ALEWIFE type	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UNID ALOSA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GIZZARD SHAD	6	1.47	0.07	0.74	956	4.23	9.67	6.39	18	0.01	0.17	0.02	36	0.56	0.28	0.81
LAKE WHITEFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLOATER	--	--	--	--	4	0.02	0.01	0.01	--	--	--	--	--	--	--	--
COHO SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHINOOK SALMON	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ROUND WHITEFISH	--	--	--	--	4	0.02	3.20	2.12	6	0.00	0.68	0.07	--	--	--	--
BROWN TROUT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LAKE TROUT	--	--	--	--	8	0.04	0.06	0.04	6	0.00	0.04	0.00	--	--	--	--
RAINBOW SMELT	--	--	--	--	3,672	16.24	19.73	13.05	54	0.03	0.63	0.06	100	1.55	0.84	2.39
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON CARP	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GOLDEN SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
EMERALD SHINER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMMON SHINER	--	--	--	--	4	0.02	0.11	0.07	--	--	--	--	--	--	--	--
SPOTTAIL SHINER	--	--	--	--	984	4.35	6.16	4.07	12	0.01	0.08	0.01	4	0.06	0.02	0.06
FATHEAD MINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE DACE	--	--	--	--	12	0.05	0.09	0.06	--	--	--	--	--	--	--	--
LONGNOSE SUCKER	--	--	--	--	--	--	--	--	--	--	--	--	4	0.06	0.41	1.18
WHITE SUCKER	3	0.74	3.94	40.16	8	0.04	12.60	8.33	3	0.00	3.91	0.40	--	--	--	--
BLACK BULLHEAD	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHANNEL CATFISH	--	--	--	--	20	0.09	0.19	0.12	--	--	--	--	--	--	--	--
TROUT-PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BURBOT	--	--	--	--	--	--	--	--	12	0.01	0.26	0.03	--	--	--	--
BROOK STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	35	8.09	0.04	0.39	136	0.60	0.14	0.09	18	0.01	0.02	0.00	92	1.42	0.09	0.26
NINESPINE STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
WHITE PERCH	--	--	--	--	8	0.04	0.53	0.35	--	--	--	--	4	0.06	0.03	0.08
GREEN SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PUMPKINSEED	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLUEGILL	--	--	--	--	8	0.04	0.05	0.03	--	--	--	--	--	--	--	--
UNID LEPOMIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SMALLMOUTH BASS	--	--	--	--	--	--	--	--	--	--	--	--	4	0.06	0.06	0.18
BLACK CRAPPIE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
YELLOW PERCH	--	--	--	--	292	1.29	1.21	0.80	21	0.01	0.09	0.01	--	--	--	--
FRESHWATER DRUM	3	0.74	3.97	40.48	--	--	--	--	--	--	--	--	--	--	--	--
ROUND GOBY	--	--	--	--	--	--	--	--	3	0.00	0.11	0.01	--	--	--	--
MOTTLED SCULPIN	--	--	--	--	20	0.09	0.11	0.07	9	0.00	0.07	0.01	8	0.12	0.04	0.10
SLIMY SCULPIN	--	--	--	--	--	--	--	--	6	0.00	0.04	0.00	--	--	--	--
UNID COTTUS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DEEPWATER SCULPIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL SHELLFISH AND FISH	432	100.00	9.81	100.00	22,616	100.00	151.20	100.00	214,632	100.00	977.05	100.00	6,468	100.00	35.00	100.00

Document Request 11

Affected SLRA Sections: None

SLRA Page Number: N/A

Description of Change: Existing reference provided for docketing.

Existing Reference

NEE. 2018a. Review of Source Waterbody Status Point Beach Nuclear Plant WPDES Permit Reissuance No. WI-000957-08. NPL 2018-0008. January 23, 2018.

NEXTera® ENERGY
POINT BEACH

January 23, 2018

NPL 2018-0008
§316(b)

Mr. Jason Knutson
Wisconsin Department of Natural Resources
PO Box 7921
Madison, WI 53707-7921

NextEra Energy Point Beach, LLC
Point Beach Nuclear Plant, Units 1 and 2
WPDES Permit No. WI-0000957-08-0

Review of Source Waterbody Status and Entrainment Characterization Study Report

Enclosed please find NextEra Energy Point Beach, LLC's (NextEra Energy) submittal of Point Beach Nuclear Plant Review of Source Waterbody Status and Entrainment Characterization Study Report(s). Enclosure 1 of this letter provides a review of the changes in Lake Michigan near NextEra Energy and at the facility, and compares the data collected at Point Beach in 2006 and 2017. The report concludes that the two data sets are similar and that sampling for entrainment in 2018 in not necessary. Enclosure 2 of this letter provides an overview of the 2017 program and its results.

Should you have any questions please call Mr. Mark Schanke 920-755-6270.

Sincerely,

NextEra Energy Point Beach, LLC

Randy Hastings for
Chemistry Manager

Enclosures (2)

cc: Keith Pierce, Wastewater Engineer, WDNR
David Gerdman, Wastewater Engineer, WDNR

ENCLOSURE 1

NEXTERA ENERGY POINT BEACH, LLC
POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2

REVIEW OF SOURCE WATERBODY STATUS

59 pages follow

Review of Source Waterbody Status

Point Beach Nuclear Plant

WPDES Permit Reissuance No. WI-0000957-08-0

Prepared for:

NextEra Energy Point Beach, LLC

Two Rivers, Wisconsin

Prepared by:

ECT Environmental Consulting & Technology, Inc.
2200 Commonwealth Blvd., Suite 300
Ann Arbor, Michigan 48105

ECT No. 150596.D209

Version 1.0
Last Updated: January 23, 2018

DOCUMENT REVIEW

The dual signatory process is an integral part of Environmental Consulting & Technology, Inc.'s (ECT's) Document Review Policy No. 9.03. Under this policy, all ECT documents undergo internal technical review prior to dispatching these documents to any outside entity. This internal review does not address the peer review requirements of the 316(b) rule at 40 CFR 122.21(r)(13). To the extent that the requirement for external peer review is necessary, it is executed and documented separately.

This document has been authored and reviewed by the following employees:

Greg Gaulke	Mark Gerath
Author	Technical Review
Signature	Signature
January 23, 2018	January 23, 2018
Date	Date

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LIST OF ACRONYMS AND ABBREVIATIONS

BTA	Best technology available
CFR	Code of Federal Regulations
CPUE	catch per unit effort
CWIS	Cooling water intake structure
DIF	design intake flow
EA	EA Engineering, Science and Technology, Inc.
ECT	Environmental Consulting & Technology, Inc.
ft	feet
GLCS	Great Lakes Sciences Center
gpm	gallon per minute
ha	hectare
in	inches
kHz	kilohertz
km	kilometers
kt	kiloton
m	meters
MGD	million gallons per day
MW	megawatts
NMFS	National Marine Fisheries Service
PCB	Polychlorinated biphenyl
sec	seconds
TMDL	Total Maximum Daily Load
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish & Wildlife Service
USGS	United States Geological Survey
WDNR	Wisconsin Department of Natural Resources
WI	Wisconsin
WPDES	Wisconsin Pollutant Discharge Elimination System

1.0 EXECUTIVE SUMMARY

NextEra Energy Point Beach, LLC (NextEra) has proposed that entrainment data collected under the now-remanded 316(b) Phase II rule at its Point Beach Nuclear Plant (Point Beach) in 2006 can be used in part to address the requirement for entrainment characterization defined by the 2014 316(b) final rule for existing facilities. The rule states that historical entrainment data can be used to satisfy the rule's requirements but that an explanation of how the historical data remain relevant and representative of conditions at the facility must be provided. Such an explanation has also been requested by staff at Wisconsin Department of Natural Resources (WDNR) and was included in the entrainment characterization work plan for the 2017 effort at Point Beach.

While the rule does not provide guidance on the nature of the required explanation, United States Environmental Protection Agency (USEPA) staff have suggested that it include a review of potential changes at the plant and in the source waterbody that may affect data utility. Potential changes in the waterbody could include shifts in water quality, hydrology, and biology. In addition to this information, this report also reviews long-term changes in the waterbody's biology using historical data from quantitative stock surveys, and to the extent possible from these databases, changes that may have occurred since the completion of the Phase II and 2017 entrainment characterizations.

In addition to considering changes in the plant and waterbody, the report compares the two entrainment datasets and examines them in the context of documented biological changes in the source water and how these changes might affect the assessment of entrainment at Point Beach under the rule.

The following is a brief summary of the report's findings including reference to the methods:

- The methods and scope of the Phase II entrainment study conform to the Entrainment Characterization Study requirements defined by the rule at 40 CFR 122.21(r)(9). The elements of the Phase II study are reviewed relative to the rule's requirements and it was found that the Phase II and 2017 methods are very similar and both address the requirements of the rule. Both study plans were reviewed and approved by WDNR. A narrative summary of the entrainment data illustrates how they address the rule's requirements.

- No changes at the plant have occurred that affect the relevance of the entrainment data. Point Beach has been "uprated" so that it generates additional electricity as well as discharges heated effluent at a higher temperature (i.e., the uprate resulted in a 2.0°C additional increase across the facility's condensers) and a higher flow rate. The assessment of the potential thermal effects of this uprate (EA, 2008) found that it would "not have any significant adverse environmental impacts, nor will it prevent the continuation of the BIC [balanced, indigenous community] near the facility". These conclusions support that local biological resources, and resulting entrainment, would not be affected by the uprate. The nature of the uprated facility is reflected in the renewed Wisconsin Pollutant Discharge Elimination System (WPDES) permit and the increased intake flows were used in the calculation of entrainment rates in 2017. Rates of entrainment measured in 2006 will be adjusted to reflect the increased cooling water flow rates.
- No substantial changes in lake water quality were identified that might have led to shifts in entrainment patterns. This review included assessment of WDNRs assessments of lake water quality in 2006 and 2017, which was found to be essentially unchanged relative to support of aquatic life. We also evaluated lake surface temperature and found changes in temperature to be within normal ranges during and after the Phase II entrainment study.
- While lake water surface elevation has increased dramatically in the last few years after a more than ten-year period at lower than average levels, there is no evidence that this would affect entrainment rates. The Phase II data were collected during a period of reduced lake levels that was reversed in 2014. While the rate of rebound was very rapid, the range of levels is within historic norms and no change in entrainment rates would be expected as a result of variations in lake levels.
- No new wastewater dischargers were identified in the vicinity of the station that might affect water quality or entrainment rates.
- Based on several different analyses and the literature, we might expect that overall rates of entrainment would have declined since the Phase II effort associated with reduced lake-wide abundance levels. Despite this, we could expect that the dominant forage and rough fish entrained at Point Beach (e.g., alewife and rainbow smelt) would remain among the dominant taxa entrained. We might also predict that the invasive round goby may become a dominant entrained species based on its recent and rapid proliferation in the lake. These findings are supported by the following lines of evidence:

- Entrainment at Point Beach and other facilities on the Great Lakes is dominated by a relatively limited number of species, with a larger number of species that are represented at very low percentages. Susceptibility to entrainment is greatly affected by the habitat preferences and spawning/rearing habits of the various species.
- Review of the literature on lake-wide fisheries trends and data on local fish populations from the U.S. Geological Survey (USGS), which indicate steep declines in several species over the last approximately 20 years and a recent proliferation of round goby. While forage and rough fish populations have often continued to decline since the Phase II survey, it has generally been at a lower rate and with episodes of recovery.
- Review of temporal trends in recreational landings from Lake Michigan in lake-wide commercial landings available from the National Marine Fisheries Service (NMFS). These data illustrate recent trends in landings of species that dominate entrainment at Point Beach including alewife, burbot, and rainbow smelt.

- <u>The two sets of entrainment data (i.e., those collected in 2006 and 2017) exhibit very similar overall trends including:</u>
  - The total estimated annual rate of entrainment is very similar between the two years;
  - Entrainment is dominated by forage and rough fish with very few game fish;
  - Rainbow smelt and alewife are dominant species in both years; and
  - Shellfish (as defined by WDNR) continue to be dominated by amphipods[1] although the nature of the amphipods has changed consistent with lake-wide trends.
- <u>Differences between the two data sets are apparent but are unlikely to affect the conclusions of the rule's assessment of entrainment particularly since the two years will be considered separately:</u>
  - While burbot were a dominant entrained taxon in 2017 but not 2006, their increased importance is not reflected in historical lake-wide surveys, likely due to differences in spatial distribution and the gear type used in lake-wide studies;

[1] ECT understands that the Phase II characterization of shellfish was requested by WDNR in order to understand losses of zooplankton that constitute a forage base for finfish such as alewife (e.g., *Diporeia*). Based on the Phase II precedent, shellfish characterization was also performed in 2017.

- Several taxa were observed at low frequency in 2006 but were absent from the 2017 samples. There is a possibility that their absence from the later data set is associated with random factors but it may also reflect shifts in the lake's fishery and relative biomass documented in the literature. The presence of these taxa will be considered in the assessment including the potential social benefits. To the extent that their populations would remain reduced in the future over the long-term, their inclusion with the Phase II data in the entrainment BTA analysis would over-estimate the potential benefits of additional entrainment controls.
- Consistent with lake-wide data, the nature of the amphipod shellfish has changed as invasive species have largely replaced native ones. While the shift in the nature of the amphipods is apparent, ECT believes that the shellfish populations are enriched local to the rocky intake "crib" and do not reflect water column populations (EA, 2007).

- The available entrainment data support the two key goals of the benefits assessment: 1) they allow for evaluation of effectiveness of entrainment control measures including species- and life stage-specific exclusion by fine mesh screens; and 2) they allow for estimation of social benefits of reduced entrainment of forage, rough, and game fish.

In summary, ECT finds that the Phase II entrainment data are reasonable and relevant to address a portion of the entrainment characterization requirements of the 316(b) rule and are supported by the literature. The entrainment data from 2006 and 2017 exhibit small differences but those differences are in line with broader changes in the lake's fishery and typical inter-annual variation. ECT concludes that the available data are sufficient and representative to support the entrainment BTA assessment and there is no utility in collecting additional entrainment data in 2018.

2.0 INTRODUCTION

This report evaluates recent trends in the water quality, hydrology, and fisheries biology of Lake Michigan in order to assess whether entrainment data collected at Point Beach in 2006, as part of the implementation of the now-remanded 316(b) Phase II rule, can support evaluation of best technology available (BTA) for entrainment as defined in the 2014 316(b) existing facilities rule (USEPA 2014 – the rule). In particular, this report considers whether entrainment data collected in 2006 remain relevant to partially address the data requirements set out in 40 CFR 122.21(r)(7) and (9) – Entrainment Characterization Study, and support the assessment of alternatives for entrainment BTA as described in 40 CFR 122.21(r)(11) – the Benefits Valuation Study. Additional entrainment data collected in 2017 at Point Beach will be used to address the remainder of the rule's requirement to characterize entrainment and will serve as a basis of comparison to the 2006 data.

2.1 BACKGROUND ON THE 316(b) RULE

The rule requires that facilities that use cooling water at a rate in excess of 125 million gallons per day[2] (MGD) assess three alternatives to reduce entrainment at the facility (i.e., retrofit to closed-cycle cooling, use of fine mesh screens to exclude ichthyoplankton, and use of an alternative source of cooling water). This assessment includes characterizing the nature of entrained organisms as well as their rate of entrainment (see Section 2.1.1). It also requires the assessment of the costs, benefits, and other environmental impacts of the potential entrainment measures, as described in 40 CFR 122.21(r)(10), (11), and (12), respectively. The key utility of the entrainment data under the rule is to support the assessment of the effectiveness of the potential measure (i.e., how much does the technology reduce entrainment?) and estimation of the social benefits of that reduction in entrainment. Another important goal of the entrainment data is to document the potential entrainment of species listed by the federal or state government for special protections.

2.1.1 REQUIREMENTS OF 40 CFR 122.21(r)(9)

As summarized in Table 2-1 and described in more detail in Section 3, the Phase II and 2017 entrainment characterization program executed at Point Beach addresses all the required elements of the Entrainment Characterization Study as defined by the rule.

[2] The rule's threshold for inclusion is the "Actual Intake Flow" (AIF) defined as that average intake flow over three years (or five years for permit terms subsequent to the first permit issued under the rule).

Table 2-1 : Review of the Rule's Requirements Relative to Point Beach's Entrainment Data

40 CFR 122.21(r)	Quote from the Rule	Does the Point Beach Database Conform to the Rule's Requirement?
(9) Entrainment Characterization Study	Entrainment Characterization Study that includes a minimum of two years of entrainment data collection	Yes, entrainment data were collected during the full recruitment seasons for two years (2006 and 2017)
	Study should identify and document the data collection period and frequency	The data collection period as well as the sample collection frequency and methodology were clearly defined to address other aspects of the Rule's requirements.
	Document organisms collected to the lowest taxon possible of all life stages of fish and shellfish	Entrained organisms were identified to the lowest taxon possible using normal identification methods. All life stages were counted and enumerated.
	Any species protected under Federal, State, or Tribal law, including threatened or endangered species	All entrained organisms were enumerated including protected species.
	Biological data collection must be representative of the entrainment at the intakes subject to this provision	Entrainment samples were collected to be representative of the plant's cooling water intakes, which are similarly configured and located contiguous to one another.
(ii) Biological Entrainment Characterization	Sufficient data to characterize annual, seasonal, and diel variations in entrainment	Samples were collected throughout the recruitment season allowing for characterization of annual and seasonal variation. Subsamples were also collected four times over each 24-hour period to assess diel variation.
	Characterization may include historical data that are representative of the current operation of the facility and of biological conditions at the site	The data summary report includes comparisons to data collected by the USGS near the facility since 1973. This document will assess the current relevance of the 2006 data.
(iii) Analysis and Supporting Documentation	Entrainment data to support the facility's calculations must be collected during periods of representative operational flows for the cooling water intake structure, and the flows associated with the data collection must be documented	Data were collected during normal, full operation of the generation units. All data were expressed on a volumetric basis (i.e., organisms/volume) to allow extrapolation to other plant conditions.
	The owner or operator of the facility must identify and document all assumptions and calculations used to determine the total entrainment for that facility together with all methods and quality assurance/quality control procedures for data collection and data analysis.	All assumptions and calculations were documented in an agency approved Entrainment Characterization Study Plan that included the required quality control documentation. The analyses are consistent with prior studies conducted at Point Beach and are considered routine for this sort of analysis in the Great Lakes region.
	The proposed data collection and data analysis methods must be appropriate for a quantitative survey	The data collection and data analysis methods were appropriate for quantitative surveys and have been accepted by regulatory agencies across the United States including Wisconsin DNR.

Critically, the Phase II assessment complement the 2017 sampling effort as it includes data that allow for the consideration of biological effectiveness (e.g., seasonal changes in ichthyoplankton densities, size, and life stage) and benefits of alternative measures (e.g., species and life stage of entrained organisms; enumeration of any listed species). The attributes of the Phase II data set and their use in conjunction with the 2017 data are described below in Section 3. Note that the rule discusses the utility of historical entrainment data in two contexts:

> 40 CFR 122.21(r)(7) Entrainment Performance Studies.
> ... In the case of studies more than 10 years old, the applicant must explain why the data are still relevant and representative of conditions at the facility ...

> 40 CFR 122.21(r)(9) Entrainment Characterization Study.
> ...This characterization may include historical data that are representative of the current operation of the facility and of biological conditions at the site.

While neither the rule nor its preamble offer guidance on the form that an explanation of the data's continued relevance and representativeness might take, staff from USEPA Region 5 have indicated that it would be productive to consider the potential for new wastewater dischargers, changes in water quality, changes in hydrology, and shifts in fisheries populations since the collection of the historical data. This document addresses those issues by assessing trends from approximately 2005, just prior to the Phase II effort, to the current conditions, or the most recent available.

2.2 REPORT ORGANIZATION

The balance of this document is organized as follows:

- Section 3 summarizes the configuration of the plant as well as provides an overview of Lake Michigan. Recent trends in water levels and water temperatures near the plant are also discussed.
- The regulatory and water quality status of Lake Michigan in the vicinity of Point Beach is discussed in Section 4.
- Section 5 evaluates recent trends in the fish community of Lake Michigan. This begins with a brief summary of key peer-reviewed papers on recent trends in fish populations. This section also presents recent temporal trends in commercial and recreational landings as well as quantitative annual surveys of the populations of key forage fish species. These temporal data on fish populations and landings are derived from government databases.

This section also reviews the implications of recent trends in fish populations for the utility of the Phase II data at Point Beach.

- Section 6 summarizes available entrainment data collected at Point Beach and examines them in the context of the discussion in Section 5.
- Section 7 provides citations for literature cited.

3.0 OVERVIEW OF THE FACILITY AND SOURCE WATERBODY

This section presents an overview of the Point Beach facility and local environs in Lake Michigan. It also provides a general overview of Lake Michigan and presents data on changes in water temperatures and water levels before, during, and after the Phase II surveys. Additional water quality trends are discussed in Section 4.

3.1 FACILITY OVERVIEW

Point Beach is located on the shore of Lake Michigan approximately eighty miles north of Milwaukee, WI in Manitowoc County. The plant consists of two once-through cooling steam units with a combined output of about 1,250 megawatts (MW).

The intake draws cooling water from Lake Michigan through a rock intake crib located 1,750 feet offshore at a depth of approximately 22 feet. The water flows through two 14-foot diameter steel pipes under the lakebed to the station. The offshore Crib consists of two annular rings of 12 inch steel "H" piles driven into the Lake bed, with an outside diameter of 110 ft and an inside chamber diameter of 60 ft. The annulus is filled with 3- to 12- ton limestone blocks. Water is drawn into the chamber through the plastic mesh grating located on the top of the Crib, as well as through the interstitial spaces between the limestone blocks and through 27, 30-inch diameter, corrugated, galvanized steel pipes that penetrate the blocks in a ring 5 ft above the lakebed. The steel pipes are covered with 1 3/16-inch by 2-inch galvanized bar grating to prevent debris and large fish from entering the intake system. Also, the Crib is equipped with three 6.5-ft square concrete pipes near the lake bottom in the south half of the Crib. The concrete pipes are covered with a 1/4-square-inch grating that is hinged for lowering in the winter months (usually December 1 to March 1) to prevent the formation of frazil ice on the grate and the subsequent restriction of water flow.

A high frequency acoustic deterrent system (ADS) surrounds the Crib in order to reduce alewife impingement. The acoustic array at PBNP consists of 16 Integrated Projector Assemblies ("IPAs") uniformly spaced around the outer circumference of the Crib. The deterrent signal consists of high frequency broad band (122 – 128 kHz) pulses, 0.5 second in duration, at 1-second intervals.

The design intake flow (DIF) of the cooling water pumps is 1,248 MGD. Vertical bar racks (3/8-inch by 4 inches, with 2 ¼ in. spacing on center) are located in the inshore forebay. Eight traveling water screens (3/8-inch mesh, 11 feet wide) are located at the pumphouse. An 80-psi screen wash is used to clean the traveling screens, which discharges to the lake via a return trough with a debris basket.

Approach velocities in the vicinity of the crib have been measured has high as 2.0 feet/second, but most velocities are much lower (Bootsma, 2001). Based on the measured velocities, it has been estimated that approximately one-half of the intake flow occurs through the crib's cap with the other half through the walls of the intake crib.

Prior to 2001, the intake crib extended above the lake surface so that cooling water was drawn into the crib from the entire water column. This resulted in cormorants being impinged. In addition, it was discovered the Point Beach thermal discharge plume that floats on the lake surface would occasionally encounter the intake crib, attracting significant numbers of alewife to the thermal plume. This was assumed to cause substantial impingement numbers. To address both impingement and thermal recirculation concerns, the intake crib was cut down so that it was submerged about 11.5 feet below the lake surface. In addition to changing the configuration of the crib, the intake was outfitted with an acoustic deterrent system intended to reduce impingement of alewife. The sound frequency (125 kHz) of the system has been shown to be effective at deterring alewife at a cooling water intake structure located on Lake Ontario (Ross et al., 1993). These changes were in place in 2006 and were unlikely to affect rates of entrainment between the two entrainment sampling efforts.

3.2 DESCRIPTION OF LAKE MICHIGAN

Lake Michigan is approximately 307 miles long and 118 miles wide with an average depth of 279 feet and a maximum depth of 923 feet. With a water surface area of 22,300 square miles and a drainage area of 45,600 square miles, it is the third largest of the Great Lakes and the fifth largest freshwater lake in the world by surface area. It is hydrologically connected to Lake Huron through the Straights of Mackinac (USEPA, 2016).

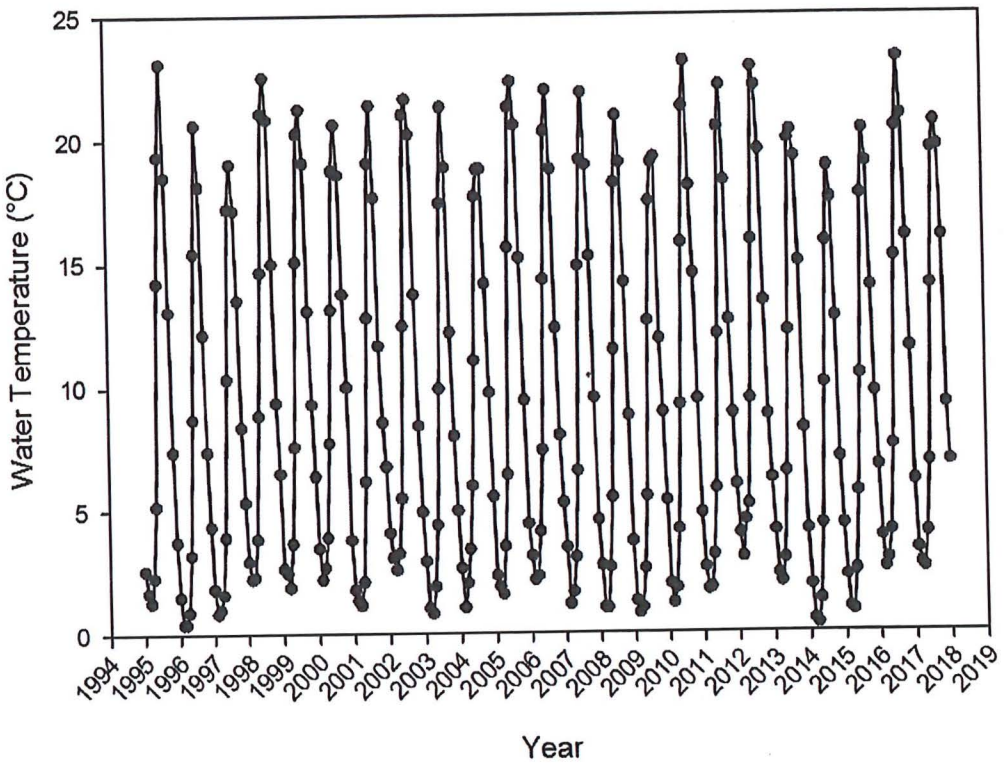
3.2.1 LAKE MICHIGAN WATER TEMPERATURES

Average monthly surface water temperatures in Lake Michigan for the period of 1995 to 2017 range from a low of 1.7°C in February to 21.2°C in August (Coast Watch 2017; Figure 3-1). Average annual temperatures using the same data range from a low of 7.8°C in 1996 to a high of 11.3°C in 2012. Surface water temperatures from Coast Watch are derived from satellite imagery and represent the average surface water temperature for Lake Michigan.

Water in Lake Michigan circulates in a generally counterclockwise motion, with the prevailing current along the western coastline to the south; several gyres have been noted to occur offshore. Currents are generally stronger in the winter than in the summer (Beletsky et al., 1999). Upwelling events can result in drastic temperature changes along the coast. For example, offshore winds can push warmer surface waters into the middle of the lake; colder waters from deeper parts of the lake move in to replace it resulting in as much as a 20°F (11.1°C) drop in temperatures in 24 hours (Torregrossa, 2015). The shape of the lake as well as circulation patterns result in a long retention time (residence time) of as much as 99 years (USEPA, 2016).

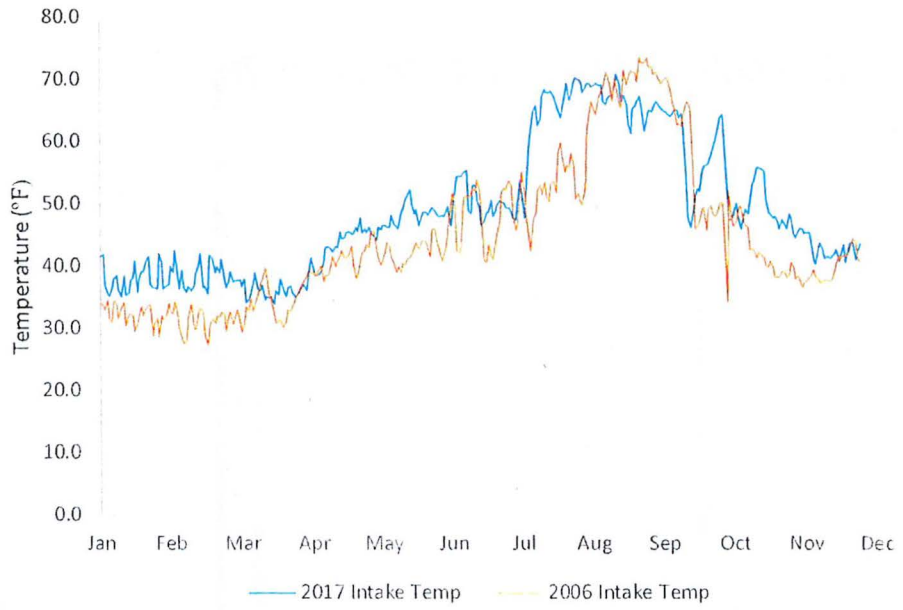
Short-term variations associated with upwelling are evident in the data records for intake temperature in both 2006 and 2017 (Figure 3-2). The temperature records also illustrate seasonal differences such as the relatively higher winter-time temperature observed in 2017.

Figure 3-1 Monthly Average Lake Michigan Surface Temperature 1995 – 2017



Source: CoastWatch, 2017

Figure 3-2 Point Beach Nuclear Plant Intake Temperatures 2006 - 2017



Source: EA, 2017

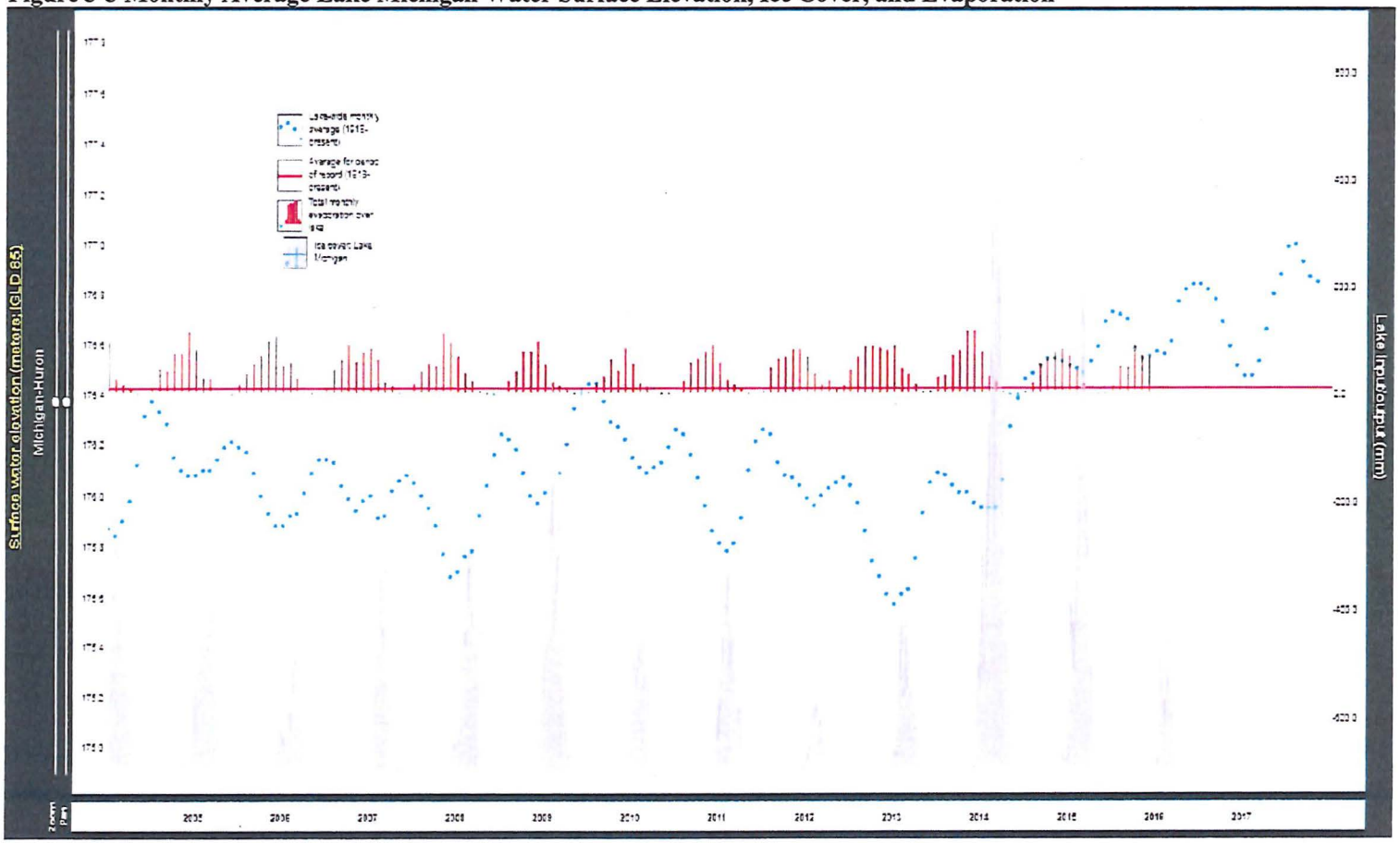
3.2.2 LAKE MICHIGAN WATER LEVELS

The lake-wide average water level in Lake Michigan for the period 1918 to 2017 was 176.4 feet[3] (International Great Lakes Datum [IGLD85]). Water levels throughout the Great Lakes are recorded at 53 monitoring stations in the U.S. and 33 in Canada. Water levels over the past 15 years have fluctuated below this long-term average until recently (Smith et al., 2016). Lower water levels were attributed to above-average evaporation due to lower than average ice cover (Figure 3-3). A rapid increase in water levels, rising 0.96 meters from January 2013 to December 2014, has been attributed mainly to high precipitation and the high percentage of ice cover during the winter of 2013 to 2014 (Gronewold et al., 2015.) This has continued in 2015 through 2017.

Lake water levels were below the long-term averages for several years before the Phase II surveys and continued for several years afterward until lake water levels rebounded prior to the 2017 entrainment study. However, ECT does not believe that these variations in lake level are likely to have affected the fish populations around Point Beach or the rates of entrainment.

[3] https://www.glerl.noaa.gov/data/dashboard/data/

Figure 3-3 Monthly Average Lake Michigan Water Surface Elevation, Ice Cover, and Evaporation



Source: Smith et al., 2016

4.0 CHANGES IN PLANT OPERATIONS OR LOCAL WATER QUALITY

This section reviews the potential changes that might affect the nature of entrainment, both at the plant and its vicinity. These include operations at the plant, potential changes in water quality, or the potential effects of new wastewater discharges in proximity to the plant. This section focuses on changes that may have occurred since approximately the onset of the Phase II entrainment program to the present time.

4.1 CHANGES AT THE FACILITY

Point Beach continues to operate at a high rate of capacity with curtailment of generation only occurring during refueling/maintenance outages. The facility has undertaken an extended power uprate (or EPU) that resulted in an approximate 17% increase in plant output. The EPU resulted in a higher rate of heat rejection to the lake in the form of a greater temperature rise across the condensers. At the time of the EPU, the circulating water pumps, which had experienced a typical degradation in their performance as they aged, were also refurbished resulting in a return to their original design capacity. The EPU was reviewed and approved by the Nuclear Regulatory Commission in 2011 and Point Beach's renewed WPDES permit reflects the changes to the cooling water system.

The potential ecological effects of the increased thermal discharge were evaluated as part of the EPU application (EA, 2008). The thermal assessment considered the potential effects on 16 WDNR-selected Representative Important Species (RIS) and concluded that the EPU would continue to protect the Balanced Indigenous Community (BIC) in the vicinity of the Point Beach plant. Consistent with this conclusion, no substantial changes to the nature of entrainment (i.e., number per volume of water) were expected but the annualized rate of entrainment will reflect the increased cooling water flow.

The observed entrainment densities in 2006 and 2017 (i.e., number per volume of cooling water) were used with the respective actual flow rate during the sampling period to estimate annual rates of entrainment (i.e., number per year). The average rate of intake flow in the 2017 study was 1,004 MGD while in 2006 it was 973 MGD, an increase of approximately 7.3% between the two years. When estimating the current rates of entrainment and in the context of BTA assessment, the most recent actual intake flow will be paired separately with the entrainment densities for two years. In

this way, the inter-annual variation will be accounted for as well as the most current pumping rates at the facility.

4.2 CHANGES IN LAKE MICHIGAN

The following is a review of changes in the lake that may have effects on the rate of entrainment, including biological changes (e.g., changes in ambient densities; proliferation of invasive species) and direct human-caused changes (e.g., use of lake water for cooling and effluent discharges).

An important change to Lake Michigan has been the inadvertent introduction of invasive dreissenid mussels (zebra and quagga mussels). This has had important effects on the lake including reducing the concentration of particles in the water due to filter feeding by the mussels. This feeding activity has substantially increased the clarity of the water and has also changed the food base for forage fish (Section 5). The mussel invasion and proliferation predates the 2006 Phase II program but the problem has worsened since that time (Nalepa et al. 2014).

Green algae of the genus *Cladophora* has caused recurring problems along Lake Michigan beaches since the 1950s, but there has been a resurgence over the last decade. *Cladophora* colonizes on the lake bottom and when it is dislodged, it accumulates and decays on the beaches becoming a nuisance and compromising beach safety. Research shows that *Cladophora* encourages the growth of *Escherichia coli* and enterococci bacteria and decaying mats have been linked to bird kills. Causes of *Cladophora* resurgence is not fully understood, but the success of invasive quagga and zebra mussels and changes in nutrient loading are considered important factors.

The invasive mussels have increased water clarity, resulting in increased light penetration into the water column that encourages *Cladophora* and other macrophyte productivity. The abundance of *Cladophora* likely has little effect on entertainment at Point Beach because of its submerged, offshore intake. However, colonization on the hard structures of the intake could be a factor contributing to the abundance of entrained "shellfish", as defined by WDNR.

4.3 OTHER DISCHARGES IN THE VICINITY OF POINT BEACH

Kewaunee Power Station, located on Lake Michigan about four miles north of Point Beach, was a 566 MW pressurized water reactor that was operated from December of 1973 to May 7, 2013. Its

once-through cooling water system used 281,000 to 412,000 gpm (405 to 593 MGD) via an offshore intake. With its retirement and cessation of the circulating water pumps, it no longer contributes to impingement and entrainment losses from Lake Michigan that resulted when the plant was operating. The potential effects of the cessation of operation of Kewaunee on entrainment at Point Beach are likely to be minor given their distance of separation and the volume of water in the lake between the two facilities.

Twenty-six minor discharges are permitted in Manitowoc County. Minor industrial permits include dairy, food processing, metal finishing, meat processing and manufacturing plants. Publicly owned wastewater treatment plants that have a design average flow of less than 1.0 MGD are considered minor discharges. Most of the permitted discharges in the County do not discharge directly to Lake Michigan and because of the small discharge volumes have low potential to influence the water quality in the lake.

The City of Two Rivers, in Manitowoc County, owns and operates an advanced secondary wastewater treatment facility (WWTF) that discharges to Lake Michigan at the Two Rivers Harbor. It provides service for the City of Two Rivers and the Village of Mishicot. The WWTF includes preliminary screening, primary clarification; secondary, biological treatment with an activated sludge system operating in the extended aeration mode; phosphorus removal by chemical precipitation; final clarification; and effluent disinfection with ultraviolet radiation.

The history of these minor permits has not been established for this review, but as minor discharges in compliance with their discharge permits it is likely they have not resulted in substantial changes to water quality in Lake Michigan near Point Beach since the 2006 Phase II study.

4.4 SECTION 303(d) IMPAIRED WATERS

Section 303(d) of the Federal Clean Water Act requires WDNR to biennially update the list of impaired water bodies in Wisconsin that are not meeting water quality standards, and requires development of Total Maximum Daily Load (TMDL) studies for these waters which are plans to restore water quality to meet designated uses. This list is updated to reflect waters that are newly added or removed based on new information or changes in water quality status.

There are no TDMLs for Lake Michigan in Wisconsin and the lake in vicinity of Point Beach is meeting its designated uses, but tributary waters in several counties including Manitowoc County, where Point Beach is located, have been listed as impaired for PCBs and mercury as far back as 1998 because of contaminated fish tissue[4]. New listings for PCBs were added in 2012 for the lower segments of the East and West Twin Rivers. These impairments were attributed to contaminated sediments and are therefore likely legacy issues that predate the Phase II entrainment studies. Other recent listings in these tributaries since the Phase II studies primarily include impairments from total phosphorus and *E. coli*, many of which are attributed to contributions from non-point sources and may also represent legacy issues that would likely not have affected entrainment rates between 2006 and 2017.

4.5 POTENTIAL PRESENCE OF FEDERALLY LISTED SPECIES

USEPA consulted with the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) under the Endangered Species Act during development of the final existing facilities §316(b) rule. While it was concluded that the rule is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of designated critical habitat, the rule requires that facilities identify all federally listed threatened and endangered (T&E) species and/or designated critical habitat that are, or may be, present "*in the vicinity of impingement and entrainment at the cooling water intake structure*".

Federally listed fish and other aquatic species are not known to occur in Lake Michigan near Point Beach based on the USFWS Environmental Conservation Online System (ECOS) that provides access to the USFWS database by county[5] (Table 4-1). Using the Information for Planning and Consultation (IPaC) tool in ECOS, four T&E species are listed for Manitowoc County, Wisconsin[6]. There is no nexus for these listed species with the Point Beach cooling water intake structure, including potential entrainment.

Wisconsin's Endangered and Threatened Species Laws & List includes 10 fish and 19 mussel species[7]. None of the endangered fish or mussel species listed by the WDNR occur in Lake

[4] http://dnr.wi.gov/water/wsSWIMSDocument.ashx?documentSeqNo=150694583
[5] https://ecos.fws.gov/ecp/
[6] https://ecos.fws.gov/ipac/location/J63KWIDYORB55JIALDOC7FB6AY/resources
[7] http://dnr.wi.gov/files/PDF/pubs/er/ER001.pdf

Michigan in the vicinity of Point Beach. The WDNR Natural Heritage Inventory includes Redfin Shiner (*Lythrurus umbratilis*) and three mussel species (Slippershell mussel *Alasmidonta viridis,* Monkeyface, *Quadrula metanevra*; and Ellipse *Venustaconcha ellipsiformis*) as threatened in Manitowoc County, but based on these species habitat requirements, neither would be expected to occur in Lake Michigan.

Table 4-1 List of Federally-listed species potentially present in the vicinity of Point Beach

Common Name	Scientific Name	Status
Northern Long-eared Bat	*Myotis septentrionalis*	Threatened
Rusty Patched Bumble Bee	*Bombus affinis*	Endangered
Pitcher's Thistle	*Cirsium pitcheri*	Threatened
Piping Plover	*Charadrius melodus*	Critical habitat

Source: USFWS IPaC

5.0 RECENT TEMPORAL TRENDS IN LAKE MICHIGAN FISHERIES

This section evaluates long-term trends in the fishery of Lake Michigan and examines changes since the completion of the Phase II entrainment characterization. The goal of this assessment is to identify trends in the fishery that would affect the representativeness and relevance of the Phase II data to current conditions. This section begins with a general summary of fisheries trends based on reviews developed by others. Fisheries data collected by government agencies are also evaluated. Section 6 then discusses the entrainment data in this context to examine the relevance of Phase II entrainment data given the available data record.

5.1 REVIEW OF LAKE MICHIGAN FISHERIES FROM THE LITERATURE

This section provides a summary of key papers on the fishery of Lake Michigan from the peer-reviewed literature. By way of introduction, it is important to note that the Lake Michigan fishery has been affected by both management for game fish (e.g., stocking of both the game fish and stocking/protecting their prey species) and the unwanted proliferation of non-native fish (e.g., alewife, round goby, sea lamprey) and shellfish (i.e., dreissenid mussels). For this reason, populations of some species have experienced significant increases and/or decreases over the last several years. Some of the key trends are summarized below from recent reports that summarize ongoing surveys, with a focus on trends in species that have historically dominated entrainment at Point Beach (e.g., alewife).

The following is a set of key excerpts from Bunnell et al.'s (2017) review of the 2016 status and trends in forage fish of Lake Michigan which is based on the USGS's annual survey of the fishery:

> *In 2016, total prey fish biomass was estimated to be 11.4 kt* [kilotons], *a 275% increase over 2015... Relative to previous years in the time series, however, total prey fish biomass for 2016 was still relatively low- the third lowest estimate ever. This low level of prey fish biomass can be attributable to a suite of factors, two of which can be clearly identified: (1) a prolonged period of poor bloater recruitment since 1992 and (2) intensified predation on alewives by salmonines during the 2000s and 2010s. Adult alewife density has been maintained at a relatively low level over the last 11 years and the age distribution of the adult alewife population has become especially truncated in recent years. As recent as 2007, alewives as old as age 9 were sampled in this survey, whereas the oldest alewife*

sampled in 2013-2014 was age 5 and the oldest alewife sampled in 2016 was age 4. In addition to the importance of top-down forces, prey fishes also may be negatively influenced by reduced prey resources (i.e., "bottom-up" effects). For example, several data sets are indicating a reduction in the base of the food-web- particularly for offshore total phosphorus and phytoplankton- as a consequence of long-term declines in phosphorus inputs and the proliferation of dreissenid mussels (Evans et al. 2011; Bunnell et al. 2014b). Grazing of phytoplankton by dreissenid mussels appeared to be the primary driver of the 35% decline in primary production in offshore waters between the 1983-1987 and 2007-2011 periods (Madenjian et al. 2015). The evidence for declines in "fish food" (e.g., zooplankton, benthic invertebrates) in offshore waters of Lake Michigan is somewhat less clear. Diporeia has undoubtedly declined in abundance (Nalepa et al. 2014), but whether or not crustacean zooplankton and mysids have declined depends on which data set is examined (e.g., Pothoven et al. 2010; Bunnell et al. 2014b; Madenjian et al. 2015). Crustacean zooplankton biomass density in nearshore waters appeared to decrease during 1998-2010, likely due to a reduction in primary production mainly stemming from grazing of phytoplankton by dreissenid mussels. The above-mentioned decline in Diporeia abundance appeared to have led to reductions in growth, condition, and/or energy density of lake whitefish, alewives, bloaters, and deepwater sculpins during the 1990s and 2000s (Pothoven et al. 2011, 2012; Madenjian et al. 2015). Of course, decreases in growth, condition, and energy density do not necessarily cause declines in fish abundance. The challenge remains to quantify bottom-up effects on prey fish abundances and biomasses in Lake Michigan. Given the complexities of the food web, disentangling the effects of the dreissenid mussel invasions and the reduction in nutrient loadings from other factors influencing the Lake Michigan food web will require a substantial amount of ecological detective work.

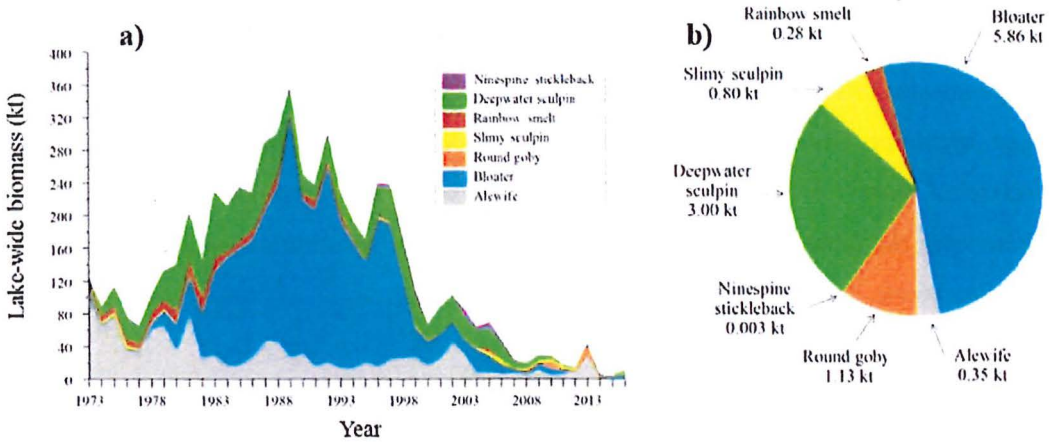
The following is a set of important excerpts from the Warner et al.'s (2015) 2014 status and trends of pelagic prey fish:

Prey fish biomass in Lake Michigan remains at levels much lower than in the 1990s, and the estimate of total lakewide biomass (31.7 kt) from acoustic sampling was the second lowest in the time series. This is in contrast to 2008-2010, when biomass was relatively high (but still lower than in the 1990s). The recent decline resulted primarily from

decreased alewife biomass. Because of predation by salmonines and a weak 2014 alewife year-class, it seems likely that biomass of alewife will be lower in 2015 than in 2014. Despite this, alewife were the dominant component of pelagic prey fish biomass in 2014. The large difference between prey fish biomass in the 1990s and the 2000s resulted primarily from a decrease in large bloater abundance, but alewife and rainbow smelt declined as well. Bloater densities showed an increasing trend 2001-2009, driven primarily by increases in small bloater. It is not clear what led to the drastic decline in bloater abundance from the 1980s to present. Recent stock-recruit modeling for bloater in Lakes Michigan and Huron indicated that bloater sex ratio and alewife abundance were related to recruitment (Collingsworth et al. 2014). It is also possible that predation on small bloater by salmonines could be an important limit to recruitment at times (see Warner et al. 2008) as these small fish are found in the same location as alewife and at times can be important to some predators (Elliott 1993; Rybicki and Clapp 1996; Warner et al. 2008).

The trends referenced in these excerpts are apparent in Figure 5-1, which has been adopted from Bunnell et al., 2017.

Figure 5-1 Estimated Lake-Wide (5 m to 114 m depth region) Biomass of Prey Fishes in Lake Michigan, 1973-2016 (a) and Species Composition in 2016(b)



Source: Bunnell et al., 2017

From the above excerpts and Figure 5-1, some conclusions relevant to assessing the entrainment data at Point Beach are apparent:

- Alewife populations have been greatly reduced from historic highs in the lake. Alewife populations were relatively low throughout the 2000's including during the Phase II study when alewife dominated both entrainment and impingement at Point Beach. Biomass densities in 2016 trawl data set a record low. For example, at the Port Washington, WI location, no alewife were captured in 2016. They were collected at the Sturgeon Bay, WI site, albeit in low numbers compared to 2006. Despite these declines, they remain an important component of the forage base in Lake Michigan.
- Round goby populations have increased dramatically to a point where they contribute substantially to lake-wide estimates of the forage biomass in the last few years.
- Deepwater sculpin have been a dominant component of the forage base and were so during the Phase II effort at Point Beach. Despite their lake-wide importance, deepwater sculpin were not an important contributor to entrainment in 2006 and were not entrained in 2017. Deepwater sculpin populations have declined in recent years.
- Bloater populations have been greatly reduced for many years and remain at low levels. Their numbers have declined substantially from 1992 to the present. Bloater did not contribute substantially to entrainment in 2006 and were not entrained 2017.
- Rainbow smelt numbers have also declined lake-wide since about 1998. Populations were at relatively low levels during the Phase II entrainment surveys at Point Beach and remained so in 2017. During both entrainment sampling events, rainbow smelt were the dominant taxa entrained at Point Beach.

In summary, key components of the forage base have been in decline since before the 2006 Phase II entrainment study through the 2017 study. These taxa include rainbow smelt and alewife, which have dominated entrainment at Point Beach in both surveys. While lake-wide alewife and rainbow smelt population estimates are unlikely to be a perfect predictor for entrainment, it is reasonable to expect that entrainment rates will be also reduced given the reduced adult populations. It is also reasonable to expect that round goby may become a common component of entrainment at intakes located on Lake Michigan.

Finally, this general review focused on literature that attempts to synthesize lake-wide fisheries trends. This literature is quite reasonably focused on the forage base as it affects game and commercial fish stocks. While entrainment at Point Beach has included several forage species

including rainbow smelt and alewife, it has also included species that are not evaluated by the USGS effort (e.g., common carp, suckers, Coregoninae). Section 6.2 considers temporal trends in these species based on other available data.

5.2 SURVEY DATA

Multiple data sources were used to determine the temporal changes in important species that might be subject to entrainment, including data from both Lake Michigan as a whole and the subsection of the lake that is located near the facility. These data sources included the USGS long-term benthic trawl data, summaries of the NMFS commercial landings, and a WDNR survey report. In general, annual variation is a common occurrence for all datasets. Another apparent hallmark for many of the data are declining forage populations as illustrated by a variety of metrics (abundance, catch per unit effort [CPUE], catch in pounds, etc.). Populations and catch rates of game fish appear to be more stable. The following sections outline the trends observed in each data set and provides inferences for all datasets combined.

When working with multiple datasets from different sources that cover long temporal spans, it is difficult to have fully standardized and consistent methods between those datasets. This makes determining trends a challenging task. Therefore, the following sections take into account that generally each data set is not directly comparable to the others based on each survey's collection methods. However, the datasets are comparable to themselves. Conclusions drawn from each source take into account these discrepancies, but trends can still be deduced. As such, all datasets attempted to use time series analyses based on a standardized parameter (e.g., CPUE, biomass, net catch tonnage) relative to the type of data collected.

5.2.1 USGS TRAWLS OF LAKE MICHIGAN

5.2.1.1 Background and Methods

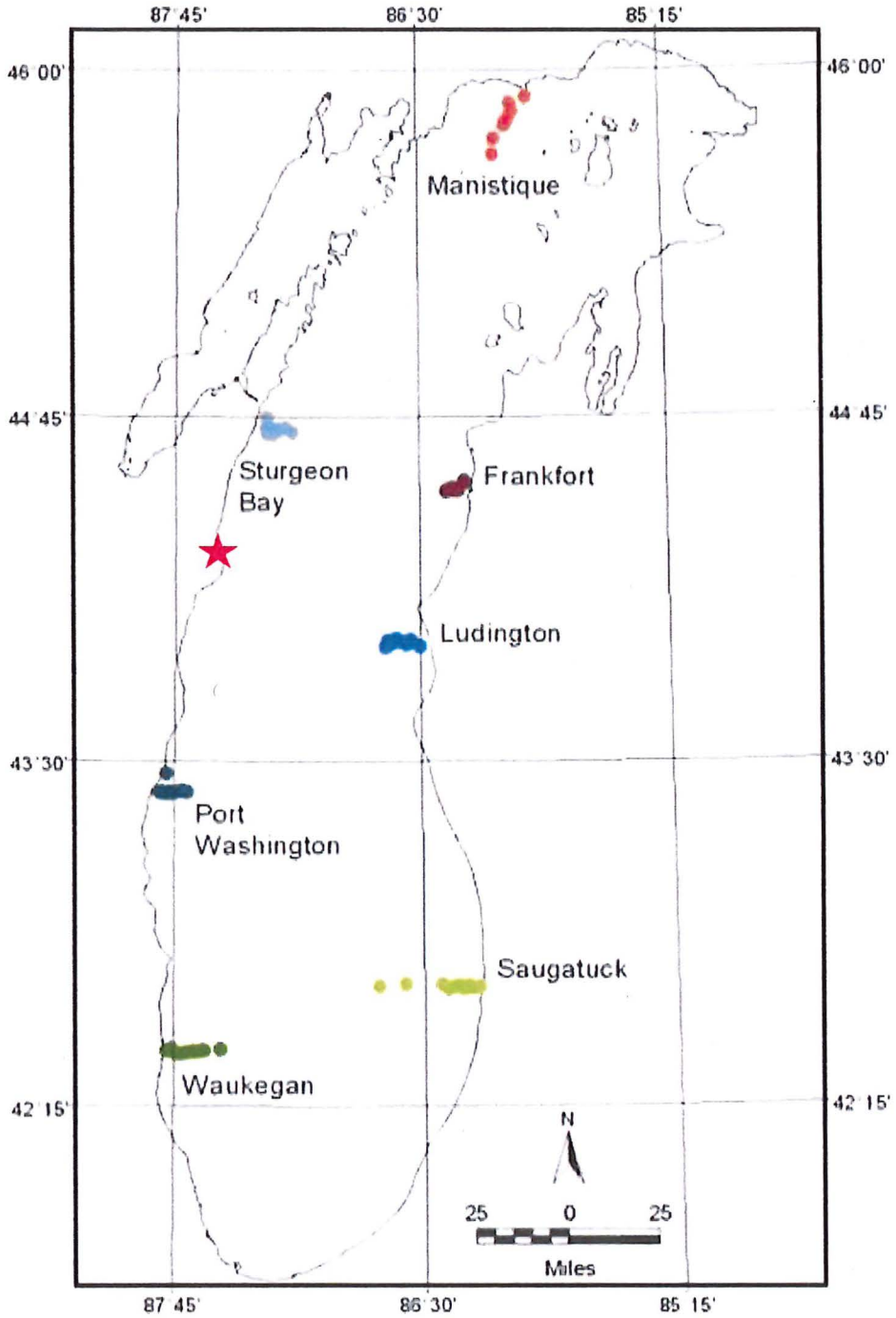
Starting in the fall of 1973, the USGS Great Lakes Science Center (GLSC) has conducted yearly trawls of the fish community in Lake Michigan. Transects consist of standard 12-meter (m) bottom trawls towed along contours at depths of 9 to 110 m at seven index transects across Lake Michigan. Waters of Lake Michigan that were within Wisconsin jurisdiction had two transects included in the dataset, which was located north and south of Point Beach (Figure 5-2). Catch data (#/hectare [ha]) at each index transect from 1973-2016 were obtained from the USGS GLSC and used for

analyses. Catch densities and biomass are reported for twelve species, two of which (alewife and rainbow smelt) are among commonly entrained species. The balance of the species are indicators of the overall status of the Lake Michigan fishery.

For the purposes of this report, only the two Wisconsin transects (Port Washington and Sturgeon Bay) were used in the time-series analysis (Figure 5-2). While the data are reported herein both separately and as a single dataset, comparisons using the combined dataset based on the data between the two sites showing similar trends, despite inter-annual variations. Comparisons to the lake-wide estimates (which include all transects) using the entire data set have also been made and generally follow similar trends.

While time series analyses were used to visualize the long-term trends (#/ha per year; Figure 5-3), a rank order analysis was conducted to show how densities may have changed during each of the impingement and entrainment sampling years (2006 and 2017; see Table 5-1). This was used as a potential estimator of how entrainment rates might change at the facility, based on catch densities as a surrogate of population size.

Figure 5-2 Locations of the USGS bottom trawls. The red star indicates the approximate location of the Point Beach Power Plant



Source: Bunnell et al. 2017

Table 5-1 Ranking of Key Species Surveyed by the USGS near Point Beach During the Entrainment Survey Periods

Port Washington, WI

Species	2006			2016			Average		
	No./hectare	%	Rank	No./hectare	%	Rank	No./hectare	%	Rank
Deepwater sculpin	5,321.94	47.94%	1	1,233.24	14.99%	2	3,277.59	33.92%	1
Bloater	223.40	2.01%	6	6,154.88	74.83%	1	3,189.14	33.00%	2
Slimy sculpin	1,645.32	14.82%	3	829.33	10.08%	3	1,237.33	12.80%	3
Ninespine stickleback	2,132.85	19.21%	2	2.05	0.02%	5	1,067.45	11.05%	4
Rainbow smelt	1,321.98	11.91%	4	0.00	0%	9.5	660.99	6.84%	5
Alewife	436.14	3.93%	5	0.00	0%	9.5	218.07	2.26%	6
Yellow perch	9.23	0.08%	7	0.00	0%	9.5	4.62	0.05%	7
Burbot	3.63	0.03%	9	1.72	0.02%	6	2.68	0.03%	8
Lake trout	4.34	0.04%	8	0.00	0%	9.5	2.17	0.02%	9
Round goby	0.00		11.5	4.09	0.05%	4	2.05	0.02%	10
Lake whitefish	2.55	0.02%	10	0.00	0%	9.5	1.28	0.01%	11
Threespine stickleback	0.00	0%	11.5	0.00	0%	9.5	0.00	0.00%	12
Total	11,101.38			8,225.31			9,663.35		

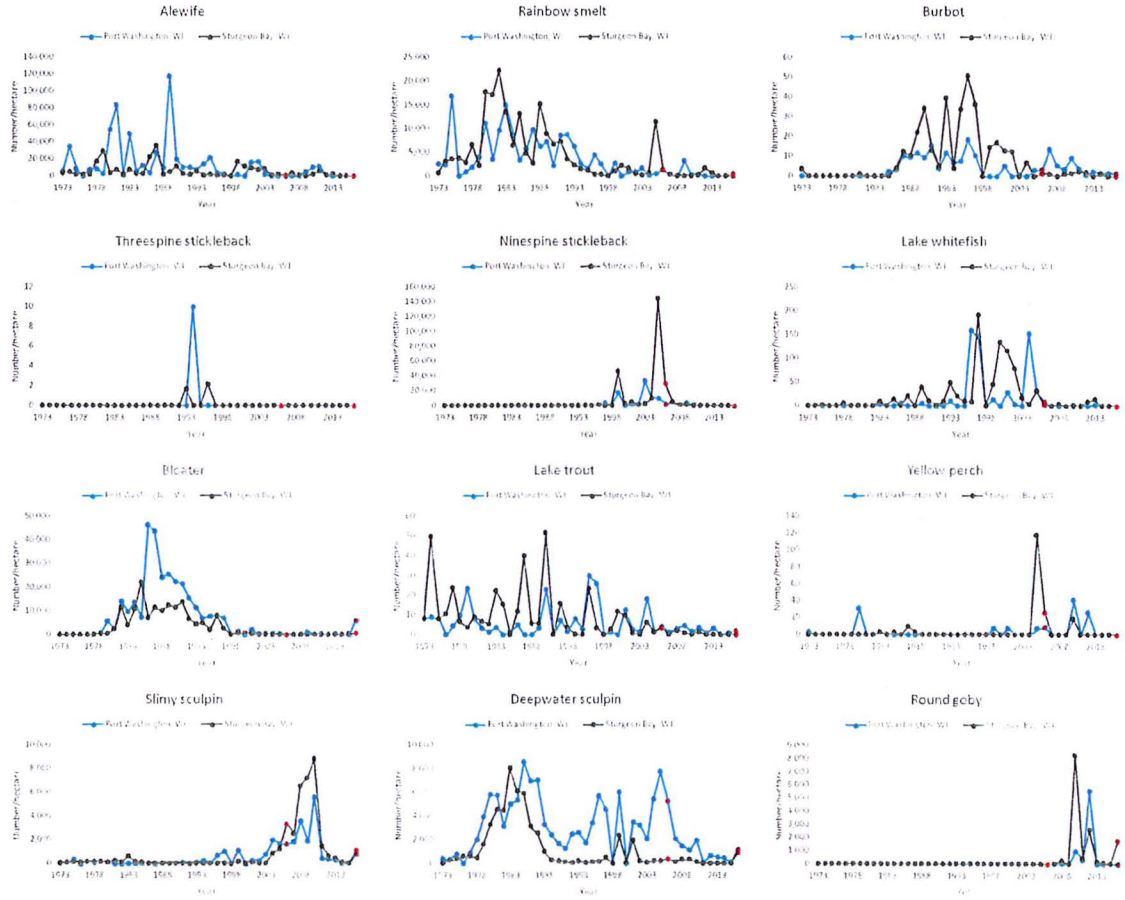
Sturgeon Bay, WI

Species	2006			2016			Average		
	No./hectare	%	Rank	No./hectare	%	Rank	No./hectare	%	Rank
Ninespine stickleback	30,353.72	82.85%	1	1.84	0.04%	8	15,177.78	72.92%	1
Slimy sculpin	3,340.05	9.12%	2	1,093.06	21.90%	2	2,216.56	10.65%	2
Rainbow smelt	1,347.37	3.68%	3	491.81	9.85%	5	919.59	4.42%	3
Round goby	19.02	0.05%	8	1,746.03	34.98%	1	882.53	4.24%	4
Deepwater sculpin	385.88	1.05%	5	923.04	18.49%	3	654.46	3.14%	5
Alewife	1,108.14	3.02%	4	130.34	2.61%	6	619.24	2.98%	6
Bloater	40.01	0.11%	6	603.67	12.09%	4	321.84	1.55%	7
Yellow perch	26.10	0.07%	7	0.00	0%	10.5	13.05	0.06%	8
Lake whitefish	9.49	0.03%	9	0.00	0%	10.5	4.75	0.02%	9
Lake trout	3.45	0.01%	10	2.17	0.04%	7	2.81	0.01%	10
Burbot	1.54	0.00%	11	0.00	0%	10.5	0.77	0.00%	11
Threespine stickleback	0.00	0%	12	0.00	0%	10.5	0.00	0.00%	12
Total	36,634.77			4,991.96			20,813.37		

Port Washington and Sturgeon Bay, Averaged

Species	2006			2016			Total Average		
	No./hectare	%	Rank	No./hectare	%	Rank	No./hectare	%	Rank
Ninespine stickleback	16,243.29	68.05%	1	1.95	0.03%	7	8,122.62	53.30%	1
Deepwater sculpin	2,853.91	11.96%	2	1,078.14	16.31%	2	1,966.03	12.90%	2
Bloater	131.71	0.55%	6	3,379.28	51.13%	1	1,755.49	11.52%	3
Slimy sculpin	2,492.69	10.44%	3	961.20	14.54%	3	1,726.94	11.33%	4
Rainbow smelt	1,334.68	5.59%	4	245.91	3.72%	5	790.29	5.19%	5
Round goby	9.51	0.04%	8	875.06	13.24%	4	442.29	2.90%	6
Alewife	772.14	3.24%	5	65.17	0.99%	6	418.66	2.75%	7
Yellow perch	17.67	0.07%	7	0.00	0.00%	11	8.83	0.06%	8
Lake whitefish	6.02	0.03%	9	0.00	0.00%	11	3.01	0.02%	9
Lake trout	3.90	0.02%	10	1.09	0.02%	8	2.49	0.02%	10
Burbot	2.59	0.01%	11	0.86	0.01%	9	1.72	0.01%	11
Threespine stickleback	0.00	0.00%	12	0.00	0.00%	11	0.00	0.00%	12
Total	23,868.08			6,608.64			15,238.36		

Figure 5-3 Numerical Densities of 12 Fish Species in the Vicinity of Point Beach, 1973-2016



Note: Red symbols are those years included in Table 5-1.

5.2.1.2 Summary of Trends

Two species that are dominant components of Phase II and 2017 entrainment at Point Beach are included in the USGS trawl data: rainbow smelt and alewife. Both species have shown variable but declining population densities near Point Beach over the period of record (Figure 5-3). In both 2006 and 2016, rainbow smelt and alewife densities were low compared to historical values at both USGS trawl sampling sites. Densities for all fish species captured in the USGS trawls largely unchanged between 2006 and 2016, with the exception of round goby. Bloater were not present in the entrainment data for either year, and round goby were only present in the 2017 entrainment data, consistent with their recent introduction to the lake.

Despite near record low levels of prey fish biomass in USGS trawl data, rainbow smelt and alewife densities at the combined Sturgeon Bay and Port Washington collection sites comprised of a

similar proportion of the total trawl catch data between 2006 and 2016. For example, in 2006 rainbow smelt had a ranked score of 4 in the combined data set, and a rank score of 5 in 2016. Alewife similarly dropped in rank between the two entrainment study years (5 to 6 in the averaged data sets from the two trawl locations). While rainbow smelt biomass has declined since the mid-1990s, their mean biomass was the highest at the two northern-most trawl sampling sites, which includes Sturgeon Bay, WI (Bunnell et al., 2017). The importance of these two species in the entrainment data despite their relatively low numbers in the trawl data is likely due to their habit of broadcast spawning nearshore and their planktonic larvae.

The three most abundant species in the combined trawl data for both trawl sites were ninespine stickleback, deepwater sculpin, and bloater (Table 5-1). Ninespine stickleback saw an increase in abundances in the mid-2000s, but quickly declined thereafter (Figure 5-3); potentially a result of increased predation (Bunnell et al., 2017). As discussed above, deepwater sculpin are not expected to be impacted by intake operation due to the lack of appropriate habitat for the species.

Burbot were shown to represent a larger proportion of the entrainment samples in 2017 compared to the Phase II data (i.e., a nearly 10-fold increase – see below). This increase is not apparent in the USGS trawl data (although their relative rank increased in 2016 at Port Washington). However, the USGS trawl surveys are mostly selective to adult burbot and exclude juveniles, so it is unlikely the trawl data are indicative of the earlier life stage densities of burbot. While the decline in burbot in Lake Michigan since the 1950s has been attributed to sea lamprey predation, it has been proposed that the reduction in alewife abundance could be a precursor for the recovery of burbot (Eshenroder and Burnham-Curtis, 1999).

While round goby appear to be increasing dramatically beginning in 2011, a sharp decline occurred from 2013to 2015 (Figure 5-3). Despite this recent increase and the ensuing sharp decline, round goby are being consumed in larger numbers by predators (e.g., Coho salmon, yellow perch, walleye), and have even become a larger constituent in lake trout, burbot, lake whitefish, smallmouth bass, and yellow perch diets (Bunnell et al. 2017). This increased predatory pressure may explain the decline between 2013 through 2015, but round goby now represents an important part of the forage base.

The potential for entrainment of round goby was evident in the 2017 entrainment study data, as this species comprised approximately 7 percent of the entrained organisms. The Sturgeon Bay trawl site also had the highest densities of round goby compared to the rest of the USGS trawl sampling sites. However, round goby are likely underestimated in the trawl surveys due to round goby preferred habitats (rocky, inshore areas) not being sampled by the trawls.

In summary, based on the USGS survey data, we expect that rainbow smelt and alewife will continue to dominate entrainment at Point Beach albeit at rates that are lower than historical ones. Round goby are likely to continue to be present in the entrainment data. It is unclear as to whether burbot will remain a dominant species or will be subject to inter-annual variations in entrainment rates. Other species captured during the Phase II data and subsequently absent in 2017 is not necessarily indicative that they are absent from the waterbody. It is more likely they are in low abundances near the intake and are, therefore, entrained episodically and at low rates.

5.2.2 ANGLER SURVEY DATA BY WISCONSIN DEPARTMENT OF NATURAL RESOURCES

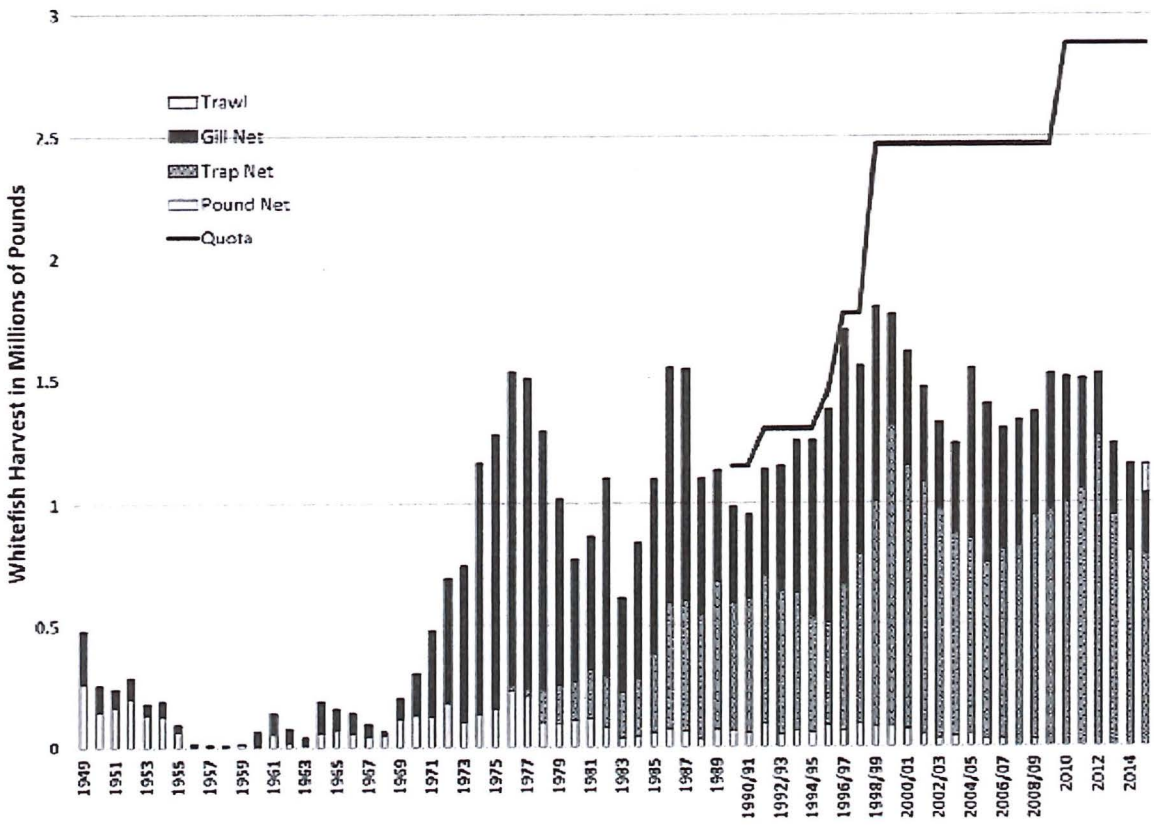
WDNR provides an annual review of Lake Michigan game fish (e.g., WDNR, 2017) which is focused on fish that are harvested commercially and recreationally. For example, Table 5-2 indicates that the harvest of salmonids has been variable but without a substantial trend since 2001. The commercial harvest of whitefish has also remained relatively stable over the last several years (see Figure 5-4. While the data reported by WDNR suggest that the commercial and recreational fishery is relatively stable, few of these fish are affected by entrainment at Point Beach.

Table 5-2 Total Number of Fish Harvested and Harvest per Hour of Effort (2001 to 2016)

Species	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	(SINCE 1986)
Brook Trout	263	144	126	1	18	17	62	13	27	0	26	18	0	0	0	0	39,040
Brown Trout	26,421	35,220	23,654	20,918	27,489	17,769	37,947	23,763	15,792	13,029	9,936	21,337	17,094	23,324	20,174	23,879	1,132,630
Rainbow Trout	72,854	74,031	48,548	25,529	48,490	48,420	62,249	41,552	46,529	49,121	75,442	75,981	58,311	73,105	59,106	76,846	2,142,199
Chinook Salmon	191,378	275,454	317,619	360,991	418,918	398,905	431,143	256,796	214,621	315,294	169,752	390,385	145,301	130,698	113,973	139,082	5,837,602
Coho Salmon	47,474	102,313	50,625	76,944	59,244	56,136	94,677	25,453	42,690	42,445	157,367	73,395	89,061	52,297	41,010	125,964	2,494,490
Lake Trout	40,408	39,865	23,881	14,209	14,139	10,638	19,281	12,763	14,946	17,483	17,788	29,094	27,240	25,425	35,715	19,137	1,402,976
TOTAL	**378,798**	**527,027**	**464,453**	**498,592**	**568,298**	**531,885**	**645,359**	**360,340**	**334,605**	**437,372**	**430,311**	**590,210**	**337,007**	**304,849**	**269,978**	**384,908**	**14,048,937**
Harvest Per Hour	0.1382	0.1789	0.1719	0.1904	0.2036	0.1916	0.2108	0.1443	0.1171	0.1539	0.1693	0.2337	0.1213	0.1163	0.0990	0.1464	0.1486

Source: WDNR, 2017

Figure 5-4 Lake whitefish reported commercial harvest by gear in pounds dressed weight from Wisconsin waters of Lake Michigan (1946 to 2015)



Source: WDNR, 2017

5.2.3 NMFS COMMERCIAL LANDINGS

5.2.3.1 Background and Methods

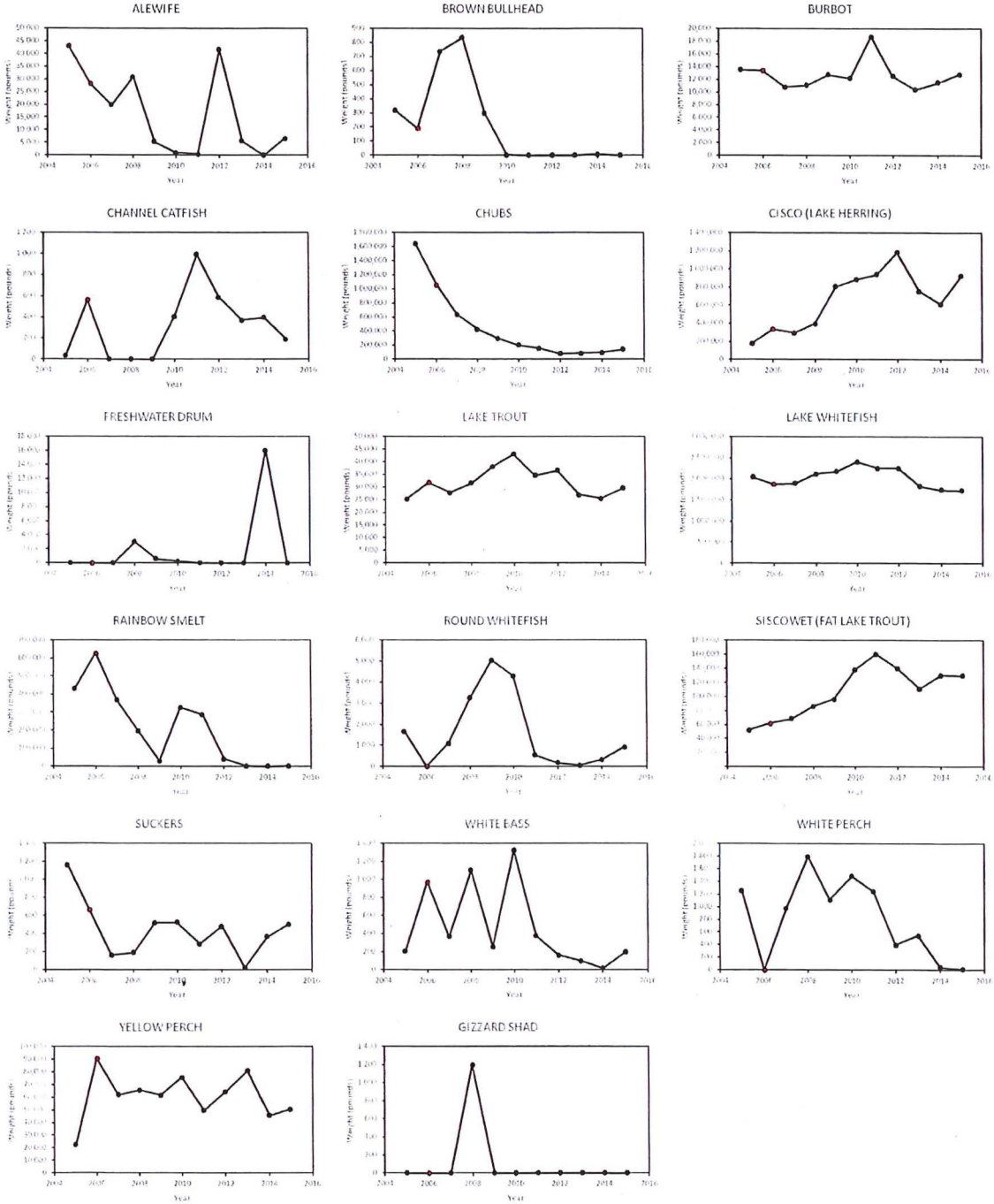
Great Lakes commercial fishery landings data are provided through NMFS, courtesy of the USGS GLSC[8] (hereafter referred to as NMFS data). These data report the round (live) weight of all landed finfish captured by U.S. commercial anglers (excluding Canadian commercial landings). These Great Lakes data include finfish that were landed but not sold and may differ from data reported in NMFS annual, monthly and gear web query programs which usually do not report finfish landings unless they are sold. For the purposes of this report, only landing data reported as caught under Wisconsin jurisdiction are included, not lake-wide catch data. The dataset consists of, among other species, a number of the most commonly entrained species at Point Beach: alewife, burbot, and rainbow smelt. Together these three species represented 84% of the estimated entrainment at Point Beach for the Phase II and 2017 studies, combined (87% in 2006 and 80% in 2017).

The commercial landings data are only an indirect measure of fish populations in the lake. Importantly, the commercial landings are not normalized to the level of effort expended to make the landings. Despite this, it is reasonable to conclude that landings are directly, if imperfectly, related to fish stocks, and can be used as an approximation of population trends in the lake.

Fish landings in Wisconsin for eight important Lake Michigan species are presented in Figure 5-5. Data coinciding with the 2006 Phase II entrainment sampling at Point Beach are indicated in red symbols on the figures. Data for 2016 and 2017 were not publicly available at the time of this report, so the figures and the following discussion of the commercial landing data include data through 2015.

[8]http://www.st.nmfs.noaa.gov/commercial-fisheries/commercial-landings/other-specialized-programs/great-lakes-landings/index

Figure 5-5 Commercial Landings from Lake Michigan for Seventeen Fish Species (2005-2015)



Source: NMFS, 2017

5.2.3.2 Findings

With the exception of lake trout, burbot, lake whitefish, yellow perch, and lake herring, reported live weights of all landed finfish have generally trended downward since the early 2000s (Figure 5-5). While a few species had incomplete datasets (gizzard shad and freshwater drum), data are available for those species for a number of years since the Phase II entrainment characterization and all of the measurements during that period are consistently low.

All three of the commonly entrained species at Point Beach have experienced historical declines in commercial landings in the last several years:

- Alewife: Commercial landings fell sharply from 2005 to 2011 and rebounded in 2012. However, live weights fell in 2013 and remained low. Since the Phase II entrainment program, commercial landings of alewife have been a small fraction of historical highs.
- Burbot: Commercial landings of burbot have remained consistent between the Phase II and 2017 entrainment studies.
- Rainbow smelt: Landings of this species have decreased substantially since 2006 and are likely a reflection of the longer-term declines in populations. These trends mimic those seen in the USGS survey data as shown in Table 5-1.

As noted above, these three species represented 84% of entrained organisms at Point Beach for both entrainment studies, combined. Since the Phase II survey, the commercial landings would suggest that the fish stocks (and likely entrainment rates) are largely unchanged (e.g., burbot) or reduced (e.g., alewife and rainbow smelt). The trends for alewife and rainbow smelt landings are confirmed by the USGS survey record in which lake-wide populations have declined over the last two to three decades.

5.3 SUMMARY OF SURVEY DATA AND IMPLICATIONS FOR USE OF PHASE II ENTRAINMENT DATA

For the datasets evaluated, the large decreases in fish abundance, densities, and catch rates/weights have largely been attributed to the introduction of the invasive dreissenid mussels, the zebra and quagga (Nalepa et al., 2008). These two species have effectively increased water clarity in the Great Lakes to a point where it has substantially decreased the production of *Diporeia*, the main food source for many native prey species. This bottom-up effect has resulted in lower abundance of many native prey and, therefore, predator species. There is also a possibility that round goby

affects the populations of forage fish by competition for spawning sites and food as well as direct predation by round goby on the early life stages of the other species.

While the stocks of forage fish have declined, the rates of entrainment for the dominant taxa have not been affected to the same degree. For some species (e.g., stickleback), rates of entrainment have been low both before and after a decline in the lake populations suggesting that habitat and spawning behavior limit their susceptibility to entrainment. On the other hand, while the populations of taxa that are susceptible to entrainment (e.g., rainbow smelt and alewife) have declined in the USGS survey data by 82% and 92%, respectively, between 2006 and 2016, their rates of entrainment have exhibited a smaller decline, 25% and 67%, respectively. The importance of round goby in the lake, as illustrated by a 92-fold increase in their population density, is also apparent in their rate of entrainment.

With these trends in mind, it is important to return to the goals of the entrainment data collection under the 2014 316(b) rule for existing facilities. These goals include the study requirements set out in 40 CFR 122.21(r)(9) as well as the anticipated use of the entrainment data in the preparation of the benefits assessment defined at 40 CFR 122.21(r)(11).

ECT believes that the Phase II entrainment data collected at Point Beach adequately addresses all of those goals for the following reasons:

- The Phase II program met the rule's requirements for level of taxonomic resolution, characterization of temporal variation, etc. None of these factors are expected to have changed in the last several years. Importantly, there is no reason that diel or seasonal behaviors of any species would have changed in such a short period.
- Entrained organisms at Point Beach are dominated by forage and rough fish that will be considered in similar ways when evaluating the benefits of reduced entrainment. For example, modeling of adult equivalents and production forgone will be approached similarly and small changes that may occur in the frequency of a given species will not substantially affect the outcome.
- While we expect that round goby has become a dominant entrained species, it will be possible to consider the benefits of reducing their losses through a reasonable set of

assumptions about the species' role in the trophic structure and its proportion of annual entrainment. ECT notes that it would assume that reducing entrainment losses of round goby would yield a social benefit due to maintenance of forage (Bunnell et al., 2017). Such an assumption would have been unlikely just a few years ago.

- Shellfish continue to be dominated by amphipods with very low numbers of *Mysis* and no *Diporeia* in the 2017 samples. Native amphipods have been replaced to a great extent by two invasive species (*Echinogammarus ischnus* and *Hemimysis anomala*). Annual estimates of amphipod entrainment are very similar and are likely determined by the colonization of the intake structure rather than populations in the water column.
- The 2017 data set includes key data on assessing the effectiveness of entrainment control measures. For example, life stage information and length/head capsule data for the important taxa are included. We note that such information can be reliably obtained from the literature for round goby.

In assessing potential benefits, ECT proposes to model each year of entrainment data separately rather than alternative approaches such as using the means of the two years. To the extent that the fishery of Lake Michigan, and rates of entrainment, are declining, the 2006 data would tend to result in higher predicted benefits than the current 2017 data.

6.0 PREVIOUS ENTRAINMENT STUDIES AT POINT BEACH

This section presents a summary of entrainment data collected previously at Point Beach with emphasis on the data collected under the Phase II rule in 2006 and in 2017 under the current rule. NextEra has proposed using these data to support its assessment of entrainment BTA under the 2014 rule for existing facilities.

6.1 PHASE II AND 2017 EFFORTS

Entrainment samples were collected weekly at Point Beach from April 2006 through September 2006 (EA, 2007). Samples were collected at a single depth (mid-water column) from the intake forebay. Water in the intake bays was well mixed as a result of the turbulent nature of the forebay, so multiple depth replicates were not necessary. The 2017 samples were collected similarly over the same temporal period (April through September 2017), in an identical manner as the Phase II samples except that samples were collected every two weeks and the intake hose for the pump system used to collect the samples was moved vertically during sample collection to ensure a depth-integrated sample.

Ichthyoplankton (fish eggs, larvae, and juveniles) were hand sorted from the preserved debris with the aid of illuminated magnifiers and/or dissecting microscopes during both the 2006 and 2017 studies. Ichthyoplankton and shellfish were identified in both years using a dissecting microscope equipped with polarizing lenses. Following identification and enumeration, voucher collections were created in both years. Larval length, egg diameter, and head capsule depth were measured in 2017.

6.1.1 SPECIES COMPOSITION AND RELATIVE ABUNDANCE

The 2006 entrainment data were summarized as "Phase II" results and the current entrainment data as "2017" results. Data available from other sources (e.g., surveys by government agencies) were from 2006, the year of Phase II collection, and from 2016, the most recent year available.

6.1.1.1 Phase II Results

A total of 167 ichthyoplankton specimens (15 taxa) representing five life stages (egg, yolk-sac, post yolk-sac, larvae, and juveniles) were collected during the Phase II entrainment study (Table

6-1[9]). Samples contained primarily rainbow smelt and clupeid (alewife) taxa. Amphipods, which were considered by WDNR to be "shellfish" under the rule, (e.g., *Gammarus* sp. and *Hyalella azteca*), comprised a much larger proportion of the entrainment samples than did ichthyoplankton. With the exception of one specimen, all of the entrained shellfish were in the Gammaridae family; one *Hyalella azteca* was sampled during the Phase II study. Entrained ichthyoplankton taxa represented fishes common in Lake Michigan based on historical impingement and entrainment data collected at Point Beach and other power plants on Lake Michigan. The inter-annual variation in total numbers as well as individuals of a given species were also typical of data observed at other plants (CDM/Limnetics, 1977).

Nearly 85% of all entrained organisms fell within two taxa: rainbow smelt and alewife. Rainbow smelt comprised a larger percentage than alewife (53% and 32%, respectively). Eggs were the largest proportion of alewife life stages collected, and rainbow smelt juveniles were the largest proportion among rainbow smelt life stages. Unidentified taxa were the third highest entrained taxa (5%), with eggs being the largest proportion of unidentified taxa life stages entrained. Overall, forage fish dominated the entrained organisms, accounting for 91% of all entrained organisms. Rough fish (common carp, Catostomidae, etc.) accounted for 3%, while 2% were comprised of sport fish taxa (*Lepomis*, Coregoninae). Juveniles and eggs were the most commonly entrained life stages for the Phase II entrainment study (61% and 25%, respectively). The remaining 14% were split evenly between post yolk-sac, yolk sac, and larvae life stages.

6.1.1.2 2017 Results

A total of 72 ichthyoplankton specimens (six taxa) representing six life stages (egg, yolk-sac, post yolk-sac, larvae, juveniles, and adults) were collected during the 2017 entrainment study (Table 6-1). Samples were primarily rainbow smelt, burbot, and alewife. Again, entrained taxa represented fishes common in Lake Michigan based on historical impingement and entrainment data collected

[9] The presentation in Table 6-1 and the discussion here considers the estimated annual rates of entrainment (number/volume of water) and the actual rate of water use during the two separate years. In the 2017 study, intake flow was roughly 7.3% higher than it was in 2006 and no attempt has been made here to update those numbers for a new intake flow. Instead, when the entrainment BTA assessment is made, the densities for the two years will be paired with the most recent Actual Intake Flow to develop two new estimates of annual entrainment. In rough terms, the 10.5 million fish entrained in 2006 could be estimated to represent 11.5 million fish at the 2017 flow rate. Therefore, when approximately normalizing for intake flow, the total annual entrainment of fish would be approximately 14.6% higher than observed in 2017. In ECT's experience, this level of inter-annual variation is not at all unusual. In fact, inter-annual changes in entrainment rates at the same facility in consecutive years are observed to vary by a factor two or more.

at Point Beach and other power plants on Lake Michigan (CDM/Limnetics, 1977). The inter-annual variation in total numbers as well as individuals of a given species were also typical of data observed at other plants. Shellfish were again a large portion of the entrainment samples, with nearly 100% of the sample comprised of taxa in the Gammaridae family. Smaller proportions of Mysidae were also present in the shellfish entrainment samples. Similar to the Phase II study, shellfish comprised a larger proportion of the entrainment samples than ichthyoplankton.

Table 6-1 Annual Comparisons of the Number and Relative Abundance of Ichthyoplankton Taxa Collected during Entrainment Sampling at Point Beach, Phase II (2006) and 2017

Taxa	Life stage	Type	Phase II		2017		Total	
			No./yr	%	No./yr	%	No./ 2 yr	%
			Ichthyoplankton					
Alewife	Adult	Forage		0%	289,357	3%	289,357	1%
Alewife	Egg	Forage	2,197,299	20%			2,197,299	11%
Alewife	Juvenile	Forage	1,158,320	11%	580,909	6%	1,739,229	8%
Alewife	Post yolk-sac larvae	Forage	62,830	1%	270,952	3%	333,782	2%
Burbot	Juvenile	Rough	64,579	1%			64,579	0%
Burbot	Larvae	Rough		0%	710,516	7%	710,516	3%
Burbot	Post yolk-sac larvae	Rough		0%	144,251	1%	144,251	1%
Burbot	Yolk-sac larvae	Rough	178,558	2%	1,808,418	18%	1,986,976	10%
Catostomidae	Egg	Rough	63,786	1%			63,786	0%
Clupeidae	Larvae	Forage	64,740	1%	291,625	3%	356,365	2%
Common carp	Yolk-sac larvae	Rough	64,740	1%			64,740	0%
Coregoninae	Yolk-sac larvae	Uncertain	125,676	1%			125,676	1%
Cyprinidae	Larvae	Forage	64,413	1%			64,413	0%
Cyprinidae	Yolk-sac larvae	Forage	64,413	1%			64,413	0%
Lepomis	Post yolk-sac larvae	Potential Sport	63,786	1%			63,786	0%
Rainbow smelt	Adult	Forage, Commercial		0%	144,755	1%	144,755	1%
Rainbow smelt	Juvenile	Forage, Commercial	5,341,080	50%	290,175	3%	5,631,255	27%
Rainbow smelt	Larvae	Forage, Commercial	193,219	2%	2,393,658	24%	2,586,877	12%
Rainbow smelt	Post yolk-sac larvae	Forage, Commercial	129,507	1%	1,445,121	14%	1,574,628	8%
Round goby	Adult	Invasive, Forage		0%	66,911	1%	66,911	0%
Round goby	Juvenile	Invasive, Forage		0%	141,929	1%	141,929	1%
Round goby	Post yolk-sac larvae	Invasive, Forage		0%	504,166	5%	504,166	2%
Sculpin	Larvae	Forage	64,682	1%			64,682	0%
Sculpin	Post yolk-sac larvae	Forage	64,755	1%			64,755	0%
Slimy Sculpin	Post yolk-sac larvae	Forage	128,775	1%			128,775	1%

Taxa	Life stage	Type	Phase II		2017		Total	
			No./yr	%	No./yr	%	No./ 2 yr	%
Stickleback	Larvae	Forage	64,717	1%			64,717	0%
Stickleback	Yolk-sac larvae	Forage	127,571	1%			127,571	1%
Unidentified	Egg	-	387,103	4%	276,891	3%	663,994	3%
Unidentified	Larvae	-	64,413	1%	693,456	7%	757,869	4%
Total			10,738,962		10,053,090		20,792,052	
			Shellfish					
Echinogammarus ischnus[1]	-	Invasive			3,349,193,628	72%	3,349,193,628	38%
Gammaridae[1]	-	Native			2,189,783	0%	2,189,783	0%
Gammarus sp.[1]	-	Native	4,057,474,137	100 %	1,307,295,469	28%	5,364,769,606	61%
Hemimysis anomala	-	Invasive			12,863,458	0%	12,863,458	0%
Hyalella azteca	-	Native	62,838	0%			62,838	0%
Mysis diluviana	-	Native			141,929	0%	141,929	0%
Total			4,057,536,975		4,671,684,267		8,729,221,242	

[1]All members of the Gammaridae family.

While fewer taxa were represented in the 2017 entrainment samples, rainbow smelt were again the dominant taxa (43%). Burbot comprised a larger proportion of the samples (26%) than the Phase II data (1%), while alewife represented a smaller portion compared to Phase II (11%). Forage fish (64%) and rough fish (26%) dominated the entrainment samples in 2017. Few sportfish or commercially important fishes were represented in the sample data. Larvae, post yolk-sac larvae, and yolk-sac larvae were the most abundant life stages entrained (41%, 24%, and 18% respectively). Eggs (3%) and adults (5%) comprised smaller proportions of the entrainment data.

At the request of WDNR. amphipods were identified and enumerated under the Phase II effort as "shellfish". WDNR's interest in amphipods was tied to the importance of *Diporeia* and *Mysis* as a prey base for forage fish such as alewife (EA, 2007). During the Phase II effort, no individuals of either of these taxa were entrained, although low numbers of *Mysis* were found in samples of the ambient water. During Phase II, the number of shellfish in the entrainment samples were believed to be associated with their colonization of the rocks that make up the intake crib (Section 6.1). This was based on the nearly 100-fold enrichment of shellfish in the entrainment samples relative to the ambient water at the same depth.

In both years of sampling, shellfish were far more numerous than ichthyoplankton. While the total number entrained is relatively similar in the two years, native amphipods have been partially replaced by invasive ones. *Echinogammarus ischnus* and *Hemimysis anomala* have recently been introduced to the lake and constitute about 70% of the 2017 shellfish. Mysis were encountered in the 2017 effort but at a very low fraction of the entrained shellfish (i.e., 0.003%). No *Diporeia* were found in 2017. ECT believes that the amphipods encountered in 2017 are also likely to be associated with the local intake environment (i.e., the crib). Based on the habitat preferences of *E. ischnus* (i.e., relatively shallow water and rocky substrates – Great Lakes Aquatic Nonindigenous Species Information System, 2017), it is reasonable to expect that the entrained shellfish observed in 2017 are also enriched by virtue of the intake crib.

6.1.2 SIZE DISTRIBUTION

Ichthyoplankton lengths were not recorded under the Phase II study, but were estimated for each species and life stage based on published literature. The offshore location of the Point Beach intake resulted in reduced entrainment relative to EPA's Phase II "calculation baseline" intake, and it was the conclusion of the Phase II report that that condition met the entrainment performance standard of the Phase II 316(b) rule. Larval length, egg diameter, and head capsule depths were recorded under the 2017 study for the purposes of fine mesh screen exclusion analyses.

For the Phase II data, reported egg diameters ranged from 0.8 mm (rainbow smelt and sunfish species) to 3.6 mm (Catostomidae). Alewife eggs are relatively small (0.9 - 1.2 mm), as are rainbow smelt eggs (0.8 - 1.3 mm). Lengths of yolk-sac larvae are more variable than egg diameters. Of the taxa sampled during the Phase II study, sunfish species yolk-sac larvae are the smallest (2.0 - 5.0 mm) and lake whitefish (Coregoninae) are the largest (8.8 - 15.0 mm). Yolk-sac larvae develop into post yolk-sac larvae at about 4.0 mm (e.g., alewife and sunfish species) to 15.0 mm (bloater/Clupeidae). Development of the taxa to juveniles starts at about 8.0 mm (slimy sculpin) to 34 mm (lake whitefish). Alewife juveniles are 19.0-32.2 mm. Length minima and maxima for entrained taxa during the 2017 entrainment study are included in Table 6-2.

Table 6-2 Dimensions of Entrained Organisms - 2017 Point Beach Entrainment Study

Taxa	Life Stage	Length/Egg Diameter (mm)				Head Capsule Depth (mm)			
		N	Min	Mean	Max	N	Min	Mean	Max
Shellfish									
Echinogammarus ischnus		45	5.6	8.8	12.0				
Gammarus sp.		20	4.7	7.3	10.6				
Hemimysis anomala		3	9.9	10.3	11.0				
Mysis diluviana		1	9.9	9.9	9.9				
Ichthyoplankton									
ALEWIFE	Post Yolk-sac Larvae	2	6.8	13.1	19.3	1	1.9	1.9	1.9
	Juveniles	5	24.7	30.0	37.1	4	3.5	4.5	6.2
	Adult	1	87.0	87.0	87.0	1	19.0	19.0	19.0
RAINBOW SMELT	Post Yolk-sac Larvae	7	5.6	20.7	31.0	10	0.5	2.1	3.7
	Juveniles	2	33.7	34.1	34.5	2	3.5	3.7	3.9
	Adult	1	88.0	88.0	88.0	1	8.7	8.7	8.7
	Larvae	--	--	--	--	1	0.6	0.6	0.6
BURBOT	Yolk-sac Larvae	13	3.9	4.4	5.2	12	0.7	0.8	0.9
	Post Yolk-sac Larvae	1	7.2	7.2	7.2	1	1.5	1.5	1.5
ROUND GOBY	Juveniles	5	8.4	11.4	20.5	5	1.4	2.1	3.6
	Adult	1	76.0	76.0	76.0	1	12.0	12.0	12.0
UNIDENTIFIED	Eggs (viable)	2	1.0	1.0	1.0	0	--	--	--

The head capsule depth of the larvae and the egg diameter will be compared to the potential mesh size of fine mesh screens to estimate the rates of exclusion on the screens. ECT believes that there are sufficient data from the 2017 effort as well as the literature to provide a sound basis for this comparison.

6.1.3 DIEL DISTRIBUTION

For both the Phase II and 2017 programs, samples were collected during daylight and nighttime hours in order to ensure that the rates of entrainment reflected any diel changes.

6.1.4 SEASONAL DISTRIBUTION

The Phase II entrainment study indicated spawning of resident species in the vicinity of Point Beach occurs primarily from April through August. Unidentified Coregoninae were only present

in the entrainment samples collected the week of April 16 to 22, and burbot were entrained the next two weeks only, from Apriil 23 through May 6.

Depending on species, Coregonids spawn from late fall through early spring (Becker, 1983) and burbot is one of the earliest spawning fish species in Lake Michigan that typically spawns before ice-out (University of Wisconsin Sea Grant Program, 2006). These early spawning species occurred as yolk-sac larvae only once (unidentified Coregoninae) or twice (burbot) during the 24-week study. Post yolk-sac larvae and juveniles of these two taxa did not occur in the entrainment samples. Ichthyoplankton did not occur in the entrainment samples collected over a four-week period from May 7 through June 3.

Several different taxa/life stages occurred sporadically from June 11 through July 1 when estimates remained less than 400,000 ichthyoplankton per week. Entrainment rates increased when alewife-type eggs and juvenile rainbow smelt began to be entrained in early July. Alewife-type eggs were entrained through the first week of August and juvenile rainbow smelt were entrained from July 16-22 through the completion of the study in late September. Rainbow smelt were collected more frequently than any other taxa and occurred in samples from eight of the 24 sampling events, followed by alewife type eggs (four events), juvenile alewife (four events), and unidentified eggs (three events). Seasonal trends for the majority of taxa/life stages collected during the Phase II study were difficult to establish as most taxa occurred only once (15 taxa/life stages) or twice (5 taxa/life stages) suggesting they had limited vulnerability to entrainment at Point Beach (EA, 2007).

During the 2017 study, burbot larvae, yolk-sac and post yolk-sac larvae occurred in samples from May 9 through July 6 and were absent the remaining sampling season. Rainbow smelt larvae dominated the earlier sampling periods (April 24 through July 6), whereas later sampling periods were dominated by post yolk-sac larvae and juvenile rainbow smelt. This species was also collected during more sampling events of any other taxa (seven). Round goby were present in early samples (April 12 and April 25), then absent until August 2 and 16. Other taxa were either present once or twice throughout the entire sampling period and in low numbers.

6.2 DISCUSSION

Overall the Phase II entrainment results were similar to the 2017 results in that the two entrainment characterization efforts entrained essentially the same species. In both studies, rainbow smelt and alewife were dominant taxa entrained. While the Phase II results did have a larger number of different taxa entrained, those species combined were only 8% of the annual entrainment estimate and occurred in very low numbers. Forage and rough fish were the majority of fish types entrained during both studies. No federally or state-listed species was entrained.

Variation in numbers entrained by taxa are apparent between the two study years at Point Beach. For example, the total number of burbot entrained was approximately 11-fold higher in 2017 relative to 2006. It is ECT's experience that such inter-annual variation is not at all unusual. For example, rates of yellow perch entrainment varied by 24-fold from one year to the next at a power plant on Lake Michigan in Illinois. At the Kewaunee Nuclear Power Plant over a much longer inter-sampling period, rates of burbot entrainment varied by a factor of more than 100 and bracketed the rates observed at Point Beach. Finally, such variation is also apparent in the inter-annual trends of some taxa in the lake-wide stocks as summarized by Bunnell et al. (2017).

The timing of the peak abundance varied somewhat as peaks for commonly entrained taxa (alewife, rainbow smelt) were generally dependent on ambient water temperatures. The primary difference between years was the difference between life stages that were entrained (Table 6-1). For example, during the Phase II study, juveniles and eggs dominated the entrainment samples, while in 2017 larvae and post yolk-sac larvae were dominant. In 2017, eggs and juveniles comprised a smaller proportion of the samples (3% and 10%, respectively). Larvae, yolk sac and post yolk-sac larvae during the Phase II study were each roughly 5% of the samples. While total annual entrainment estimates were similar between the two years, one difference between the two sample years was the abundance of alewife. In 2017, total alewife abundances decreased by nearly 67% compared to the Phase II study. However, this trend in alewife is consistent with lake-wide trends in Lake Michigan (Section 5).

Shellfish in the Gammaridae family (one taxon in Phase II, three taxa in 2017) were similar between the two studies (roughly 4.1 billion annual entrainment estimated in Phase II and 4.7 billion estimated in 2017). However, two species in the Mysidae family were present in 2017 that

were absent in Phase II, and *Hyalella azteca* was absent in 2017 but present in Phase II. These species comprised of less than a percent of the total shellfish entrainment in the respective years they were present. The high number of Gammaridae species during both studies may be a result of preferable habitat for this species (rocky substrates) near the offshore intake crib and the intake forebay (EA, 2007).

Table 6-3 presents the entrainment data discussed above in a format that facilitates consideration of temporal trends in a variety of fisheries data. For each study period, the annualized estimate of entrained organisms is presented along with their percentage of the total and their rank order within the year. All observed life stages for a particular taxon were summed for the purposes of this presentation. The various taxa are listed from the most numerous in the combined two-year data set to the least numerous – as ranked under the columns "Total". In addition, conditional formatting is used to highlight the most numerous (green) to the least numerous (red) in all three data sets (the two years separately and the combined data).

Table 6-3 Ranking of Dominant Entrained Taxa in the Phase II and 2017 Entrainment Data

Taxa	Phase II No./yr Estimate*	%	2017 No./yr Estimate*	%	Total No./2 yr Estimate*	%
Ichthyoplankton						
Rainbow smelt	5,663,806	53%	4,273,710	43%	9,937,516	48%
Alewife	3,418,449	32%	1,141,218	11%	4,559,667	22%
Burbot	243,137	2%	2,663,186	26%	2,906,323	14%
Unidentified	451,516	4%	970,347	10%	1,421,863	7%
Round goby			713,006	7%	713,006	3%
Clupeidae	64,740	1%	291,625	3%	356,365	2%
Stickleback	192,288	2%			192,288	1%
Sculpin	129,437	1%			129,437	1%
Cyprinidae	128,826	1%			128,826	1%
Slimy Sculpin	128,775	1%			128,775	1%
Coregoninae	125,676	1%			125,676	1%
Common carp	64,740	1%			64,740	0%
Catostomidae	63,786	1%			63,786	0%
Lepomis	63,786	1%			63,786	0%
Shellfish						
Gammarus sp.	4,057,474,137	100%	1,307,295,469	28%	5,364,769,606	61%
Echinogammarus ischnus			3,349,193,628	72%	3,349,193,628	38%
Hemimysis anomala			12,863,458	0%	12,863,458	0%
Gammaridae			2,189,783	0%	2,189,783	0%
Mysis diluviana			141,929	0%	141,929	0%
Hyalella azteca	62,838	0%			62,838	0%

** Based on weekly extrapolations using actual pumping rates*

The important trends on annual entrainment patterns in the Phase II Point Beach data are apparent in Table 6-3:

- Two species, rainbow smelt and alewife, dominate the entrainment rates in both study years. These two species comprise 70% of entrained organisms in the combined data set. Among these two taxa, the relative importance of alewife is reversed in the 2017 study. Alewife were entrained less often in 2017 than in Phase II. However, these trends are typical for what is shown in lake-wide trends (as discussed later).
- The third most dominant taxa, burbot, comprised a larger proportion of the entrainment data in 2017 than in Phase II data. While this increase is not reflective in lake-wide data as discussed below, this is likely a result of the surveys conducted offshore and in deeper waters, whereas young-of-year and juvenile burbot tend to reside in shallower waters not

included in the bottom trawl surveys. However, researchers have proposed that reductions in alewife (which are occurring) may strengthen the recovery of burbot (Eshenroder and Burnham-Curtis 1999).

- Inter-annual variation in both dominant and less dominant taxa is considerable. Among the less dominant species, representing two percent or less of entrained organisms in Phase II, fish species present in the Phase II data are generally absent in the 2017 effort. While these non-dominant taxa are unlikely to affect the conclusions of the entrainment BTA assessment, the source of the variation (e.g., actual changes in the stock or simple variation in the sampling results) is unclear.
- Most of the fish entrained were forage fish or rough fish that are not a major component of the Lake Michigan sport fishery. No salmonids or species of major commercial importance were entrained. However, two yolk-sac larvae of the Coregoninae subfamily were entrained during the Phase II study, likely a member of the genus *Coregonus* (cisco, whitefish, or bloater).
- While total numbers of shellfish are similar to 2006 measurements, there has been a marked shift to invasive species. The 2006 effort concluded that shellfish numbers were driven by colonization of the intake structure rather than populations in the water column. Based on the habitat preferences of the dominant shellfish observed in 2017, that conclusion remains reasonable.

6.3 SUMMARY OF PHASE II AND 2017 FINDINGS

The entrainment results were consistent in approximate number and the dominant taxa between the two sampling studies. Both data sets, therefore, provide information on the relative susceptibility to entrainment of species common in Lake Michigan in the vicinity of Point Beach. The entrainment estimates reflect the abundance of early life stages of primarily forage fish (including early life stages of rainbow smelt and alewife).

Alewife and rainbow smelt are abundant in Lake Michigan as indicated by the Phase II impingement study and temporal trend monitoring surveys of Lake Michigan (Section 5). Furthermore, forage fish generally have high fecundity and extended spawning seasons. The overall low relative abundance of species that build nests and/or provide parental care (e.g., sunfishes, sticklebacks, slimy sculpin) is typical of entrainment at power plant intakes. Low

representation of these species reflects spawning and life development characteristics that reduce susceptibility to entrainment. The life history of fishes is important in determining the extent to which they are at risk to entrainment. In addition to nest builders and species providing parental care, cover orientated-species, species with demersal and/or adhesive eggs will be less at risk (e.g., walleye, yellow perch). Conversely, species with a pelagic lifestyle and those with buoyant, semi-buoyant, or non-adhesive eggs are at greater risk [examples, including the ones entrained?]. Most freshwater fishes have low risk lifestyles or spawning strategies.

Results of the entrainment characterization study indicated that ichthyoplankton impacted by entrainment represented primarily forage fish that have high reproductive potentials, high natural mortality rates, and low economic value. The dominance of forage fish taxa with high fecundity, coupled with low contributions of sportfish to the total entrainment estimates suggest that impacts to the Lake Michigan fishery are likely low (CDM/Limnetics, 1977; Spigarelli, et al., 1981).

The similarity of the two data sets supports that the Phase II data may be used to address one year of the 316(b) rule's requirement to characterize entrainment as described at 40 CFR 122.21(r)(9). As described in the Executive Summary (see Section 1) other lines of evidence (e.g., conformance of the Phase II methods to the rule's requirements, the lack of changes to Lake Michigan in the vicinity of the plant, etc.) also support that the Phase II data remain relevant to the assessment of entrainment BTA under the 316(b) rule. Therefore, ECT concludes that collection of additional entrainment data in 2018 would have no additional utility and recommends against it.

7.0 REFERENCES

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ENCLOSURE 2

NEXTERA ENERGY POINT BEACH, LLC
POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2

ENTRAINMENT CHARACTERAZATION STUDY REPORT

135 pages follow

Point Beach Nuclear Plant
Entrainment Characterization Study Report

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January 2018
FINAL
EA Project No. 1526004

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LIST OF ACRONYMS AND ABBREVIATIONS

°C	Degrees Celsius
CFR	Code of Federal Regulations
EA	EA Engineering, Science, and Technology, Inc., PBC
ECOS	Environmental Conservation Online System
EPA	U.S. Environmental Protection Agency
°F	Degrees Fahrenheit
ft	Foot (feet)
gpm	gallons per minute
in.	Inch(es)
IPaC	Information for Planning and Consultation
mgd	Million gallon(s) per day
NMFS	National Marine Fisheries Service
SOP	Standard operating procedure
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
WDNR	Wisconsin Department of Natural Resources

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1. INTRODUCTION

On August 15, 2014, the EPA published the final §316(b) Rule for existing facilities (the Rule) that presents compliance options EPA requires for impingement and entrainment control. Details of the Rule are available at the EPA website located at http://water.epa.gov/lawsregs/lawsguidance/cwa/316b/index.cfm.

The Rule contains study requirements to support assessment of compliance options. One of those is the *Entrainment Characterization Study* under §122.21(r)(9) that requires (see Table 1-1):

> "*[t]he owner or operator of an existing facility that withdraws greater than 125 mgd [million gallons per day] AIF [actual intake flow], where the withdrawal of cooling water is measured at a location within the cooling water intake structure*[1] *that the Director deems appropriate, must develop for submission to the Director an Entrainment Characterization Study that includes a minimum of two years of entrainment data collection. The Entrainment Characterization Study must include the following components:*
>
> *(i) Entrainment Data Collection Method. The study should identify and document the data collection period and frequency. The study should identify and document organisms collected to the lowest taxon possible of all life stages of fish and shellfish that are in the vicinity of the cooling water intake structure(s) and are susceptible to entrainment, including any organisms identified by the Director, and any species protected under Federal, State, or Tribal law, including threatened or endangered species with a habitat range that includes waters in the vicinity of the cooling water intake structure. Biological data collection must be representative of the entrainment at the intakes subject to this provision. The owner or operator of the facility must identify and document how the location of the cooling water intake structure in the waterbody and the water column are accounted for by the data collection locations;*
>
> *(ii) Biological Entrainment Characterization. Characterization of all life stages of fish, shellfish, and any species protected under Federal, State, or Tribal law (including threatened or endangered species), including a description of their abundance and their temporal and spatial characteristics in the vicinity of the cooling water intake structure(s), based on sufficient data to characterize annual, seasonal, and diel variations in entrainment, including but not limited to variations related to climate and weather differences, spawning, feeding, and water column migration. This characterization may include historical data that are*

1 The EPA defines a cooling water intake structure (CWIS) "as the total physical structure and any associated constructed waterways used to withdraw cooling water from waters of the United States...the cooling water intake structure extends from the point at which water is first withdrawn from waters of the United States up to, and including, the intake pumps." Federal Register, Vol. 79 No. 158, August 15, 2014, Page 48306.

representative of the current operation of the facility and of biological conditions at the site. Identification of all life stages of fish and shellfish must include identification of any surrogate species used, and identification of data representing both motile and non-motile life-stages of organisms;

(iii) Analysis and Supporting Documentation. Documentation of the current entrainment of all life stages of fish, shellfish, and any species protected under Federal, State, or Tribal law (including threatened or endangered species). The documentation may include historical data that are representative of the current operation of the facility and of biological conditions at the site. Entrainment data to support the facility's calculations must be collected during periods of representative operational flows for the cooling water intake structure, and the flows associated with the data collection must be documented. The method used to determine latent mortality along with data for specific organism mortality or survival that is applied to other life-stages or species must be identified. The owner or operator of the facility must identify and document all assumptions and calculations used to determine the total entrainment for that facility together with all methods and quality assurance/quality control procedures for data collection and data analysis. The proposed data collection and data analysis methods must be appropriate for a quantitative survey."

This report provides the results and discussion of the Entrainment Characterization Study (§122.21(r)(9)) conducted during 2017 at the Point Beach Nuclear Plant (Point Beach) to meet the relevant requirements under the Clean Water Act 316(b) Existing Facilities Rule. The study was conducted under a Study Plan reviewed and commented on by the Wisconsin Department of Natural Resources (Appendix A).

2. STUDY AREA

Point Beach is located on the western shore of Lake Michigan about 80 miles north of Milwaukee in Manitowoc County, Wisconsin (Figure 2-1). The plant has two steam generating reactor units, together rated to generate approximately 1,246 megawatts of power. Once-through cooling water is withdrawn from Lake Michigan through an intake crib that is 1,750 feet offshore in about 22 feet of water (Figure 2-2). The intake crib has a 110-ft outside diameter and consists of two annular rings of steel piles driven into the lakebed, with the annulus filled with limestone blocks (Figure 2-3). Water is drawn through the limestone blocks and concrete encased 30-in corrugated galvanized steel pipes (Figure 2-4 and Figure 2-5). Water flows from the intake to the pumphouse through two, 14-ft diameter, corrugated galvanized structural steel pipes buried beneath the lakebed (Figure 2-6).

The total design capacity of the cooling water pumps is 1,248.48 MGD. Water passes through vertical bar racks (3/8-in by 4-in, with 2¼-in spacing on center) in the onshore forebay and eight traveling bar screens (3/8-in mesh, 11-ft wide) at the pumphouse (Figure 2-7). The traveling screens use an 80-psi screen wash that discharges to the lake via a return trough.

Approach velocities in the vicinity of the crib have been measured as high as 2.0 ft/sec, but most velocities measured in the vicinity of the crib are much lower (Bootsma 2001). Based on the measured velocities, it has been estimated that approximately one-half of the intake flow occurs through the cap with the other half through the walls of the intake crib.

3. METHODS AND MATERIALS

3.1 ENTRAINMENT SAMPLING LOCATION

The intent of entrainment sampling under the final Rule is to collect, identify, and count organisms that are being entrained. The final Rule states that entrainment "[*occurs when any life stages of fish and shellfish are drawn into the intake water flow entering and passing through a cooling water intake structure and into a cooling system*"]. EPRI (2014) provides four conceptual locations for sampling entrained organisms: 1) within the hydraulic zone or area of influence (AOI) in the source waterbody just prior to entering the intake (AOI sampling); 2) as or after organisms enter the intake (intake sampling), 3) between the cooling water pumps and condenser (condenser sampling), and 4) from the cooling water system downstream of the condensers (discharge sampling). The advantages and disadvantages of each potential sampling location are presented in Table 3-1.

The 2017 study at Point Beach was conducted in accordance with a sampling plan reviewed and commended on by the WDNR (Appendix A). It followed the 2006 study at Point Beach, which was conducted in accordance with a sampling plan outlined in the Proposal for Information Collection (PIC) submitted to the WDNR in December 2004 (ENSR 2004). WDNR provided comments to the PIC and the sampling plan was subsequently revised (Hellman 2005). The 2017 entrainment samples at Point Beach were collected by pumping water from the intake forebay, a sampling approach that represents intake sampling (Table 3-1). The 2006 approach (EA 2007) was chosen for the 2017 entrainment study so that the new data would be consistent with the 2006 results. The primary advantage of intake sampling is that there is low potential for damage to or loss of entrained organisms resulting from passage through the cooling water system and there is certainty that all organisms collected will be entrained based on approach velocities within the intake system.

3.2 SAMPLING FREQUENCY

The Rule requires that existing facilities obtain site-specific information "*...sufficient to characterize the annual, seasonal and diel variations in ... entrainment...*" It does not specify sampling frequency for existing facilities, but for new units at existing facilities that elect to install open cycle cooling (or comply under 40 CFR 125.94(e)(2)): "*[s]amples will be collected no less than biweekly*[2] *during the primary period of reproduction, larval recruitment, and peak abundance identified during the Source Water Baseline Biological Characterization Data required under §122.21(r)(4)*"[3]. The draft WDNR guidance specifies biweekly sampling at facilities with AIF >125 mgd. Therefore, biweekly sampling was conducted in 2017 from April through September, a schedule that is consistent with the primary spawning season of common Lake Michigan fishes known to occur in the vicinity of the Point Beach (Wenholz 2007). Because entrainment often varies on a diel basis, the sampling program addressed diel patterns as required by the final Rule and consistent with the draft WDNR §316(b) guidance. As in 2006,

[2] Biweekly is defined as every other week (EPRI 2014).
[3] Federal Register, Vol. 79 No. 158, August 15, 2014, Page 48378.

the 2017 sampling events were segregated into four, six-hour intervals (0600-1200, 1200-1800, 1800-0000 hours, and 0000-0600 hours) over each 24-hour sampling event. The 2017 program included identification and enumeration of ichthyoplankton and shellfish in a total of 52 samples (four diel sampling periods per event x 13 sampling events).

3.3 SAMPLE COLLECTION

Entrainment samples were collected from the intake forebay with an electric powered pump rated at about 240 gallons per minute (gpm). In 2006, it was assumed that mid-depth sampling was adequate due to turbulence in the forebay as well as mixing that very likely occurs in the offshore crib and pipes connecting the crib to the forebay. WDNR questioned that assumption upon reviewing the 2017 study plan, so it was agreed to collect samples over the water column by lowering (or raising) the intake hose so that a third of each sample was collected at near bottom, mid-, and near surface depths.

Pumped water was discharged into a 0.75 m diameter plankton net with 335 μm mesh that was partially submerged in a 250-gal tank to minimize turbulence and possible damage to pumped organisms. A schematic of the pump, hoses, and net assembly used in 2006 and used for this effort is shown in Figure 3-1. Figure 3-2 shows the entrainment sampling equipment set on a scaffold placed alongside the intake forebay to raise the sampling equipment near the top of the forebay wall.

The target sample volume for each six-hour sampling event was 100 m^3. Sample volumes ranged from 100.0 m^3 to 111.9 m^3 and averaged 101.3 m^3 (Table 3-2). A Signet 8150 Flow Totalizer was installed in the intake hose to measure the volume of water pumped. When the target volume was reached, the pump was turned off and the net washed down to concentrate the sample into the collection bucket at the cod end of the plankton net. The samples were transferred to pre-labeled sample containers and preserved with 10% buffered formalin and rose bengal.

Water temperatures were measured during each diel sampling event using a calibrated thermistor by inserting the probe into the collection tank. Daily cooling water volumes and intake water temperatures were provided by Point Beach for the study period.

3.4 SAMPLE PROCESSING

Entrainment samples were logged on a sample control sheet. Prior to processing, the samples were rinsed with a 335 μ mesh sieve to remove excess debris and formalin. The rinsed samples were then sorted for shellfish and ichthyoplankton with the aid of an illuminated magnifier or dissecting microscope and placed in labeled vials. Ten percent of the samples were resorted for quality assurance purposes. All ichthyoplankton were sorted from each sample, but because of the number of shellfish in the samples, a subsampling routine was adopted (Klemm et al, 1990). After the ichthyoplankton were removed from the sample, the remaining shellfish/detritus were split so that approximately 100 shellfish were sorted from a subsample. The taxonomists then

identified the shellfish specimens in the subsample and extrapolated the counts for the entire sample.
Sorted specimen were enumerated and identified with the aid of dissecting microscopes equipped with polarizing lenses. Characters used to describe early life stages of fishes (e.g., pigmentation patterns) are qualitative, rather subjective, and change as early development progresses. Quantitative characters such as myomere counts often show considerable overlap among species and can vary geographically and temporally for a given species (Bosley and Connor 1984). Thus, identifications were made to the lowest possible taxon, which for larval fish, could be to the species level, but often to the genus level (e.g., *Alosa*). "Type" identifications were made when characters of a specimen agree with a taxon to which it was assigned, but the taxonomist cannot be 100 % certain that it in fact it is that taxon. Thus, a "type" designation may not be the taxon indicated, but rather a taxon that shares many of the same larval characteristics with that taxon. Fish eggs typically cannot be identified to species or genus, but Alewife, Alewife type, unidentified, and Catostomid eggs were identified (Section 4.4.1).

Ichthyoplankton identifications were made using applicable references and taxonomic keys (e.g., Auer 1982, Wallus et al. 1990, Kay et al. 1994, Simon and Wallus 2003 and 2006, and Wallus and Simon 2006 and 2008). Life stages of fish were categorized as egg, yolk-sac larvae, post yolk-sac larvae, and juveniles. A voucher series was compiled and verified by noted ichthyoplankton expert and author Robert Wallus.

EPA has not defined "shellfish" in either the Phase II or existing facilities rules. The term is generally understood to include organisms used for human consumption such as shrimp, crayfish, and clams. Although EPA has not provided a definition, shellfish for this study included crayfish, amphipods, and *Mysis* sp. to be consistent with the position WDNR has taken regarding what constitutes shellfish in Lake Michigan. Invertebrate taxonomic keys used included Balcer et al. (1984), Page (1985), and Smith (2001).

The final Rule also requires "*identification of data representing both motile and non-motile life-stages of organisms*". Ichthyoplankton were categorized as eggs, yolk-sac larvae, post yolk-sac larvae, larvae, juvenile, or adult as follows:

- Fish eggs typically cannot be identified and the clear majority of them are usually reported as unidentified; however, an attempt was made to provide some level of taxonomic resolution. Fish eggs are non-motile and were classified as viable or non-viable.
- Yolk-sac larvae (non-motile to motile)—Phase of development from the moment of hatching to complete absorption of the yolk.
- Post yolk-sac larvae (motile)—Phase of development from complete absorption of yolk to the development of the full complement of adult fin rays and absorption of finfold.
- Larvae (motile)—Yolk-sac and/or post yolk-sac larvae that could not be differentiated due to damage.
- Juvenile (motile)—Complete fin ray development and finfold absorption.
- Adult (motile)—All specimens that are not young-of-the-year or greater than Age 0.

- Not Determined—This category was used when chorion-less embryos could not be readily distinguished from early yolk-sac larvae.

Ichthyoplankton were counted by taxon and life stage. For each sample, up to 20 specimens per taxon and life stage were measured to the nearest 0.1 mm (total lengths and head capsule depth for larvae and diameters for eggs).

Non-Viable eggs: Any eggs declared non-viable (e.g., non-fertilized eggs, eggs enveloped in fungus) were retained but were not included in the extrapolation of densities to annual entrainment estimates.

3.5 QUALITY ASSURANCE/QUALITY CONTROL

The Point Beach entrainment characterization study was managed under a quality assurance/quality control (QA/QC) program responsive to the final Rule regarding data used in and generated for the study. Quality Assurance (QA) was an integrated system of management activities that involved planning, implementation, assessment, reporting, and quality improvement to ensure that data were of the type and quality necessary for application to their intended use. Quality control (QC) was the system of activities that measured the QA program activities to verify that they met project specifications. In addition to requiring QA/QC procedures, the Rule set some objectives for data quality by stating that the sampling and analytical methods must have been appropriate for a quantitative survey.

The plant-specific study plan that were prepared met the intent of EA's Corporate Quality Assurance Plan (EA 2015), in that is a site-specific document that presented the study design, methodologies, and guidance from sample collection and processing through data analysis and reporting, as well as the QA/QC activities and health and safety concerns.

A Standard Operating Procedures (SOP) manual was established prior to collecting entrainment samples (EA 2017). The study plan formed the basis of the SOP, which was augmented by the addition of project-specific checklists, datasheets, and forms. The SOP also provided a more detailed approach for mobilization, communication, sample collection, sample processing and identification, data management, QA/QC procedures and documentation, and health and safety. The SOP was written in a concise, step-by-step, easy-to-read format. Information was conveyed clearly and explicitly to remove doubt as to what was required.

3.5.1 Ichthyoplankton Nets and Buckets

Upon receipt from the manufacturer, ichthyoplankton nets and cod-end buckets were visually inspected for obvious flaws and conformance with the specifications on the procurement document. If the mesh size of each item was not stamped on the net at time of receipt, the inspector wrote this number in a clearly visible area. The nets and cod-end buckets were inspected for holes or tears before each use. Defects identified were repaired or the net was discarded and replaced.

3.5.2 Signet 8150 Flow Totalizer

The Signet 8150 Flow Totalizer meters are calibrated by the manufacturer annually and provides a Certificate of Calibration.

3.5.3 Temperature

Water temperatures were measured with a Precision Plus thermometer that was factory calibrated and cross-checked with an NBS-traceable thermometer.

3.5.4 Field Sampling

All field crew members were required to read and have a copy of the SOP.

3.5.5 Laboratory Sorting

Ten percent of each sorter's samples were re-sorted by a different sorter. If resorting found less than 90% of the ichthyoplankton that were originally found, all the samples the original analyst had sorted since their last sorting efficiency test, were re-sorted until at least 90 % efficiency was achieved. Re-sorts were documented and maintained in the project file.

3.5.6 Data Management

Hard copy field and laboratory data sheets were entered into a Microsoft Access database. Access queries were to be used to create proof sets that were double checked against the hard copy field and laboratory data sheets. This process was documented on a data processing log sheet and kept as part of the project file. Only documented Access queries were used to generate tabular summaries that imported into other Microsoft Office products to produce tables and figures for the report.

3.5.7 Data Analysis

Tabular summaries of the total numbers, densities (number per $100m^3$), and relative abundance by species or taxon and life stage were generated for: 1) the study; 2) each sampling event; 3) and both diel periods (day and night). Plant-supplied operating data were summarized on a per-event basis and cooling water volumes were summarized on a daily and weekly basis. Mean, minimum, and maximum water temperatures were calculated for each sampling event. Tabular and graphical summaries were prepared that compared the diel densities of commonly entrained ichthyoplankton among sampling events. The diel densities were expanded based on cooling water volume to yield extrapolation period estimates for each sampling period and the extrapolation period estimates were summed to annual estimates.

3.5.8 Length Measurements

For each sample, up to 20 specimens per taxon and life stage were measured to the nearest 0.1 millimeter (mm) (total lengths and head capsule depth for larvae and diameters for eggs). Ichthyoplankton were measured using a dissecting scope equipped with a polarizing lens and

ocular micrometer. Measurements of two eggs and 70 juveniles and larvae were made during the study. Measurements for dominant taxa are reported as ranges and medians by life stage.

3.5.9 Ichthyoplankton Density

Ichthyoplankton density is defined as the number of specimens in the sample divided by the volume of water sampled. The number of specimens of a given taxon collected was divided by the volume sampled and yielded an event-, diel period-, and taxon-specific density. Calculation of diel densities were based on the number of specimens of a given taxon collected during a diel period divided by the total volume sampled during that period, yielding an overall density that is specific to an event, diel period and taxon.

$$\frac{N_{eps}}{V_{eps}} = D_{eps}$$

Equation 1
Calculation of diel period specific densities

Where:
N = number of specimens
V = volume sampled
D = density

For each:
e = event
p = diel period
s = taxon

3.5.10 Calculation of Extrapolation Period Cooling Water Flow

The study assumed that ichthyoplankton density data from each event was representative for a given period. These periods (termed extrapolation periods) were generally two weeks in length, reflective of the fact that samples were collected at biweekly intervals.

For determination of diel cooling water flows for each extrapolation period, daily cooling water withdrawal data were obtained. Data were separated into four six-hour segments that the entrainment samples were collected from. Total diel cooling water withdrawal for each extrapolation period was obtained from summing the flows associated with the days within the extrapolation period.

Cooling water volume (V) for a given extrapolation period (x) and diel period (p) (V_{xp}) can be calculated:

$$\sum_{i=1}^{n} v_{ip} = V_{xp}$$

Equation 2
Calculation of cooling water volume per extrapolation and diel periods

Where:
v = diel cooling water volume

For each:
i = day within extrapolation period x
n = number of days within extrapolation period x
p = diel period

3.5.11 Calculation of Annual Entrainment Estimates (100% mortality)

Diel densities were expanded based on cooling water volume to yield extrapolation period estimates and the extrapolation period estimates were summed to annual estimates.

The entrainment estimate (Y) for a given taxon (s), extrapolation period (x), and diel period (p) (Y_{sxp}) can be calculated:

$$\boldsymbol{D_{eps} \times V_{xp} = Y_{sxp}}$$

Equation 3
Calculation of taxon and extrapolation period specific entrainment estimates.

The annual estimate of entrainment for a given taxon is the sum of all extrapolation period estimates over the four diel periods.

4. RESULTS

4.1 COOLING WATER USE

Hourly cooling water flows were obtained from Point Beach for the 1 April - 30 September 2017 (Figure 4-1). Daily cooling water flow during that period ranged from 367.9 MGD to 1,110.8 MGD and averaged 1,044.3 MGD. The plant was on online throughout the study and daily inflows during the 13 sampling events ranged from 910.8 MGD during the initial sampling event in April to 1,100.8 MGD during the final seven sampling events. Cooling water use averaged 84% of design capacity during the April-September 2017 study period and 87% during the 13 sample events.

Water use during the April-September entrainment period was near capacity in 2006 and 2017 except in early April 2017 when the plant had restarted following a maintenance outage (Figure 4-1). Average intake flows (973.1 MGD) during the April-September 2006 entrainment study were 4% lower than in 2017.

4.2 EXTRAPOLATION PERIODS AND ASSOCIATED WATER VOLUMES

Based on the frequency of sampling events, 14-day extrapolation periods were defined for 12 of the 13 sampling events (Table 4-1). A 15-day extrapolation period was assigned to the initial sampling event to extend the extrapolation period to 1 April so that the full 183-day period from 1 April - 30 September was considered for the 2017 entrainment estimates. Daily cooling water withdrawn was summed through each extrapolation period to provide total volumes of water withdrawn by extrapolation period and diel period. These volumes of water were multiplied by specimen densities during the associated sampling events to obtain entrainment estimates.

4.3 WATER TEMPERATURES

Water temperature ranged from 40.5 °F to 71.8 °F during the April - September study (Table 4-2). Temperatures warmed gradually through May and then declined after the first week of June to temperatures near 50°F in late June and early July (Figure 4-2). Mean temperatures peaked from late July through mid-August, and then declined through September.

Water temperatures during the diel sampling schedule varied by an average of 2.8°F with the greatest differences occurring in April, early July, and late August when temperature during the four sampling periods varied by 4.5°F to 5.8°F (Table 4-2). Temperatures were consistently highest during the 1200-1800 and 1800-0000 hour sampling periods.

Comparison of daily intake temperatures recorded at Point Beach in 2006 and 2017 shows that temperatures followed similar seasonal trends both years, but mean temperatures from 1 April - 30 September 2017 (55.3 °F) were higher than the same period in 2006 (51.8 °F). That difference was due to much warmer temperatures in July 2017 that averaged 10.8 °F higher than in July 2006 (Figure 4-3). The reverse was the case for August when water temperatures were warmer in 2006 than in 2017.

4.4 ENTRAINMENT RESULTS

4.4.1 Species Composition and Relative Abundance

A total of 32,477 organisms representing five shellfish taxa and five ichthyoplankton taxa was collected during the 2017 entrainment study (Table 4-3). All but 72 organisms were shellfish as defined by WDNR, primarily non-native (*Echinogammarus ischnus*) and native amphipods (*Gammarus* sp.), that collectively accounted for more than 99% of the entrained shellfish. A single native opossum shrimp (*Mysis diluviana)* was collected and the non-native shrimp (*Hemimysis anomala*) accounted for <1.0% of the entrained shellfish (Table 4-3). Native *Gammarus* sp. accounted for essentially all the entrained shellfish in 2006 (EA 2007).

Dominance of non-native shellfish in 2017 is consistent with documented changes in Lake Michigan. *Echinogammarus ischnus* was reported from Lake Michigan in 1998 (Nalepa et al. 2001) and has become one of the most abundant non-dreissenid benthic invertebrates in Lake Michigan, where it has locally displaced native *Gammarus* sp. (Dermott et al. 1998, Nalepa et al. 2001). The occurrence of *Echinogammarus ischnus* and *Gammarus* sp. in the entrainment samples likely represents colonization on the offshore intake crib and/or the intake forebay because of the availability of rocky substrates at those locations as was shown in the comparison of ambient and entrainment densities during the Phase II study at Point Beach (EA 2007).

A total of 15 ichthyoplankton taxa/life stage groups were encountered in the 2017 entrainment samples (Table 4-3). The most abundant ichthyoplankton taxa were Rainbow Smelt (41.6% of the total), followed Burbot (26.4%), Alewife (11.1%), and Round Goby (8.3%). About 3% were unidentified fish eggs and 7% were unidentified larvae. Fewer taxa/life stage groups were collected in 2017 than in 2006. Nineteen taxa/life stage groups occurred in the 2006 entrainment samples (Table 4-4). As in 2006, Rainbow Smelt were the most abundant in 2017 (42%). Alewife type eggs (18%) ranked second in 2006, but were not collected in 2017. Four taxa/life stage groups accounted for 11% of the remaining collection in 2006. Only a single Burbot was collected in 2006 compared to 19 in 2017 (Table 4-4). Most taxa that occurred only in 2006 were represented by single specimens. Round Goby were not entrained in 2006, but were entrained in low numbers in 2017. Juvenile and adult Round Goby were impinged in low numbers during Phase II impingement mortality study at Point Beach (EA 2007).

Entrained taxa represented fish common in Lake Michigan based on historical data collected at Point Beach from April-October 1975 (WEPCO 1976) and from April-September 2006 (EA 2007). A total of 91 larval fish occurred in the entrainment samples collected in the 1975 study with the same fundamental collection system. The 1975 entrainment samples contained 57 Rainbow Smelt (62.6% of the larvae), 17 Alewife larvae (18.7%), 15 Sculpin (16.5%), and two Longnose Sucker (2.2%). Alewife eggs (203) were the only fish eggs collected during the 1975 study. The 1975 results were like the 2006 results discussed above when 127 specimens were collected. The lower number collected in 2017 reflects the reduced number of samples collected.

The relative abundance of early life stages of Rainbow Smelt and Alewife were similar between studies, although Alewife eggs were more abundant in 2006 than in 1975 and were not collected

in 2017. Samples from the 2006 study contained more taxa than were reported in either 1975 or 2017, which included Common Carp, Burbot, unidentified Stickleback, *Lepomis*, and several unidentified taxa groups such as Coregoninae, Cyprinids, and Catostomids.

The low number of taxa in the entrainment samples relative to the number of fish species known to occur in Lake Michigan and the number of species (40) impinged on the Point Beach traveling screens (EA 2007) is typical of entrainment samples. Differences among species regarding spawning characteristics and larval behavior following hatching results in variable susceptibility of ichthyoplankton to entrainment. Historical entrainment studies have demonstrated that it is not unusual to have five to 10 taxa comprise ≥90% of entrainment (EPRI 2005), as was the case in the current study.

Taxonomic identifications were made to the lowest possible level based on qualitative characters that change as early development progresses (e.g., pigmentation patterns) or exhibit considerable overlap among species (e.g., myomere counts) and can vary geographically and temporally for a given species (Bosley and Connor 1984).

4.4.2 Size Distributions

4.4.2.1 Shellfish

The total length of 69 shellfish was measured, primarily *Echinogammarus ischnus* and *Gammarus* sp. (Table 4-5). Total shellfish lengths were taken from the tip of the rostrum to the end of uropod III of representative specimens. Total length ranged from 4.7 mm to 12 mm with mean lengths of 7.3 to 10.3 mm. Measurements of shellfish were not initially planned, but were added to the program. A limited number were measured because the shape of the preserved specimens made it difficult to get accurate lengths.

Measured lengths of the two most abundant shellfish were compared to ranges reported in the literature. *Echinogammarus ischnus* measured during the study ranged from 5.6 mm to 12.0 mm (Table 4-5), which is comparable to the maximum reported lengths of 8 to 11 mm reported for the species.[4] *Gammarus* sp. measured during the study ranged from 4.7 mm to 10.6 mm, which is similar to the 5 mm to 14 mm range given for *Gammarus fasciatus*.[5]

4.4.2.2 Ichthyoplankton

The lengths of larval and juveniles, egg diameters, and head capsule depths (HCD) of representative specimens were measured during the 2017 program (Table 4-5). Only two eggs were collected during the study, both were 1.0 mm in diameter. Lengths of specimens classified as larvae were not measured because those specimens were damaged, which prevented establishing life stages.

[4] https://nas.er.usgs.gov/queries/greatlakes/FactSheet.aspx?SpeciesID=23
[5] http://animaldiversity.org/accounts/Gammarus_fasciatus/

Head capsule depths of 39 specimens were measured representing primarily post yolk-sac Rainbow Smelt and yolk-sac Burbot (Table 4-5). Head capsule depths ranged from 0.5 mm (post yolk-sac Rainbow Smelt) to 19.0 mm (adult Alewife that was 87 mm in length). The length of measured ichthyoplankton ranged from 3.9 to 88 mm and averaged 34 mm. The mean length was 12.9 mm excluding the three adult specimens (Table 4-5).

The existing facilities Rule requires evaluation of fine mesh screens of 2.0 mm or less to assess the potential to reduce entrainment losses. The diameters of the two eggs collected were 1.0 mm and head capsule depths ranged from 0.5 to 19 mm. Most head capsule depths were ≤2.0 mm, whereas all the larval life stages were >2.0 mm.

Ichthyoplankton were not measured during the 2006 study, but a literature review was conducted that provides a range of egg diameters and larval lengths for taxa that were collected during studies near Point Beach and taxa that were collected during the 2006 study (Table 4-6). Reported egg diameters range from 0.8 mm (Rainbow Smelt and sunfish species) to 4.5 mm (Yellow Perch). Alewife eggs are relatively small (0.9 - 1.2 mm), as are Rainbow Smelt eggs (0.8 – 1.3 mm). Yellow Perch eggs are somewhat larger (1.7 – 4.5 mm) and are spawned as gelatinous strands. The length of yolk-sac larvae is more variable than egg diameters. Of the 24 taxa listed in Table 4-6, yolk-sac larvae of the sunfish species are the smallest (2.0 – 5.0 mm) and yolk-sac Lake Whitefish are the largest (8.8 – 15.0 mm). Yolk-sac larvae develop into post yolk-sac larvae at about 4.0 mm (e.g., Alewife and sunfish species) to 15.0 mm (Bloater). Post yolk-sac Yellow Perch are about 8.0 mm. Development of these taxa to juveniles starts at about 8.0 mm (Slimy Sculpin) to 34 mm (Lake Whitefish). Alewife juveniles are 19.0 – 32.2 mm and juvenile Yellow Perch are about 20.0 – 40.0 mm.

Measurement of head capsule depth (HCD) is common component of entrainment studies under the existing facilities rule because fine mesh evaluations are required and head capsules are the largest non-compressible feature of larvae. It is commonly assumed that HCD could predict larval retention on fine mesh screens. The Rule requires consideration of alternative cooling system technologies, including potential retrofit of fine-mesh (≤2.0-mm) screens to reduce entrainment of early life stages of fish and shellfish. Low entrainment rates of only a few taxa limited the number of measurements that were possible for the 2017 Point Beach study. More data for HCD will likely become available as ongoing studies are completed at other facilities. A mean HCD 0f 0.8 mm for Rainbow Smelt larvae, the most commonly entrained taxa at Point Beach, has been reported (EPRI2010):

Length (mm)				
Mean	**S.D.**	**Min.**	**Max.**	**No. Measured**
6.2	.738	4.4	7.6	94
Head Capsule Depth (mm)				
Mean	**S.D.**	**Min.**	**Max.**	**No. Measured**
0.8	0.270	0.4	1.4	94

4.4.3 Diel and Seasonal Distributions

Entrainment samples at Point Beach were collected during four, 6-hour intervals each 24-hour sampling event (i.e., 0600-1200, 1200-1800, 1800-0000, and 0000-0600 hours) to monitor diel abundance patterns that could influence entrainment estimates. Timing of spawning, egg hatching, and swim up activity of early stage larvae and movements of larger larvae could result in variable densities over any given 24-hour period. At some facilities, diel differences could offer operational options for reducing entrainment at facilities that have the flexibility to adjust pumping rates during periods with peak abundance of ichthyoplankton. Given the nature of Point Beach's operation, diel changes in output are not feasible.

Total shellfish densities were highest in the 1800-0000 hour samples and lowest in the 0600-1200 hour samples (Table 4-7). Higher densities for 1800-0000 hours largely reflect increased abundance of *Echinogammarus ischnus*. Densities of *Gammarus* sp. were similar during the first three sampling periods and lowest in the 0000-0600 hour samples. Total shellfish densities among the four sampling periods ranged from 5,224/1,000 m^3 in the 0600-1200 hour samples to 10,025/1,000 m^3 in the 1800-0000 hours samples (Table 4-7). Shellfish densities were highest during either the 1800-0000 or 0000-0600 hour sampling intervals during 10 of the 13 sampling events (Table 4-8). *Echinogammarus ischnus* was encountered in all samples, whereas *Gammarus* sp. occurred sporadically prior to August and then was reported from all the samples collected through September (Appendix C, Table C-1).

Total ichthyoplankton densities were similar among the four sampling periods, ranging from 11.4 to 15.9/1,000 m^3 (Table 4-7). Combined densities of Rainbow Smelt and Burbot accounted for 50.0% of the density for the 1800-0000 hour sampling period and all the ichthyoplankton in the 0600-1200 hour sampling period. Rainbow Smelt densities were similar between 0600 and 0000 hours (4.6 to 5.3/1,000 m^3) and were highest (7.6/1,000 m^3) after midnight (Table 4-7). Burbot densities averaged highest during the first two sampling periods and were absent from the 0000-0600 hour samples. Ichthyoplankton densities were highest during each of the four diel sampling periods at least twice during the study depending on taxa (Appendix C, Table C-1).

Diel trends were affected by the number of samples without ichthyoplankton (25 of 52), unlike shellfish that occurred in all samples. For example, nine of the 13 samples collected between 0600-1200 hours did not have ichthyoplankton compared to four to six samples during the other three sampling periods (Table 4-9). Total ichthyoplankton densities were highest in the 1200-1800 and 1800-0000 hour samples. Species contributing to higher diel densities included Round Goby, Rainbow Smelt, Burbot, and Alewife. Round Goby was collected in April and was absent until August (Appendix C, Table C-1). Rainbow Smelt occurred most frequently, as they were collected during seven of the 13 sampling events, consistently from late April through July. Burbot were collected only during four sampling events, in May and late June/early July. Alewife were collected in late May and consistently from late July into September.

4.4.4 Entrainment Estimates

4.4.4.1 Shellfish

Estimated annual entrainment of shellfish was calculated for each taxon by event and diel period using methods detailed in Sections 3.5.10 and 3.5.11. Total estimated shellfish entrainment for each taxon by sampling event are given in Appendix C, Table C-2. Estimated shellfish entrainment at Point Beach in 2017 totaled 4.7 billion with *Echinogammarus ischnus* and *Gammarus* sp. accounting for all but 0.3% of the total estimate (Table 4-10). That estimate included primarily amphipods, the invasive *Echinogammarus ischnus* and native *Gammarus* sp.

Entrainment of amphipods varied widely between the three annual estimates available for Point Beach (Table 4-10). The 1975 estimate, when only native shellfish were entrained, was a fraction of the 2006 and 2017 estimates. *Gammarus* sp. was absent from the 1975 samples, but extremely abundant in 2006, but less so in 2017 when the non-native *Echinogammarus ischnus* accounted for 72% of the total estimate. The total 2017 shellfish estimate (4.7 billion) was similar to the 2006 estimate (4.1 billion), except that native *Gammarus* sp. accounted for virtually all the shellfish in 2006 and the non-natives that dominated the 2017 estimated were not reported in 2006.

Entrainment of shellfish varied widely between the three entrainment studies conducted at Point Beach in terms of species composition and entrainment estimates. *Gammarus* sp. was extremely abundant in the 2006 samples, but absent from the 1975 samples (WEPCO 1976) and much less abundant in 2017 (Table 4-10). In contrast, the amphipod *Diporeia* sp. (previously classified as *Pontiporeia sp*, which was the nomenclature used in 1975) was very abundant in the 1975 entrainment samples, but absent from the 2006 and 2017 samples. *Diporeia* sp. were historically the dominant benthic macroinvertebrate in the offshore waters of the Great Lakes; however, population declines have been documented throughout the Great Lakes and vast areas of Lake Michigan, Huron, Erie, and Ontario are now devoid of *Diporeia* sp. (Nalepa 2006). Its decline has been attributed to the spread of dreissenid mussels, but the exact mechanism is uncertain (Nalepa et al. 2006). *Mysis* sp. were entrained during all three studies, but were much more abundant in 1975 (10.2 million) than in 2006 (62,838) or 2017 (141,929).

Diel entrainment estimates for shellfish totaled from ~1.0 billion during the 0600-1200 hour sampling period to 1.4 billion during the 1800-0000 sampling period (Table 4-11). Overall, diel entrainment was consistent among the diel sampling periods reflecting in part, stable intake flows during each sampling period. At the taxa level, about 60% of *Echinogammarus ischnus* were entrained between 1800 and 0600 hours and 62% of the *Gammarus* sp. were entrained between 1200 and 0000 hours (Table 4-7). *Hemimysis anomala* was only entrained between 1800 and 0600 hours. Diel estimates among the four sampling events varied widely during the study (Appendix C, Table C-2), but estimates were consistently highest for the 1800-0000 hour (5 times) or the 0000-0600 hour (6 times) extrapolation periods (Table 4-8). Estimates were highest in the 0600-1200 hour samples twice. Although the 1200-1800 hour estimates were not higher than the other periods, its total estimate was similar to those for all except the 1800-0000 hour extrapolation period, which had the highest total estimate.

4.4.4.2 Ichthyoplankton

Estimated ichthyoplankton entrainment was calculated for each taxon and life stage by event and diel period using the same methods used for shellfish. Total estimated entrainment totaled approximately 10.1 million ichthyoplankton in 2017 (Table 4-12). The estimates were dominated by Rainbow Smelt (42.5%), Burbot (26.5%), Alewife (11.3%) and Round Goby (7.1%). By life stage, Rainbow Smelt post yolk-sac and larvae and yolk-sac Burbot larvae accounted for 56% of the total estimate.

The total 2017 estimate (10.1 million) was very similar to the 2006 estimate (10.7 million), both of which were about 60% higher than in 1975 (Table 4-13). The 1975 estimate was dominated by Alewife eggs and larvae (75%) and Rainbow Smelt (19%). In 2006, both taxa were again dominant, with early life stages of Alewife (including eggs identified as Alewife type) and Rainbow Smelt collectively accounting for 83% of the total estimate. Rainbow Smelt remained a dominant species in 2017 (42.5%), but Alewife accounted for only 11% in 2017 and Burbot increased from <3.0% of the 2006 estimate to 26.5% in 2017. The invasive Round Goby, which was not entrained in 1975 or 2006, accounted for 7% of the 2017 estimate.

Game and food fish were not entrained in 2017, and the game fish, exclusive of Yellow Perch, accounted for <4 % of the 2006 estimate (EA 2007). As a group, forage fish other than Alewife and Rainbow Smelt accounted for about 0.8 million (7.2 %) of the 2006 estimate and rough fish (Common Carp and unidentified catostomid) accounted for only 1.2 % of the 2006 estimate. Taxa/life stage groups that were represented by only one, two or three individuals collectively accounted for 17% of the total study estimate. Taxa that were entrained in low numbers in 2006 were absent from the 2017 samples.

Diel entrainment estimates for ichthyoplankton totaled from ~2.1 million during the 0600-1200 hour sampling period to 3.0 million during the 1200-1800 sampling period (Table 4-14). Overall, diel entrainment was consistent among the diel sampling periods reflecting in part, stable intake flows during each sampling period. Diel estimates among the four sampling events varied widely during the study (Appendix C, Table C-2), as estimates were highest at least twice during each extrapolation period (Table 4-14). Zero estimates occurred for nine of the 13 for the 0600-1200 hour extrapolation periods and four to six times during the other diel periods.

4.4.5 ENTRAINMENT RISKS TO PROTECTED SPECIES

EPA consulted with the U.S. Fish and Wildlife Service (FWS) and the National Marine Fisheries Service (NMFS) under the Endangered Species Act during development of the existing facilities §316(b) Rule. While it was concluded that the rule is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of designated critical habitat, the Rule requires that facilities identify all Federally-listed threatened and endangered (T&E) species and/or designated critical habitat that are, or may be, present "*in the vicinity of impingement and entrainment at the cooling water intake structure*".

Federally-listed fish and other aquatic species are not known to occur in Lake Michigan near Point Beach based on the FWS environmental conservation online system (ECOS) that provides access to the FWS database.[6] Using IPaC, four T&E species are listed for Manitowoc County, Wisconsin.[7]

Common Name	Scientific Name	Status
Northern Long-eared Bat	*Myotis septentrionalis*	Threatened
Rusty Patched Bumble Bee	*Bombus affinis*	Endangered
Pitcher's Thistle	*Cirsium pitcheri*	Threatened
Piping Plover	*Charadrius melodus*	Critical habitat

There is no nexus of these listed species with the Point Beach cooling water intake structure including potential entrainment.

None of the endangered fish and mussel species listed by the WDNR occur at Point Beach. The WDNR list includes 10 fish and 19 mussel species.[8] The WDNR Natural Heritage Inventory includes Redfin Shiner (*Lythrurus umbratilis*) and three mussel species (Slippershell mussel *Alasmidonta viridis,* Monkeyface, *Quadrula metanevra*; and Ellipse *Venustaconcha ellipsiformis*) as threatened in Manitowoc County,[9] but based on these species habitat requirements, none would be expected to occur in Lake Michigan.

[6] https://ecos.fws.gov/ecp/
[7] https://ecos.fws.gov/ipac/location/J63KWIDYORB55JIALDOC7FB6AY/resources
[8] http://dnr.wi.gov/files/PDF/pubs/er/ER001.pdf
[9] http://dnr.wi.gov/topic/NHI/Data.asp?tool=county&mode=detail&county=36

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Figures

Point Beach Entrainment Characterization Study

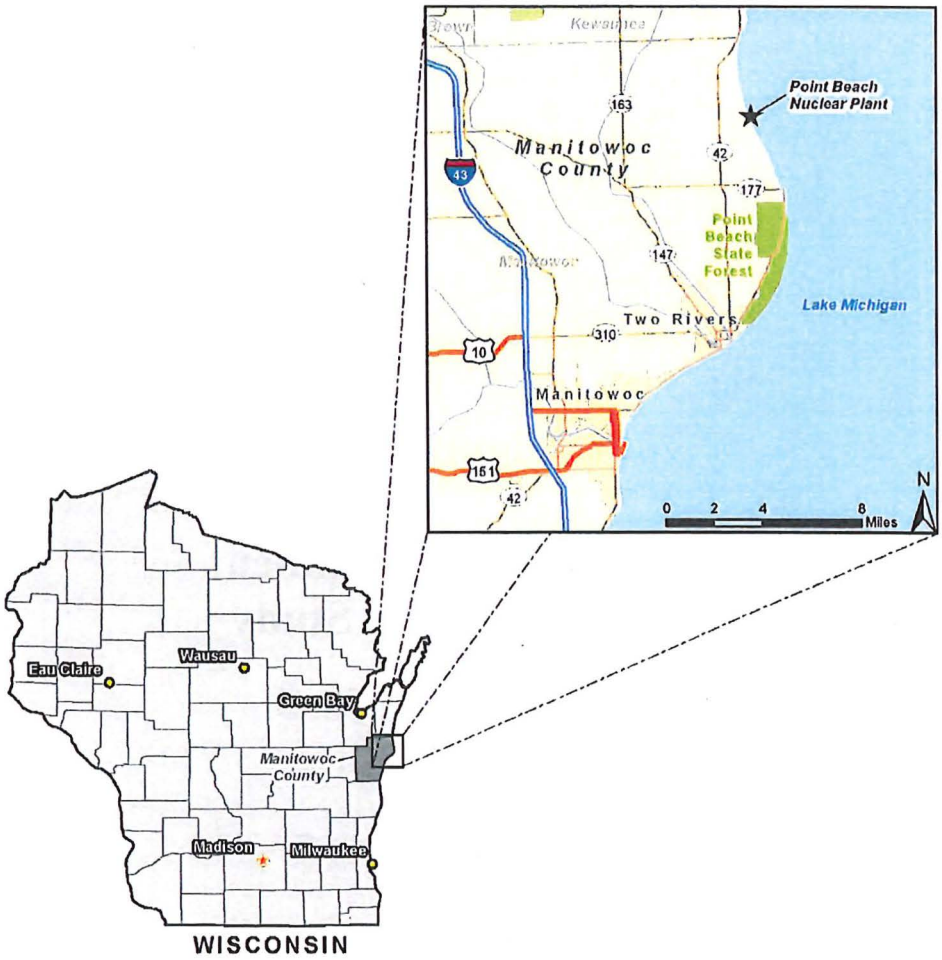
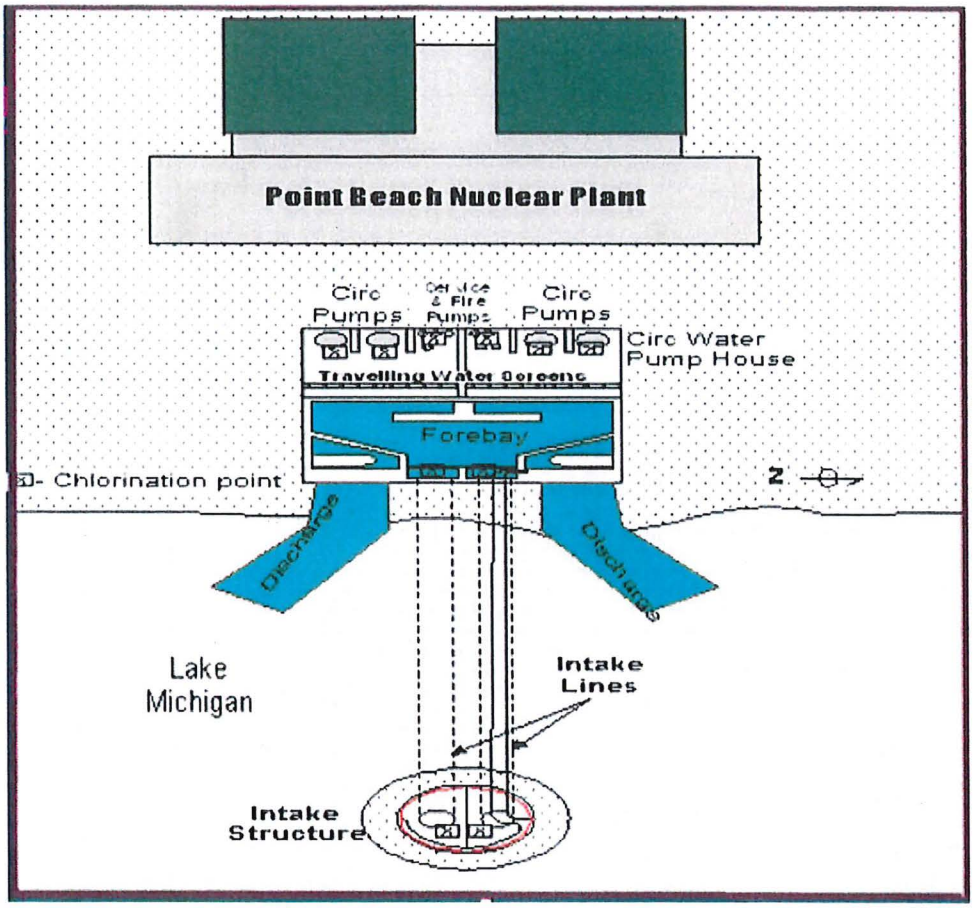


Figure 2-1. General Location Map for Point Beach Nuclear Plant.



Source: Alden Research Laboratory, Inc.

Figure 2-2. General Layout of the Point Beach Nuclear Plant Cooling Water Intake Structure.

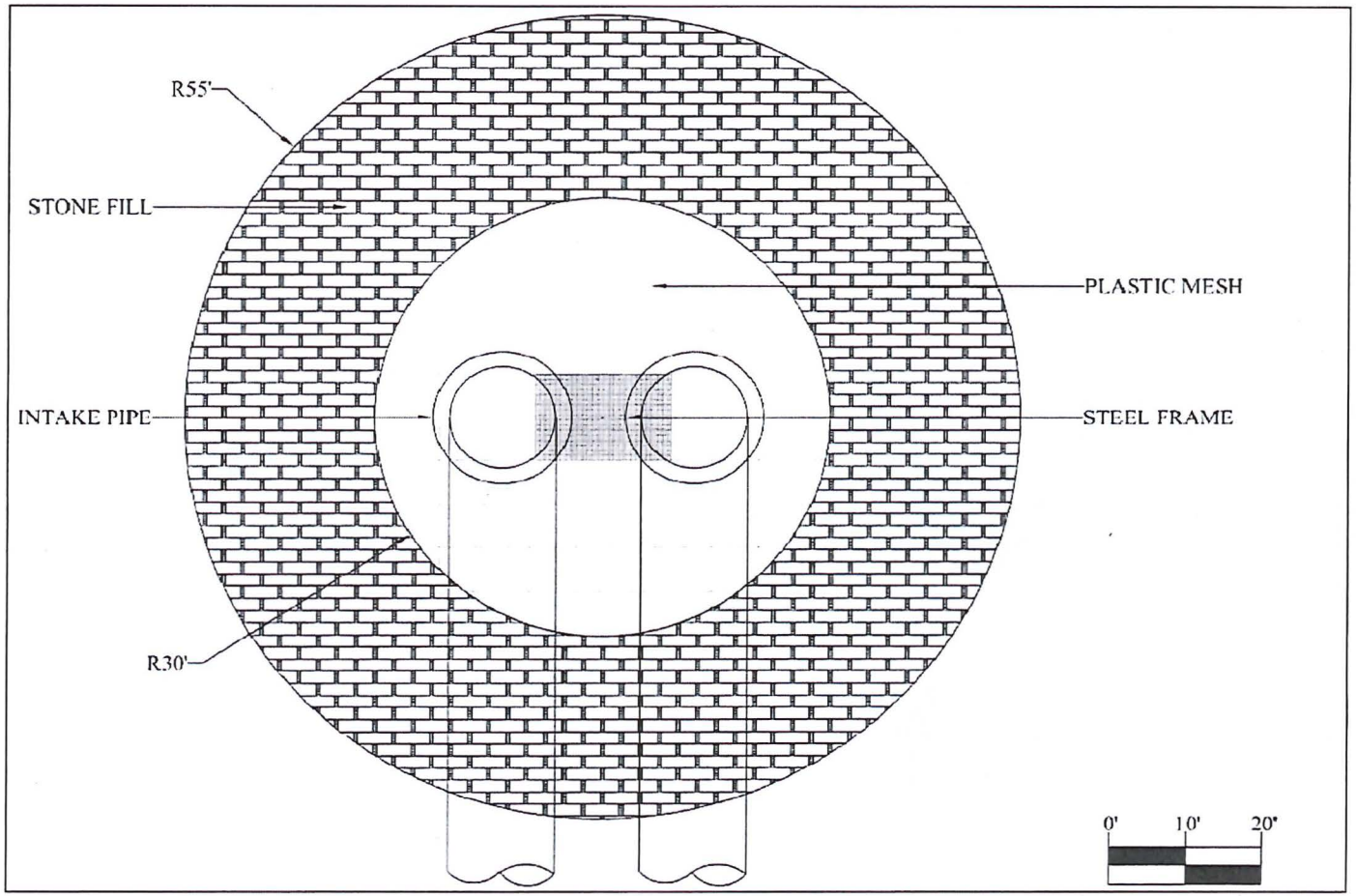


Figure 2-3. Point Beach Nuclear Plant Offshore Intake Crib – Plan View

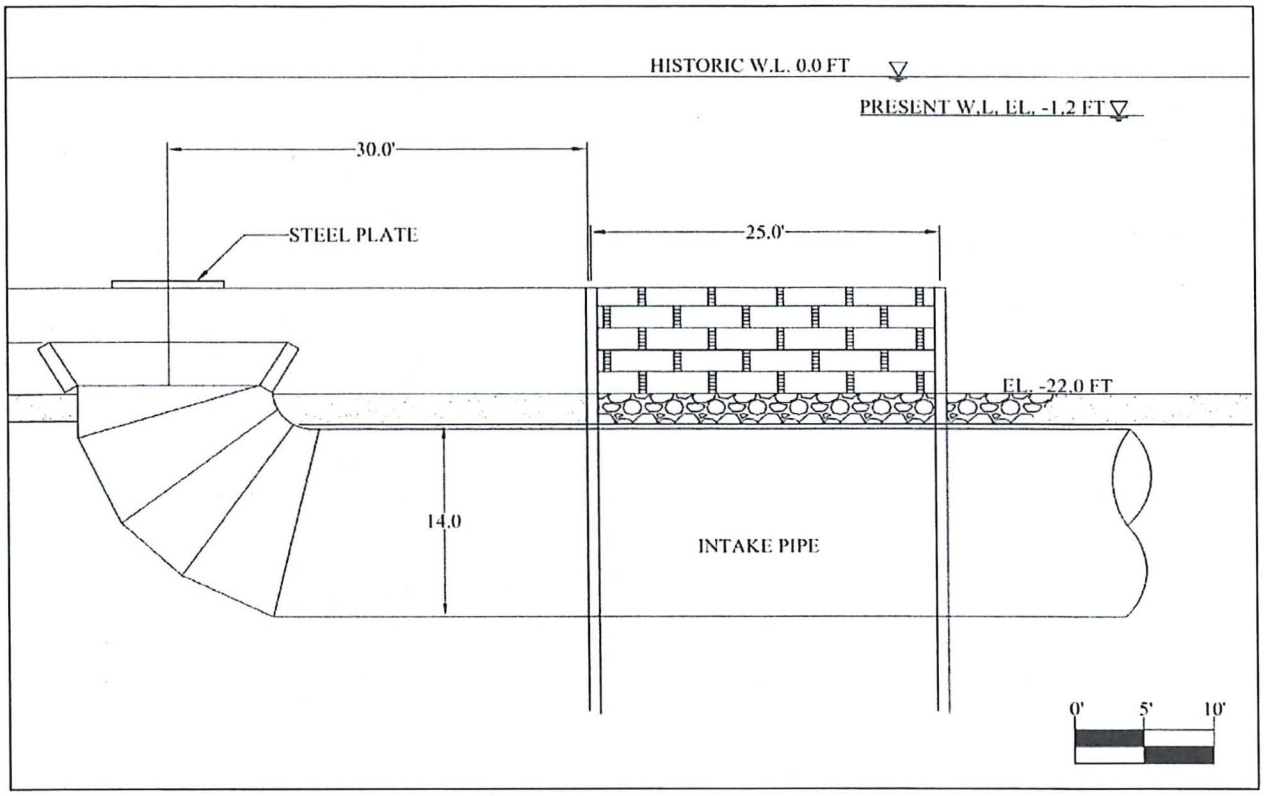


Figure 2-4. Point Beach Nuclear Plant Offshore Intake Crib – Section View

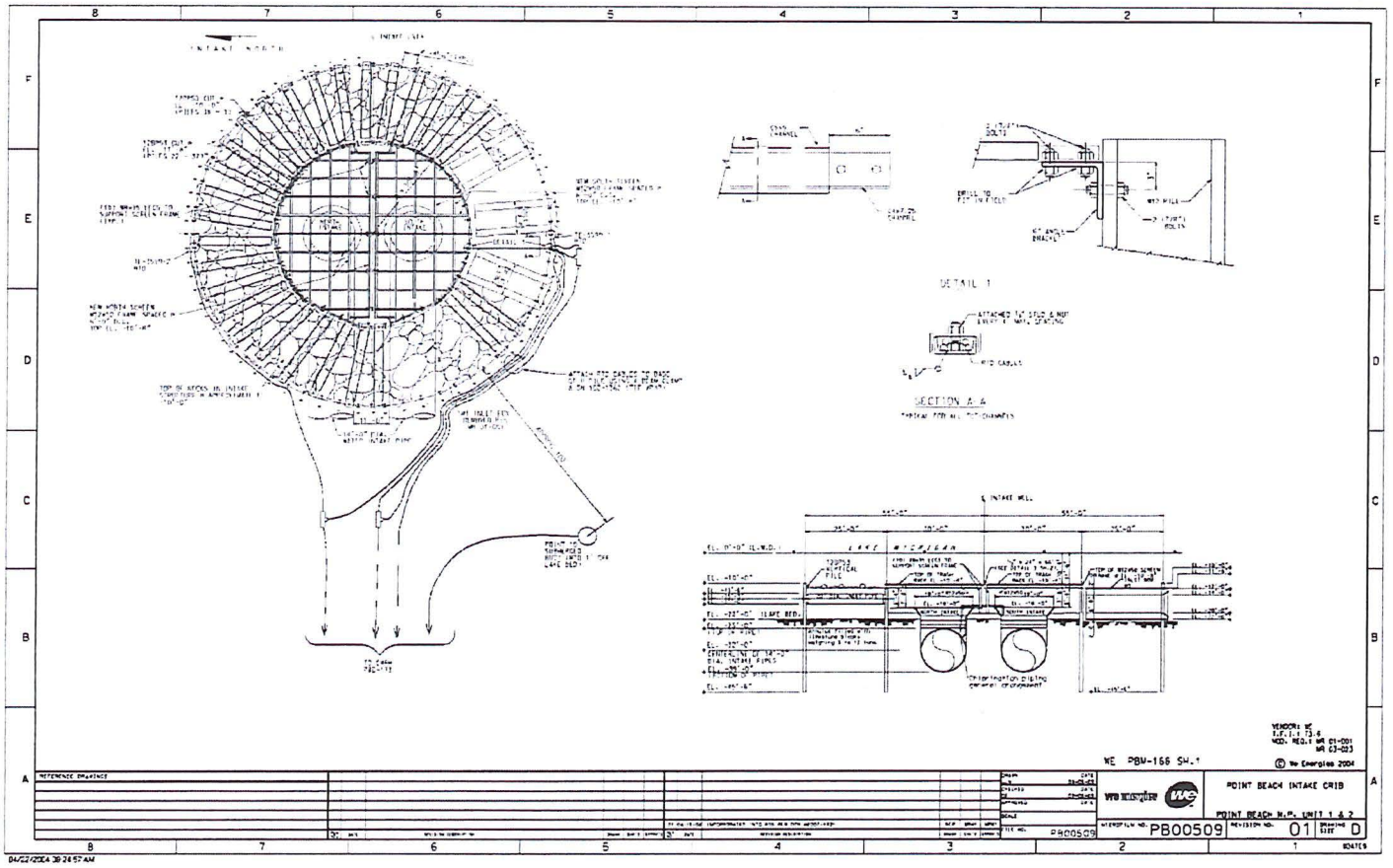
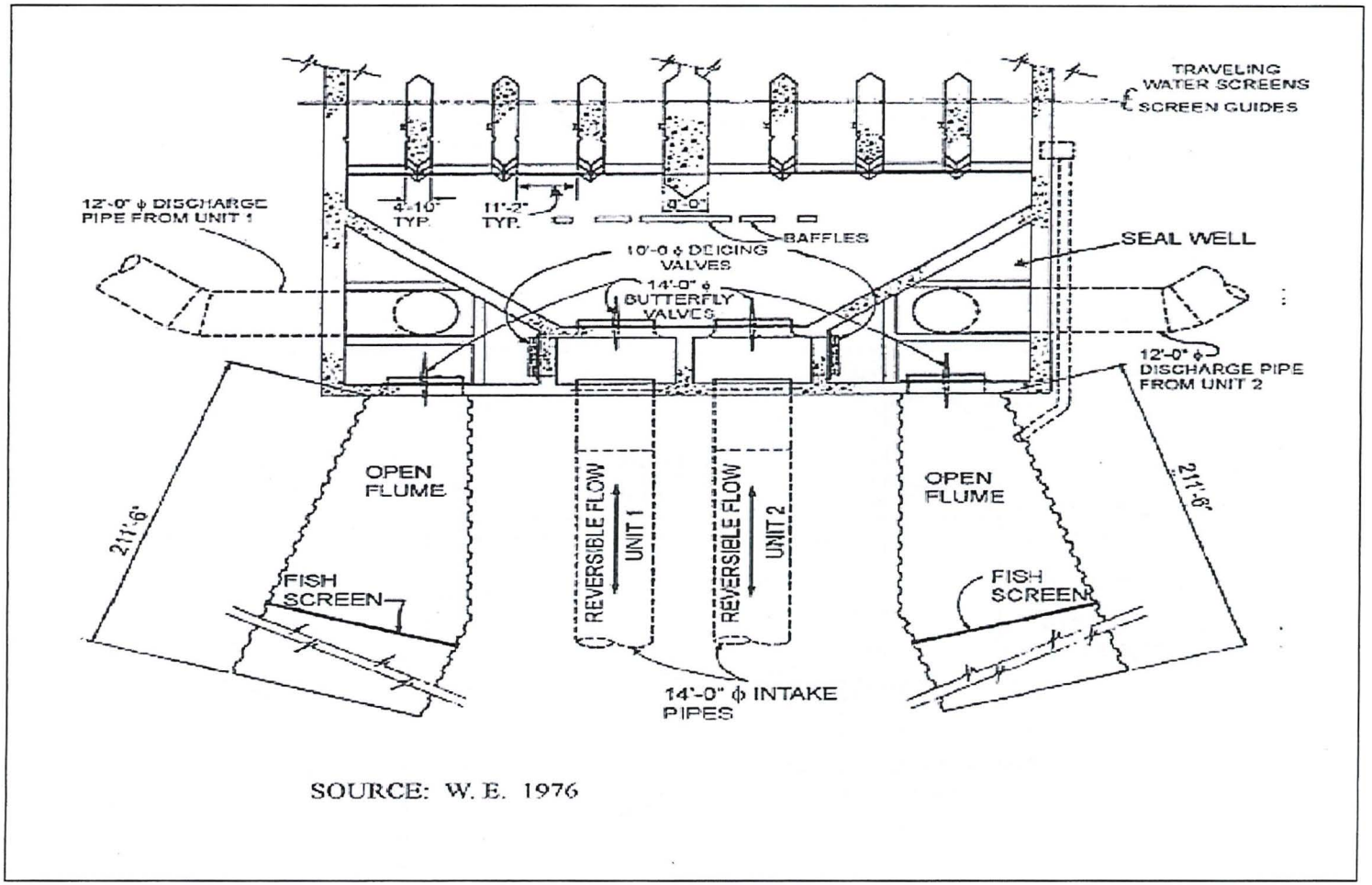


Figure 2-5. Point Beach Nuclear Plant Offshore Intake Crib—Porous Structure.



SOURCE: W. E. 1976

Figure 2-6. Point Beach Nuclear Plant Pumphouse – Plan View.

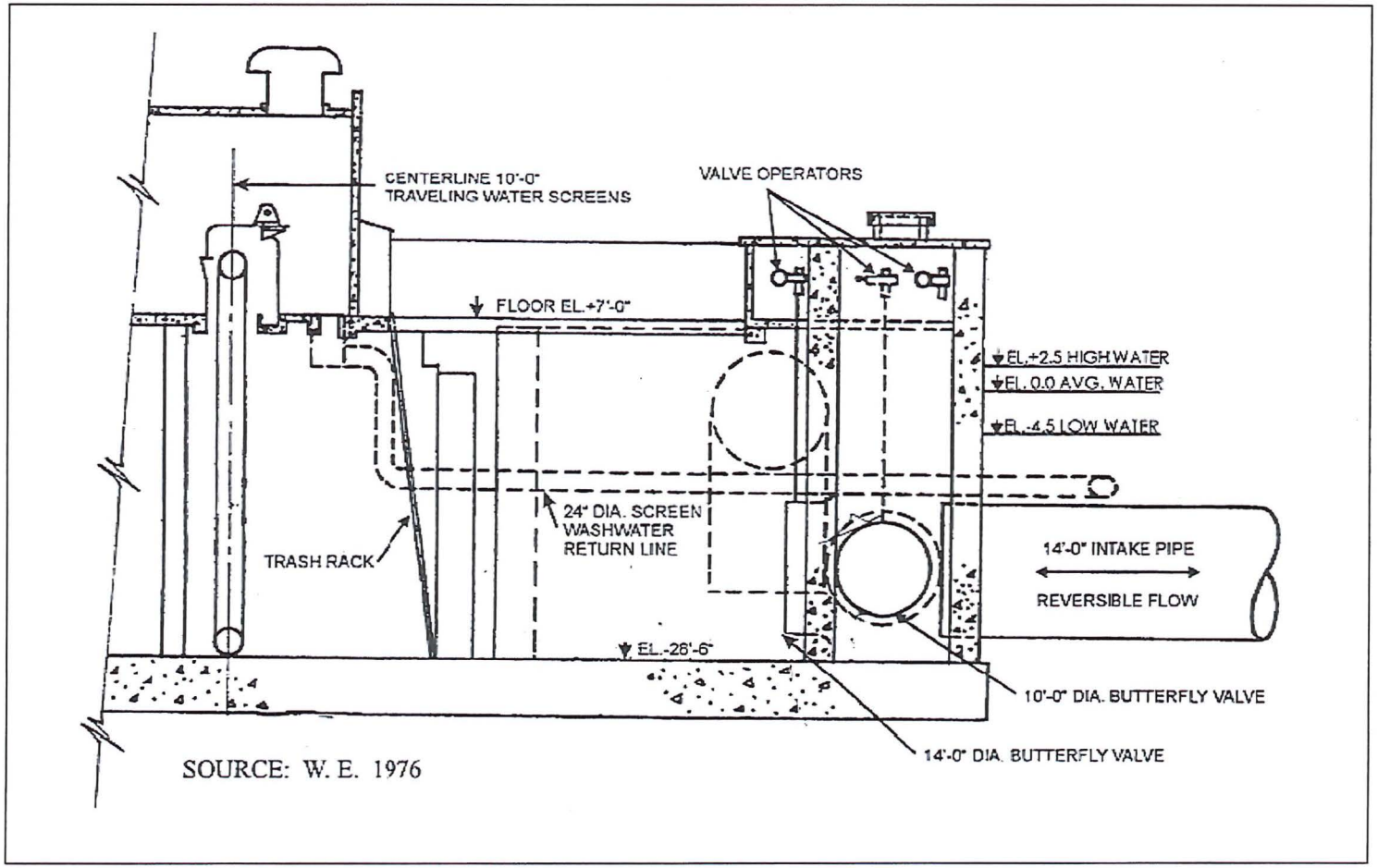


Figure 2-7. Point Beach Nuclear Plant Pumphouse – Section View.

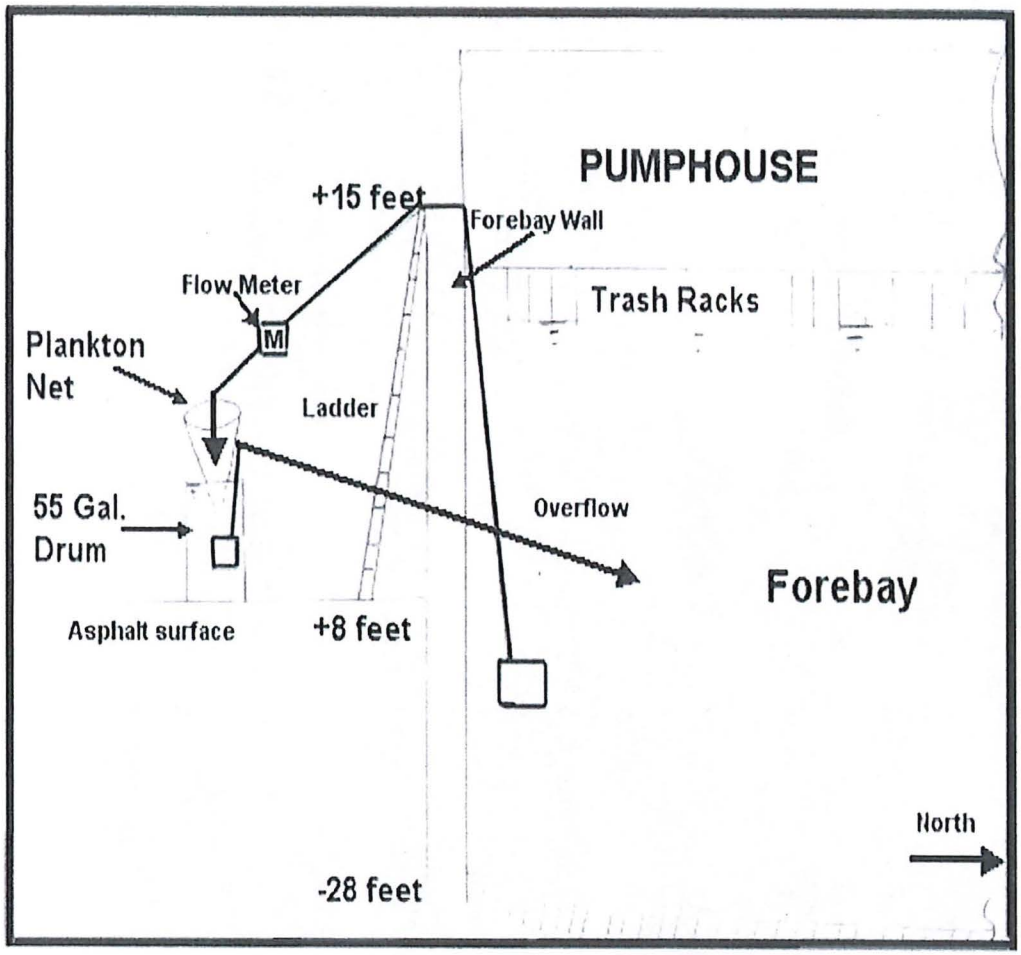


Figure 3-1. Schematic Layout of Entrainment Sampling at Point Beach Nuclear Plant, April through September 2017.

Figure 3-2. Entrainment Sampling Equipment on Scaffolding Alongside Intake Forebay.

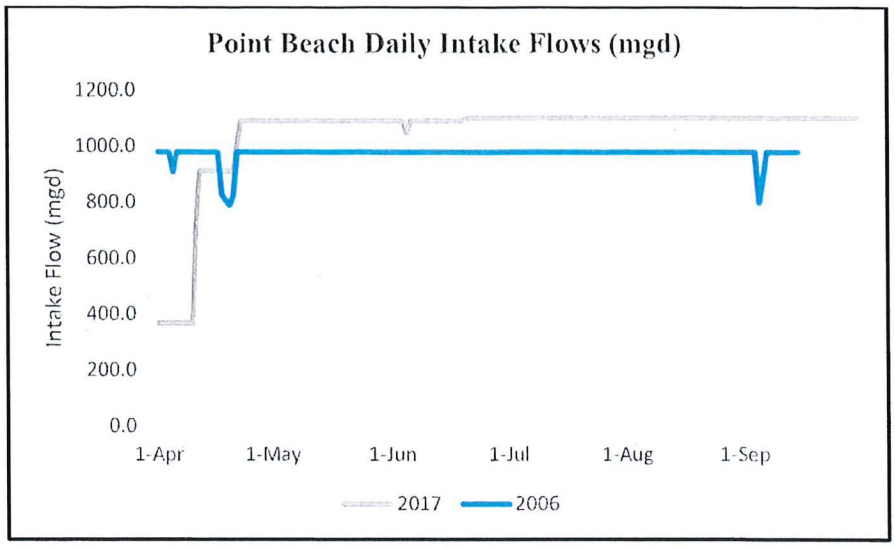


Figure 4-1. Point Beach Daily Intake Flows, 1 April – 30 September 2006 and 2017.

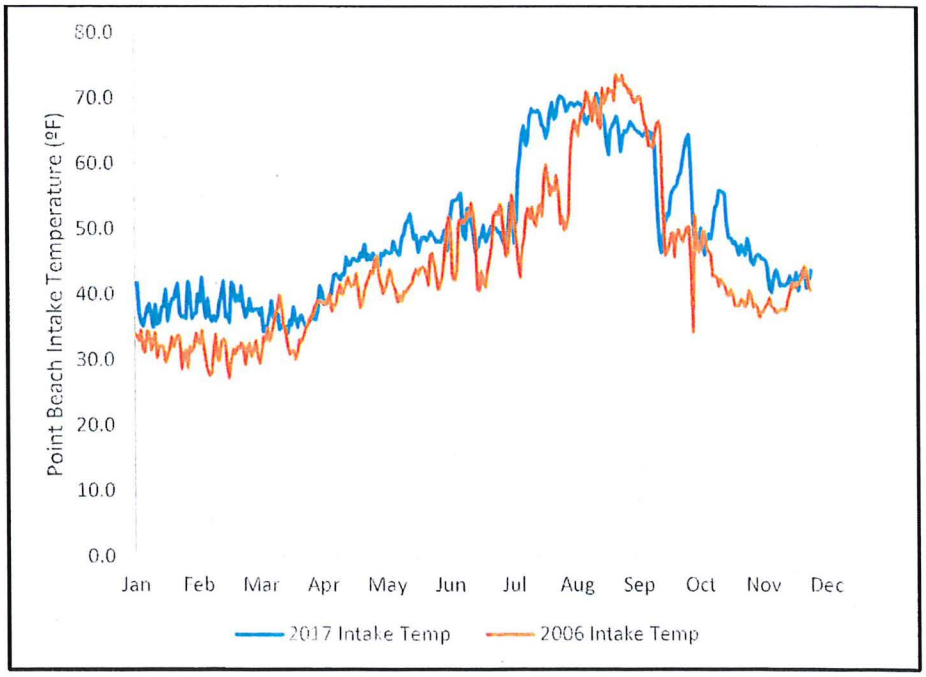


Figure 4-2. Daily Intake Temperatures (°F) at Point Beach, 2006 and 2017.

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Tables

Point Beach Entrainment Characterization Study

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Table 1-1. Checklist of the 316(b) Rule's Requirements for the Entrainment Characterization Study (40 CFR 122.21(r)(9)).

40 CFR 122.21(r)	Quote from the Rule	Summary of Proposal
(9) Entrainment Characterization Study	Entrainment Characterization Study that includes a minimum of two years of entrainment data collection	Data from Phase II implementation and 2017 will be collected in the same fashion. Together they constitute two years of record.
	Study should identify and document the data collection period and frequency	See Section 3.2. Samples were collected biweekly beginning in April and concluding at the end of September. Four samples were collected at six hour intervals during each sample event.
	Document organisms collected to the lowest taxon possible of all life stages of fish and shellfish	See Section 3.4. Fish and shellfish were identified to the lowest taxon possible and the life stage of each was recorded.
	Any species protected under Federal, State, or Tribal law, including threatened or endangered species	Listed species were not expected and none occurred in the 2017 samples.
	Biological data collection must be representative of the entrainment at the intakes subject to this provision	See Section 3.3. Samples were collected from the forebay and, based on the geometry and water velocities, any sampled water is committed to passage through the condensers.
(ii) Biological Entrainment Characterization	Sufficient data to characterize annual, seasonal, and diel variations in entrainment	See Section 3.2. The proposed sample collection periods and frequency are standard for the Great Lakes and will allow for characterization of temporal variations in entrainment rates.
	Characterization may include historical data that are representative of the current operation of the facility and of biological conditions at the site	Historically data on entrainment rates were collected under biological and plant operation conditions that are like those currently encountered. Data collected in 2006 is proposed for use to address part of the 316(b) rule's requirements.
iii) Analysis and Supporting Documentation	Entrainment data to support the facility's calculations must be collected during periods of representative operational flows for the cooling water intake structure, and the flows associated with the data collection must be documented	See Sections 3.3 and 3.5. Samples were collected during representative facility operation. Cooling water flows were recorded during sampling and throughout the year to allow extrapolation of measured organism densities (individuals/volume) to annualized estimates of entrainment rates.
	The owner or operator of the facility must identify and document all assumptions and calculations used to determine the total entrainment for that facility together with all methods and quality assurance/quality control procedures for data collection and data analysis.	See Section 5. Appropriate Quality Assurance/Quality Control measures during the collection, analysis, and reporting of entrainment data. Additional detail on assumptions and calculations will be provided in the Entrainment Characterization Study report.
	The proposed data collection and data analysis methods must be appropriate for a quantitative survey	The applied methods were appropriate for a quantitative study including the goals of the 316(b) existing facilities rule.

Table 3-1. Advantages and Disadvantages of Four Conceptual Locations for Sampling Entrained Organisms (EPRI 2014).

Conceptual Location	Advantages include:	Disadvantages include:
AOI	• No potential for damage to or loss of entrained organisms resulting from passage through the cooling water system. • Frequency of already dead or moribund organisms can be assessed at this location given appropriate sampling techniques. • May be useful to develop estimates of technology efficacy (fractional reduction in entrainment densities).	• Knowledge of AOI required to ensure sampling takes place in appropriate location and depths. • Low water velocities in the AOI may allow avoidance of stationary sampling gear by more motile larval and early juvenile stages. • Potential uncertainties as to whether organisms collected are actually being entrained.
Intake	• No potential for damage to or loss of entrained organisms resulting from passage through the cooling water system. • Frequency of already dead or moribund organisms can be assessed at this location given appropriate sampling techniques. • Samples only organisms that are actually entrained.	• Non-random vertical distribution necessitates depth-stratified sampling and knowledge of vertical distribution of cooling water withdrawals. • Low water velocities associated with many CWISs increase likelihood of active gear avoidance for more motile larval and early juvenile stages.
Condenser	• Sampling equipment very simple and easily deployed if sufficient space is available. • Due to location, stratification issues are removed. • Samples only organisms that are actually entrained.	• Potential damage to organisms during passage through cooling water pumps or valves used to control sampling rates. • Pressures and tap sizes may not be ideal for desired sampling rates.
Discharge	• Certainty that all organisms collected were actually entrained. • Turbulence reduces potential bias resulting from non-random distribution of entrained organisms. • Higher velocities and darkness reduces potential bias from gear avoidance by live organisms.	• Potential loss or damage of organisms passing through cooling water system. • Potential access difficulties. • Potential high-water velocity, causing extrusion or damage if nets are used as the sampling gear. • Potential high-water velocity increases difficulty of stabilizing sampling gear.

Table 3-2. Volume (m^3) of Water Sampled during Entrainment Sampling Events at Point Beach, April-September 2017.

Sampling Date	Diel Period				Trip Total
	0600-1200	1200-1800	1800-0000	0000-0600	
12-13 Apr	100.1	100.4	100.7	103.9	405.1
24-25 Apr	102.5	100.1	101.9	100.1	404.6
8-9 May	100.1	100.1	100.1	100.0	400.2
23-24 May	107.1	104.3	100.2	101.5	413.0
6-7 Jun	100.0	100.1	100.5	100.1	400.8
20-21 Jun	101.0	100.5	106.4	100.0	407.9
6-7 Jul	100.3	100.5	105.3	100.0	406.2
18-19 Jul	100.4	111.9	101.6	100.0	414.0
1-2 Aug	100.0	100.0	103.7	100.1	403.8
15-16 Aug	101.1	100.2	100.0	100.1	401.4
29-30 Aug	102.0	100.1	100.5	100.8	403.3
12-13 Sept	100.2	102.9	100.0	101.5	404.7
26-27 Sept	100.1	102.1	100.0	100.1	402.3

Table 4-1. Entrainment Sampling Dates, Extrapolation Periods, and Associated Intake Flows in Millions of Gallons (MG), Point Beach, April-September 2017.

Trip	Sampling Week	On-Site Dates	Sampling Event Flow (MG)	Extrapolation Period	Extrapolation Flows (MG)
1	9 Apr	12-13 Apr	910.8	1-15 Apr	13,662.0
2	23 Apr	24-25 Apr	1,090.8	16-29 Apr	15,271.2
3	7 May	8-9 May	1,090.8	30 Apr – 13 May	15,271.2
4	21 May	23-24May	1,090.8	14-27 May	15,271.2
5	4 Jun	6-7 Jun	1,068.5	28 May-10 Jun	14,959.0
6	18 Jun	20-21	1,093.5	11-24 Jun	15,309.0
7	2 Jul	6-7 Jul	1,100.8	25 Jun-8 Jul	15,411.2
8	16 Jul	18-19 Jul	1,100.8	9-22 Jul	15,411.2
9	30 Jul	1-2 Aug	1,100.8	23 Jul-5 Aug	15,411.2
10	13Aug	15-16 Aug	1,100.8	6-19 Aug	15,411.2
11	27 Aug	29-30 Aug	1,100.8	20 Aug-2 Sep	15,411.2
12	10 Sep	12-13 Sep	1,100.8	3-16 Sep	15,411.2
13	24 Sep	26-27 Sep	1,100.8	17-30 Sep	15,411.2

Table 4-2. Water Temperatures (°F) During Diel Entrainment Sampling Events, Point Beach, April-September 2017.

Sampling Trip	Diel				Average
	0600-1200	1200-1800	1800-0000	0000-0600	
12-13 Apr	40.5	41.4	46.2	44.2	43.1
24-25 Apr	46.2	44.1	48.7	47.3	46.6
8-9 May	47.3	48.2	48.9	47.3	47.9
23-24 May	48.7	50.0	48.6	48.4	48.9
6-7 Jun	53.6	54.1	54.7	54.9	54.3
20-21 Jun	49.1	49.6	48.7	50.5	49.5
6-7 Jul	48.2	46.8	51.3	47.8	48.5
18-19 Jul	67.6	68.2	68.2	66.4	67.6
1-2 Aug	68.5	66.2	69.6	67.1	67.9
15-16 Aug	68.7	71.8	69.1	70.3	70.0
29-30 Aug	63.0	63.7	67.5	64.4	64.6
12-13 Sept	63.3	64.4	64.2	64.2	64.0
26-27 Sept	58.6	57.7	59.2	58.1	58.4

Note: Field temperatures recorded in °C were converted to °F to be directly comparable with intake temperatures monitored by Point Beach.

Table 4-3. Number, Density, Relative Abundance of Shellfish and Ichthyoplankton Entrained at Point Beach, April-September 2017.

Taxa	Life Stage	Count	Density (#/1,000 m3)	%
Shellfish				
Gammaridae		16	3.0	0.05
Echinogammarus ischnus		23,273	4,418.2	71.66
Gammarus sp.		9,027	1,713.7	27.79
Hemimysis anomala		161	30.5	0.50
Mysis diluviana		1	0.2	0.00
Total Shellfish		32,477	6,165.6	100.00
Ichthyoplankton				
CLUPEIDAE	Larvae	2	0.4	2.78
ALEWIFE	Post Yolk-sac Larvae	2	0.4	2.78
	Juveniles	5	0.9	6.94
	Adult	1	0.2	1.39
RAINBOW SMELT	Post Yolk-sac Larvae	10	1.9	13.89
	Juveniles	2	0.4	2.78
	Adult	1	0.2	1.39
	Larvae	17	3.2	23.61
BURBOT	Yolk-sac Larvae	13	2.5	18.06
	Post Yolk-sac Larvae	1	0.2	1.39
	Larvae	5	0.9	6.94
ROUND GOBY	Juveniles	5	0.9	6.94
	Adult	1	0.2	1.39
UNIDENTIFIED	Eggs (viable)	2	0.4	2.78
	Larvae	5	0.9	6.94
Total Ichthyoplankton		72	13.7	100.00

Table 4-4. Comparison of the Number, Density, and Relative Abundance (%) of Ichthyoplankton Entrained at Point Beach, 2006 and 2017.

Taxa	Life Stage	2006			2017		
		No.	Density	%	No.	Density	%
CLUPEIDAE	Larvae	1	0.2	0.8	2	0.4	2.8
ALEWIFE	Post Yolk-Sac	--	--	--	2	0.4	2.8
	Juvenile	4	0.7	3.1	5	0.9	6.9
	Adult	--	--	--	1	0.2	1.4
ALEWIFE type	Egg	23	3.8	18.1	--	--	--
COREGONINAE	Yolk-Sac	2	0.3	1.6	--	--	--
RAINBOW SMELT	Post Yolk-Sac	1	0.2	0.8	10	1.9	13.9
	Juvenile	75	12.4	59.1	2	0.4	2.8
	Adult	--	--	--	1	0.2	1.4
	Larvae	3	0.5	2.4	17	3.2	23.6
COMMON CARP	Yolk-Sac	1	0.2	0.8	--	--	--
CYPRINID	Yolk-Sac	1	0.2	0.8	--	--	--
	Larvae	1	0.2	0.8	--	--	--
CATOSTOMID	EGG	1	0.2	0.8	--	--	--
BURBOT	Yolk-Sac	1	0.2	0.8	13	2.5	18.1
	Post Yolk-Sac	--	--	--	1	0.2	1.4
	Larvae	--	--	--	5	0.9	6.9
ROUND GOBY	Juvenile	--	--	--	5	0.9	6.9
	Adult	--	--	--	1	0.2	1.4
STICKLEBACK	Yolk-Sac	2	0.3	1.6	--	--	--
	Larvae	1	0.2	0.8	--	--	--
LEPOMIS	Post Yolk-Sac	1	0.2	0.8	--	--	--
SLIMY SCULPIN	Post Yolk-Sac	1	0.2	0.8	--	--	--
SCULPIN	Post Yolk-Sac	1	0.2	0.8	--	--	--
UNIDENTIFIED	Egg	6	1.0	4.7	2	0.4	2.8
	Larvae	1	0.2	0.8	5	0.9	6.9
TOTAL ICHTHYOPLANKTON		127	21.0	100.00	72	13.6	100.0

Table 4-5. Length, Head Capsule Depth, and Egg Diameter of Entrained Organisms at Point Beach, April – September 2017.

Taxa	Life Stage	Length/Egg Diameter (mm)				Head Capsule Depth (mm)			
		N	Min	Mean	Max	N	Min	Mean	Max
Shellfish									
Echinogammarus ischnus		45	5.6	8.8	12.0				
Gammarus sp.		20	4.7	7.3	10.6				
Hemimysis anomala		3	9.9	10.3	11.0				
Mysis diluviana		1	9.9	9.9	9.9				
Ichthyoplankton									
ALEWIFE	Post Yolk-sac	2	6.8	13.1	19.3	1	1.9	1.9	1.9
	Juveniles	5	24.7	30.0	37.1	4	3.5	4.5	6.2
	Adult	1	87.0	87.0	87.0	1	19.0	19.0	19.0
RAINBOW SMELT	Post Yolk-sac	7	5.6	20.7	31.0	10	0.5	2.1	3.7
	Juveniles	2	33.7	34.1	34.5	2	3.5	3.7	3.9
	Adult	1	88.0	88.0	88.0	1	8.7	8.7	8.7
	Larvae	--	--	--	--	1	0.6	0.6	0.6
BURBOT	Yolk-sac	13	3.9	4.4	5.2	12	0.7	0.8	0.9
	Post Yolk-sac	1	7.2	7.2	7.2	1	1.5	1.5	1.5
ROUND GOBY	Juveniles	5	8.4	11.4	20.5	5	1.4	2.1	3.6
	Adult	1	76.0	76.0	76.0	1	12.0	12.0	12.0
UNIDENTIFIED	Eggs (viable)	2	1.0	1.0	1.0	--	--	--	--

Table 4-6. Summary of Typical Diameters of Water-Hardened Eggs and Lengths of Larvae (in mm) for Fishes Collected During Studies near Point Beach.

Taxa	Range in size of:			
	Egg Diameter	Yolk Sac	Post Yolk Sac	Juveniles
GIZZARD SHAD	0.9 - 1.1[1]	3.3 - 6.5[1]	5.5 - 25.0[2]	20 - 50[1]
ALEWIFE	0.9 - 1.2[1]	2.5 - 5.0[1]	4.0 - 19.9[1,2]	19.0 - 32.2[1,2]
RAINBOW SMELT	0.8 - 1.3[1,2]	4.1 - 6.5[2]	6.0 - 33.0[1]	32.0 - 42.0[1]
LAKE WHITEFISH	2.3 - 3.0[1]	8.8 - 15.0[1]	14.0 - 25.0[1]	34.0 - 54.0[1]
BLOATER	1.8 - 2.1[1]	7.0 - 15.0[1]	15.0 - 25.0[1]	NA
COMMON CARP	1.5 - 2.1[1]	3.0 - 8.0[1]	8.0 - 21.0[1]	21.0 - 31.0[1]
COMMON SHINER	1.5 - 1.8[1]	5.0 - 7.0[1]	7.0 - 15.0[1]	15.0 - 16.0[1]
GOLDEN SHINER	1.0 - 1.4[1]	3.0 - 6.0[1]	5.0 - 11.0[1]	14.0 - 21.0[1]
EMERALD SHINER	3.0 - 3.3[1]	4.0 - 5.0[1]	6.0 - 14.9[1]	15.0 - 30.0[1]
SPOTTAIL SHINER	1.0 - 1.4[1]	4.0 - 7.0[1]	7.0 - 11.0[1]	11.0 - 19.0[1]
FATHEAD MINNOW	1.4 - 1.6[1]	4.0 - 6.0[1]	6.0 - 17.0[1]	17.0 - 28.0[1]
LONGNOSE SUCKER	2.9 - 3.1[4]	8.0 - 13.0[1]	11.0 - 23.0[1]	22.8 - 292[4]
WHITE SUCKER	2.0 - 3.6[4]	6.0 - 13.4[4]	11.0 - 28.5[4]	22.8 - 50.0[4]
BURBOT	1.0 - 1.9[1,5]	3.5 - 5.0[1,5]	5.0 - 19.0[1]	19.0 - 280-480[1,5]
NINESPINE STICKLEBACK	1.5 - 1.9[1]	5.0 - 9.0[1]	9.0 - 12.0[1]	NA
THREESPINE STICKLEBACK	1.5 - 1.9[1]	3.0 - 6.0[1]	6.0 - 11.0[1]	11.0 - 17.0[1]
BROOK STICKLEBACK	1.0 - 1.3[1]	5.0 - 6.0[1]	6.0 - 16.0[1]	16.0 - 18.0[1]
GREEN SUNFISH	1.0 - 1.4[1]	3.0 - 6.0[1]	7.0 - 11.0[1]	15.0 - 24.0[1]
PUMPKINSEED	0.8 - 1.2[1]	2.0 - 5.0[1]	4.0 - 15.0[1]	16.0 - 19.0[1]
BLUEGILL	1.2 - 1.4[1]	2.0 - 5.0[1]	5.0 - 12.0[1]	12.0 - 22.0[1]
YELLOW PERCH	1.7 - 4.5[3]	4.7 - 8.2[3]	8.0 - 20.0[1]	20.0 - 40.0[1]
MOTTLED SCULPIN	1.0 - 3.0[1]	6.3 - 8.0[1]	8.0 - 9.0[1]	9.0 - 15.0[1]
SLIMY SCULPIN	2.0 - 3.0[1]	5.7 - 7.5[1]	7.5 - 8.0[1]	8.0 - 11.0[1]
DEEPWATER SCULPIN	NA	8.0 - 10.0[1]	10.0 - 18.0[1]	NA

[1] Auer (1982), [2] Wallus, Yeager and Simon (1990), [3] Simon and Wallus (2006), [4] Kay et. al (1994), [5] Wallus and Simon (2006).

Table 4-7. Diel Densities (#/1,000 m^3) of Shellfish and Ichthyoplankton in the Point Beach Entrainment Samples, April-September 2017.

Taxa	Life Stage	0600-1200			1200-1800			1800-0000			0000-0600		
		Count	Density	%	Count	Density	%	Count	Density	%	Count	Density	%
Shellfish													
Gammaridae sp.		1	0.8	0.0	6	4.5	0.1	4	3.3	0.0	4	3.2	0.1
Echinogammarus ischnus		4,345	3,304.4	63.3	4,966	3,752.9	62.5	7,288	5,516.8	72.7	6,674	5,101.2	87.3
Gammarus sp.		2,523	1,918.7	36.7	2,969	2,243.6	37.4	2,607	1,973.7	26.0	928	709.1	12.1
Hemimysis anomala		--	--	--	--	--	--	125	94.5	1.2	36	27.5	0.5
Mysis diluviana		--	--	--	--	--	--	--	--	--	1	0.8	--
Total Shellfish Diel Density		6,869	5,223.8	100	7,940	6,001.0	100	10,025	7,588.0	100	7,643	5,842.0	100
Ichthyoplankton													
CLUPEIDAE sp.	Larvae	--	--	--	2	1.5	9.5	--	--	--	--	--	--
ALEWIFE	Post Yolk-sac	--	--	--	1	0.8	4.8	1	0.8	5.0	--	--	--
	Juveniles	--	--	--	2	1.5	9.5	2	1.5	10.0	1	0.8	6.25
	Adult	--	--	--	--	--	--	1	0.8	5.0	--	--	--
RAINBOW SMELT	Post Yolk-sac	--	--	--	1	0.8	4.8	3	2.3	15.0	6	4.6	37.5
	Juveniles	--	--	--	--	--	--	2	1.5	10.0	--	--	--
	Adult	--	--	--	--	--	--	--	--	--	1	0.8	6.25
	Larvae	7	5.3	46.7	5	3.8	23.8	2	1.5	10.0	3	2.3	18.75
BURBOT	Yolk-sac	6	4.6	40.0	4	3.0	19.0	3	2.3	15.0	--	--	--
	Post Yolk-sac	--	--	--	1	0.8	4.8	--	--	--	--	--	--
	Larvae	2	1.5	13.3	3	2.3	14.3	--	--	--	--	--	--
ROUND GOBY	Juveniles	--	--	--	--	--	--	1	0.8	5.0	4	3.1	25
	Adult	--	--	--	--	--	--	1	0.8	5.0	--	--	--
UNIDENTIFIED	Eggs (viable)	--	--	--	--	--	--	2	1.5	10.0	--	--	--
	Larvae	--	--	--	2	1.5	9.5	2	1.5	10.0	1	0.8	6.25
Total IP Diel Density		15	11.4	100	21	15.9	100	20	15.1	100	16	12.0	100

Table 4-8. Diel Distribution of Total Shellfish Entrainment Densities, Point Beach April- September 2017.

	Density (#/1,000 m^3)			
Sampling Date	**0600-1200**	**1200-1800**	**1800-0000**	**0000-6000**
12-13 Apr	539	359	2,188	857
24-25 Apr	117	300	510	429
8-9 May	280	240	200	340
23-24 May	112	86	399	818
6-7 Jun	380	310	1,075	1,173
20-21 Jun	1,041	906	902	1,176
6-7 Jul	239	259	778	620
18-19 Jul	1,521	1,751	1,405	3,478
1-2 Aug	2,059	1,640	2,295	979
15-16 Aug	16,294	31,946	69,094	33,901
29-30 Aug	14,748	16,094	3,435	15,722
12-13 Sep	23,197	20,934	11,409	12,357
26-27 Sep	7,596	3,604	6,270	4,197

Table 4-9. Diel Distribution of Total Ichthyoplankton Entrainment Densities (#/1,000 m^3) Point Beach, April-September 2017.

	Density (#/1,000m^3)			
Sampling Date	**0600-1200**	**1200-1800**	**1800-0000**	**0000-6000**
12-13 Apr	0.0	0.0	19.9	0.0
24-25 Apr	58.6	10.0	9.8	30.0
8-9 May	20.0	50.0	0.0	0.0
23-24 May	56.0	38.4	20.0	0.0
6-7 Jun	0.0	0.0	0.0	0.0
20-21 Jun	9.9	39.8	9.4	20.0
6-7 Jul	0.0	0.0	38.0	0.0
18-19 Jul	0.0	26.8	29.5	50.0
1-2 Aug	0.0	20.0	9.6	10.0
15-16 Aug	0.0	0.0	0.0	20.0
29-30 Aug	0.0	20.0	49.7	19.9
12-13 Sep	0.0	0.0	10.0	9.9
26-27 Sep	0.0	0.0	0.0	0.0
Mean Density	11.1	15.8	15.1	12.3

Table 4-10. Comparison of Shellfish Entrainment Estimates, Point Beach, 1975, 2006, and 2017.

TAXA	1975		2006		2017	
	Estimate	%	Estimate	%	Estimate	%
Gammaridae	0	—	0	—	2,189,783	<0.1
Echinogammarus ischnus	0	—	0	—	3,349,193,628	71.7
Gammarus sp.	0	0.0	4,057,474,137	99.9	1,307,295,469	28.0
Hemimysis anomala	0	—	0	—	12,863,458	0.3
Diporeia sp.	13,851,400	57.6	0	--	0	—
Mysis sp.	10,180,200	42.4	62,838	<0.1	141,929	<0.1
Total Shellfish	24,031,600	100.0	4,057,536,975	100.0	4,671,684,267	100.0

Table 4-11. Diel Distribution of Total Shellfish Entrainment Estimates, Point Beach, April-September 2017

Date	0600-1200	1200-1800	1800-0000	0000-0600	Total
1-14 Apr	3,634,900	2,416,505	14,741,763	5,772,584	26,565,752
15-19 Apr	1,664,457	4,259,806	7,253,105	6,102,952	19,280,320
30-Apr-13 May	4,044,282	3,466,658	2,888,117	4,911,471	15,310,528
14-27 May	1,619,142	1,247,376	5,770,777	11,823,348	20,460,643
28 May-10 Jun	5,473,430	4,460,947	15,483,417	16,907,789	42,325,583
11-24 Jun	15,091,950	13,126,872	13,072,496	17,045,509	58,336,827
25 Jun-8 Jul	3,489,593	3,773,699	11,352,537	9,039,344	27,655,173
9-22 Jul	22,178,046	25,540,270	20,496,223	50,731,206	118,945,745
23 Jul-5 Aug	30,031,678	23,913,238	33,473,273	14,281,511	101,699,700
6-19 Aug	237,636,791	465,912,095	1,007,702,965	494,427,354	2,205,679,205
20 Aug-2 Sep	215,085,333	234,721,972	50,103,593	229,292,084	729,202,982
3-16 Sep	338,319,872	305,303,361	166,389,101	180,213,089	990,225,423
17-30 Sep	110,783,905	52,557,033	91,439,714	61,215,736	315,996,388
Total	989,053,379	1,140,699,832	1,440,167,080	1,101,763,976	4,671,684,267

Table 4-12. Ichthyoplankton Entrainment Estimates, Point Beach, April-September 2017.

Taxa	Life Stage	Estimated Entrainment	
		Number	% of Total
CLUPEIDAE sp.	Larvae	291,625	2.9
ALEWIFE	Post Yolk-sac Larvae	270,952	2.7
	Juveniles	725,997	7.2
	Adult	144,269	1.4
RAINBOW SMELT	Post Yolk-sac Larvae	1,445,121	14.4
	Juveniles	290,175	2.9
	Adult	144,755	1.4
	Larvae	2,393,658	23.8
BURBOT	Yolk-sac Larvae	1,808,418	18.0
	Post Yolk-sac Larvae	144,251	1.4
	Larvae	710,516	7.1
ROUND GOBY	Juveniles	646,095	6.4
	Adult	66,911	0.7
UNIDENTIFIED	Eggs (viable)	276,891	2.8
	Larvae	693,456	6.9
Total Ichthyoplankton		10,053,091	100.0

Table 4-13. Comparison of Ichthyoplankton Entrainment Estimates at Point Beach, 1975, 2006, and 2017.

TAXA	Life Stage	Apr-Oct 1975		Apr-Sep 2006		Apr-Sep 2017	
		Estimate	%	Estimate	%	Estimate	%
Alewife	Eggs	4,661,410	69.1	2,197,300	20.5	--	--
Alewife	Larvae	416,311	6.2	1,091,888	10.2	1,141,218	11.4
Rainbow Smelt	Larvae	1,272,080	18.9	5,663,807	52.7	4,273,709	42.5
Burbot	Larvae	--	--	243,138	2.3	2,663,185	26.5
Round Goby	Larvae/Adult	--	--	--	--	713,006	7.1
Sculpin	Larvae	349,517	5.2	258,213	2.4	--	--
Other	Larvae	44,617	0.7	833,229	7.8	985,081	9.8
Other	Eggs	0	0.0	450,888	4.2	276,891	2.8
Total		6,743,935	100.0	10,738,963	100.0	10,053,091	100.0

Table 4-14. Diel Distribution of Total Ichthyoplankton Entrainment Estimates, Point Beach, April-September 2017.

Extrapolation Period	Diel Period				
	0600-1200	1200-1800	1800-0000	0000-6000	Total
1-14 Apr	0	0	133,821	0	133,821
15-19 Apr	832,229	141,994	139,483	425,787	1,539,492
30-Apr-13 May	288,877	722,220	0	0	1,011,098
14-27 May	809,571	554,389	288,539	0	1,652,499
28 May-10 Jun	0	0	0	0	0
11-24 Jun	143,538	577,005	136,172	289,890	1,146,604
25 Jun-8 Jul	0	0	553,782	0	553,782
9-22 Jul	0	390,922	430,593	728,897	1,550,412
23 Jul-5 Aug	0	291,625	140,644	145,730	577,999
6-19 Aug	0	0	0	291,526	291,526
20 Aug-2 Sep	0	291,459	725,438	289,510	1,306,408
3-16 Sep	0	0	145,785	143,665	289,450
17-30 Sep	0	0	0	0	0
Total	2,074,214	2,969,615	2,694,257	2,315,004	10,053,091

Appendix A

Point Beach Entrainment Characterization Study Plan

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NEXTera ENERGY POINT BEACH

December 8, 2016

NPL 2016-0262
§316(b)

Wisconsin Department of Natural Resources
Mr. Jason Knutson
PO Box 7921
Madison, WI 53707 - 7921

Submittal of Proposed Entrainment Characterization Study Plan
Point Beach Nuclear Plant, Units 1 and 2

NextEra Energy Point Beach is required by the final §316(b) Rule to perform an Entrainment Characterization Study. The proposed Entrainment Characterization Study Plan is being submitted for Department of Natural Resources review and approval. The Study Plan includes descriptions of entrainment data collection methodology, biological entrainment characterization and analysis and supporting documentation. As was discussed during our November 17 meeting at your offices, NextEra proposes to use the entrainment data collected under the Phase II effort to address one of the two years required by the 2014 existing facilities rule.

NextEra requests a timely response to this submittal, and is proposing to begin the Study in the Spring of 2017.

Should you have any questions, please call Mark Schanke at 920/755-6270.

Very truly yours,

NextEra Energy Point Beach, LLC

Randy Hastings
Chemistry Manager

Enclosure

EA Engineering, Science, and Technology, Inc., PBC

Point Beach Nuclear Plant
Entrainment Characterization Study Plan

Prepared for:

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December 2016
FINAL
EA Project No. 1526004

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1. INTRODUCTION

On 15 August 2014, the EPA published the final §316(b) Rule for existing power plants. The Rule became effective 14 October 2014 and presents compliance options for impingement and entrainment control. Details of the Rule are available at the EPA website located at http://water.epa.gov/lawsregs/lawsguidance/cwa/316b/index.cfm.

The Rule contains a number of study requirements to support compliance options. For facilities that withdraw greater than 125 million gallons per day (mgd) on an actual intake flow basis[1], one of those is the *Entrainment Characterization Study* under §122.21(r)(9) that requires (see Table 1-1 for a checklist of the required study attributes):

> *"[t]he owner or operator of an existing facility that withdraws greater than 125 mgd AIF [actual intake flow], where the withdrawal of cooling water is measured at a location within the cooling water intake structure[2] that the Director deems appropriate, must develop for submission to the Director an Entrainment Characterization Study that includes a minimum of two years of entrainment data collection. The Entrainment Characterization Study must include the following components:*
>
> *(i) Entrainment Data Collection Method. The study should identify and document the data collection period and frequency. The study should identify and document organisms collected to the lowest taxon possible of all life stages of fish and shellfish that are in the vicinity of the cooling water intake structure(s) and are susceptible to entrainment, including any organisms identified by the Director, and any species protected under Federal, State, or Tribal law, including threatened or endangered species with a habitat range that includes waters in the vicinity of the cooling water intake structure. Biological data collection must be representative of the entrainment at the intakes subject to this provision. The owner or operator of the facility must identify and document how the location of the cooling water intake structure in the waterbody and the water column are accounted for by the data collection locations;*
>
> *(ii) Biological Entrainment Characterization. Characterization of all life stages of fish, shellfish, and any species protected under Federal, State, or Tribal law (including threatened or endangered species), including a description of their abundance and their temporal and spatial characteristics in the vicinity of the cooling water intake structure(s), based on sufficient data to characterize annual, seasonal, and diel variations in entrainment, including but not limited to variations related to climate and weather differences, spawning, feeding, and water column migration. This characterization may include historical data that are representative of the current operation of the facility and of biological conditions at the site. Identification of all life stages of fish and shellfish must include identification of any surrogate species used, and identification of data representing both motile and non-motile life-stages of organisms;*

[1] As defined by the rule at 40 CFR 125.92(a).

[2] The EPA defines a cooling water intake structure (CWIS) "as the total physical structure and any associated constructed waterways used to withdraw cooling water from waters of the United States...the cooling water intake structure extends from the point at which water is first withdrawn from waters of the United States up to, and including, the intake pumps". Federal Register, Vol. 79 No. 158, August 15, 2014, Page 48306.

(iii) Analysis and Supporting Documentation. Documentation of the current entrainment of all life stages of fish, shellfish, and any species protected under Federal, State, or Tribal law (including threatened or endangered species). The documentation may include historical data that are representative of the current operation of the facility and of biological conditions at the site. Entrainment data to support the facility's calculations must be collected during periods of representative operational flows for the cooling water intake structure, and the flows associated with the data collection must be documented. The method used to determine latent mortality along with data for specific organism mortality or survival that is applied to other life-stages or species must be identified. The owner or operator of the facility must identify and document all assumptions and calculations used to determine the total entrainment for that facility together with all methods and quality assurance/quality control procedures for data collection and data analysis. The proposed data collection and data analysis methods must be appropriate for a quantitative survey."

Table 1-1. Checklist of the 316(b) Rule's Requirements for the Entrainment Characterization Study (40 CFR 122.21(r)(9)).

40 CFR 122.21(r)	Quote from the Rule	Summary of Proposal
(9) Entrainment Characterization Study	Entrainment Characterization Study that includes a minimum of two years of entrainment data collection	Data from Phase II implementation and 2017 will be collected in the same fashion. Together they constitute two years of record.
	Study should identify and document the data collection period and frequency	See Section 4.2. Samples will be collected biweekly beginning in April and concluding at the end of September. Four samples will be collected at six hour intervals during each sample event.
	Document organisms collected to the lowest taxon possible of all life stages of fish and shellfish	See Section 4.4. Fish and shellfish will be collected to the lowest taxon possible and the life stage of each will be recorded.
	Any species protected under Federal, State, or Tribal law, including threatened or endangered species	See Section 2.2 and Section 4.4. While listed species are not expected, if found, they will be identified, enumerated, and reported separately.
	Biological data collection must be representative of the entrainment at the intakes subject to this provision	See Section 4.3. Samples will be collected from the forebay and, based on the geometry and water velocities, any sampled water is committed to passage through the condensers.
(ii) Biological Entrainment Characterization	Sufficient data to characterize annual, seasonal, and diel variations in entrainment	See Section 4.2. The proposed sample collection periods and frequency are standard for the Great Lakes and will allow for characterization of temporal variations in entrainment rates.
	Characterization may include historical data that are representative of the current operation of the facility and of biological conditions at the site	Historically data on entrainment rates were collected under biological and plant operation conditions that are similar to those currently encountered. Data collected in 2006 is proposed for use to address part of the 316(b) rule's requirements.

Table 1-1. Continued.

(iii) Analysis and Supporting Documentation	Entrainment data to support the facility's calculations must be collected during periods of representative operational flows for the cooling water intake structure, and the flows associated with the data collection must be documented	See Sections 4.3 and 4.5. Samples will be collected during representative facility operation. Cooling water flows will be recorded during sampling and throughout the year to allow extrapolation of measured organism densities (individuals/volume) to annualized estimates of entrainment rates.
	The owner or operator of the facility must identify and document all assumptions and calculations used to determine the total entrainment for that facility together with all methods and quality assurance/quality control procedures for data collection and data analysis.	See Section 5. EA will follow appropriate Quality Assurance/Quality Control measures during the collection, analysis, and reporting of entrainment data. Additional detail on assumptions and calculations will be provided in the Entrainment Characterization Study report.
	The proposed data collection and data analysis methods must be appropriate for a quantitative survey	EA is confident that the proposed methods are appropriate for a quantitative study including the goals of the 316(b) existing facilities rule (i.e., estimate of entrainment losses, support to quantitative assessment of the effectiveness of potential entrainment reduction measures, monetization of benefits, etc.). The proposed work plan is consistent with agency-approved 316(b) studies in the Great Lakes and elsewhere.

This work plan will address each of the requirements of the rule at 40 CFR 122.21(r)(9). The work plan is patterned on the effort implemented under the §316(b) Phase II rule, which was reviewed and approved by Wisconsin Department of Natural Resources (WDNR) for that effort. The goals of the Phase II effort and Entrainment Characterization Study of the existing facility rule are essentially the same. Importantly, by adopting the same collection and analysis procedures, comparison and integration of the two years' data will be facilitated.

Consistent with this, EA, with concurrence of ECT and NextEra, proposes to use the entrainment data collected under the Phase II effort to address one of the two years required by the 2014 existing facilities rule. The proposed 2017 effort will be used to characterize the second year.

This plan for Point Beach Nuclear Plant (PBNP) provides an overview of source water biological data (Section 2) and a brief description of its location, operating characteristics, and cooling water intake structure (Section 3). The field, laboratory, and data reporting requirements outlined above are presented in Section 4, which also describes the sampling period and frequency, sample collection, ancillary data collection, laboratory analysis, data management and analysis, and content of the final *Entrainment Characterization Study* report. The quality assurance and quality control (QA/QC) procedures to meet the requirements outlined above are provided in Section 5. Section 6 outlines health and safety issues associated with conducting this study.

1.1. PROJECT TEAM

Environmental Consulting & Technology, Inc. (ECT) was contracted by NextEra Energy to

direct and manage NextEra's response to the §316(b) Rule. The *Entrainment Characterization Study* is one of several submittals required by the Rule. ECT contracted with EA Engineering, Science, and Technology, Inc., PBC (EA) to assist in the development of an approved study plan for PBNP. EA's role includes preparation of this study plan, executing the field study, performing the taxonomic identification and quantification of entrainment, and preparation of the *Entrainment Characterizations Study* report to meet requirements under §122.21(r)(9).

2. SOURCE WATER BIOLOGICAL DATA

2.1. SPECIES AT RISK OF ENTRAINMENT

Fish and shellfish that occur in Lake Michigan near the PBNP cooling water intake structure are potentially susceptible to entrainment through the plant depending on their distribution, behavior, early life stage characteristics, spawning locations and habits, and habitat utilization relative to the intake. Fish species with general spawning habits, such as alewife, are typically more susceptible to entrainment than are species that have adhesive eggs, build nests, and/or provide parental care (e.g., sunfishes).

Impingement studies conducted at PBNP provide a list of crayfish and fish species most likely at risk to entrainment because they occur in the vicinity of the intake (Table 2-1). One crayfish species was impinged during the 2005-2006 study, compared to 45 fish species representing 17 families that were impinged in studies conducted in 1975-1976 and 2005-2006. About half the impinged species were carps and minnows (8 species), trouts and salmons (9), and sunfish (6). Twenty-seven species were common between the two studies that were conducted 30 years apart (Table 2-1). Impinged species include introduced salmon, other non-native species (e.g., Alewife), and invasive species (e.g., Round Goby). Federal- or State-listed threatened or endangered species have not been collected during studies at PBNP (Section 2.2).

Entrainment sampling at PBNP, conducted from April through September 2006, encountered 19 ichthyoplankton taxa and four shellfish taxa (Table 2-2). *Gammarus* accounted for nearly 100% of the shellfish[3] in both the entrainment and offshore samples. In contrast, the number of ichthyoplankton in the entrainment samples (127) represented only 0.3% of the total entrained organisms. Offshore samples showed that *Gammarus* were much less abundant than in the entrainment samples and more ichthyoplankton were collected offshore (Table 2-2). The 2006 entrainment samples were dominated by two ichthyoplankton taxa (Alewife-type eggs and juvenile Rainbow Smelt) that collectively accounted for 77% of the ichthyoplankton. The offshore composition was dominated by yolk-sac unidentified Clupeidae, Alewife-type eggs, unidentified *Alosa* yolk-sac larvae, unidentified Coregoninae yolk-sac larvae, Rainbow Smelt post-yolk sac larvae, and yolk-sac Yellow Perch, which collectively accounted for 78% of the ichthyoplankton collected offshore. The taxa collected during the 2006 entrainment study included early life stages of fishes common in Lake Michigan.

2.2. THREATENED AND ENDANGERED SPECIES

The EPA consulted with the U.S. Fish and Wildlife Service and National Marine Fisheries Service under the Endangered Species Act during development of the existing facilities §316(b) Rule. While it was concluded that the rule is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of designated critical habitat, the Rule at §122.21(r)(9) specifically calls for consideration of any species protected under Federal, State, or Tribal law (including threatened or endangered species [T&E]). Facilities are

[3] EA notes that *Gammarus* is an amphipod and that most entrainment characterization efforts in the United States do not classify amphipods as "shellfish". At the prior request of WDNR, *Gammarus* was classified as shellfish and their entrained numbers were quantified in 2006.

required to identify all Federally-listed T&E species and/or designated critical habitat that are, or may be, present "in the vicinity of impingement and entrainment at the cooling water intake structure"[4]. Therefore, both Federally-listed and State-listed T&E species were identified that were known to or believed to occur in Manitowoc County, Wisconsin, near PBNP.

The four Federally-listed T&E species with potential to occur in Manitowoc County, Wisconsin, are the northern long-eared bat, rufa red knot, piping plover, and pitcher's thistle (Table 2-3). There is no nexus between operation of PBNP's CWIS and these species. There are no Federally-listed fish species in Wisconsin and although other aquatic T&E species are listed (e.g., unionid mussels), they are not known to occur near PBNP[5]. Twenty fish species are State-listed as T&E by the WDNR (Table 2-4). None of those species are known to occur in Lake Michigan as they primarily are stream or large river species[6]. Nineteen unionid mussel species are also State-listed with T&E status (Table 2-5); however, as for the State-listed fishes, these mussels occur in streams and rivers and not Lake Michigan.

Consistent with the anticipated absence from Lake Michigan, State-listed species were not encountered during historical impingement and entrainment studies at PBNP.

[4] 40 CFR 125.95(f).
[5] https://www.fws.gov/midwest/endangered/lists/pdf/WisconsinCtyListOct2016.pdf
[6] http://digicoll.library.wisc.edu/cgi-bin/EcoNatRes/EcoNatRes-idx?id=EcoNatRes.FishesWI

Table 2-1. Crayfish and Fish Observed during Impingement Studies at Point Beach Nuclear Plant, 1975-76 and 2005-06.

Family Name	Common Name	Scientific Name[1]	1975-1976[2]	2005-2006[3]
Cambaridae (Crayfish)	GREAT LAKES CRAYFISH	*Orconectes propinquus*	--	X
Sturgeons	LAKE STURGEON	*Acipenser fulvescens*	--	X
Herrings	ALEWIFE	*Alosa pseudoharengus*	X	X
	GIZZARD SHAD	*Dorosoma cepedianum*	X	X
Carps and Minnows	LAKE CHUB	*Couesius plumbeus*	X	--
	COMMON CARP	*Cyprinus carpio*	X	X
	COMMON SHINER	*Luxilus cornutus*	--	X
	GOLDEN SHINER	*Notemigonus crysoleucas*	--	X
	EMERALD SHINER	*Notropis atherinoides*	X	X
	SPOTTAIL SHINER	*Notropis hudsonius*	X	X
	FATHEAD MINNOW	*Pimephales promelas*	X	X
	LONGNOSE DACE	*Rhinichthys cataractae*	X	X
Suckers	LONGNOSE SUCKER	*Catostomus catostomus*	X	X
	WHITE SUCKER	*Catostomus commersonii*	X	X
North American Catfishes	BLACK BULLHEAD	*Ameiurus melas*	X	X
	CHANNEL CATFISH	*Ictalurus punctatus*	X	X
Pikes and Mudminnows	NORTHERN PIKE	*Esox lucius*	X	--
	CENTRAL MUDMINNOW	*Umbra limi*	X	X
Smelts	RAINBOW SMELT	*Osmerus mordax*	X	X
Trouts and Salmons	LAKE WHITEFISH	*Coregonus clupeaformis*	X	X
	BLOATER	*Coregonus hoyi*	X	X
	COHO SALMON	*Oncorhynchus kisutch*	X	X
	RAINBOW TROUT	*Oncorhynchus mykiss*	X	--
	CHINOOK SALMON	*Oncorhynchus tshawytscha*	X	X
	ROUND WHITEFISH	*Prosopium cylindraceum*	X	X
	BROWN TROUT	*Salmo trutta*	X	X
	TIGER TROUT	*S. trutta x Salvelinus fontinalis*	X	--
	BROOK TROUT	*Salvelinus fontinalis*	X	--
	LAKE TROUT	*Salvelinus namaycush*	X	X

Table 2-1 (Continued)

Family Name	Common Name	Scientific Name[1]	1975-1976[2]	2005-2006[3]
Trout-perches	TROUT-PERCH	*Percopsis omiscomaycus*	X	X
Cods	BURBOT	*Lota lota*	--	X
Sticklebacks	BROOK STICKLEBACK	*Culaea inconstans*	X	X
	THREESPINE STICKLEBACK	*Gasterosteus aculeatus*	--	X
	NINESPINE STICKLEBACK	*Pungitius pungitius*	X	X
Sculpins	MOTTLED SCULPIN	*Cottus bairdii*	--	X
	SLIMY SCULPIN	*Cottus cognatus*	X	X
	DEEPWATER SCULPIN	*Myoxocephalus thompsonii*	X	X
Temperate Basses	WHITE PERCH	*Morone americana*	--	X
Sunfishes	GREEN SUNFISH	*Lepomis cyanellus*	--	X
	PUMPKINSEED	*Lepomis gibbosus*	--	X
	BLUEGILL	*Lepomis macrochirus*	X	X
	SMALLMOUTH BASS	*Micropterus dolomieu*	--	X
	LARGEMOUTH BASS	*Micropterus salmoides*	X	--
	BLACK CRAPPIE	*Pomoxis nigromaculatus*	--	X
Perches	YELLOW PERCH	*Perca flavescens*	X	X
Drums	FRESHWATER DRUM	*Aplodinotus grunniens*	--	X
Gobies	ROUND GOBY	*Neogobius melanostomus*	--	X

[1] Nomenclature follows Page et al. 2013.
[2] Source: WEPCO 1976.
[3] Source: EA 2007.

Table 2-2. Number and Relative Abundance of Shellfish and Ichthyoplankton in Onshore Entrainment Samples and Offshore Sampling Locations Near Point Beach Nuclear Plant during Concurrent Sampling Events, April - September 2006.

Taxa	Life Stage	Entrainment		Offshore Contours	
		No.	%	No.	%
Shellfish					
UNID AMPHIPODA		--	--	3	0.06
Gammarus		37,974	100.00	5,164	99.86
Hyalella azteca		1	0.00	0	0.00
Mysis relicta		--	--	4	0.08
Total Shellfish		37,975	100.00	5,171	100.00
Ichthyoplankton					
UNID CLUPEIDAE	YOLK-SAC	--	--	315	7.74
	POST YOLK-SAC	--	--	75	1.84
	LARVAE	1	0.79	8	0.20
ALEWIFE	EGG	--	--	12	0.29
	YOLK-SAC	--	--	4	0.10
	POST YOLK-SAC	--	--	5	0.12
	JUVENILE	4	3.15	1	0.02
ALEWIFE type	EGG	23	18.11	1,197	29.42
UNID *ALOSA*	YOLK-SAC	--	--	349	8.58
	POST YOLK-SAC	--	--	20	0.49
	JUVENILE	--	--	8	0.20
UNID COREGONINAE	YOLK-SAC	2	1.57	249	6.12
	POST YOLK-SAC	--	--	13	0.32
RAINBOW SMELT	YOLK-SAC	--	--	138	3.39
	POST YOLK-SAC	1	0.79	705	17.33
	JUVENILE	75	59.06	12	0.29
	LARVAE	3	2.36	1	0.02
COMMON CARP	YOLK-SAC	1	0.79	92	2.26
PIMEPHALES type	YOLK-SAC	--	--	8	0.20
UNID CYPRINID	YOLK-SAC	1	0.79	2	0.05
	LARVAE	1	0.79	0	0.00
UNID CATOSTOMINAE	YOLK-SAC	--	--	1	0.02
UNID CATOSTOMIDAE	EGG	1	0.79	44	1.08
BURBOT	YOLK-SAC	1	0.79	173	4.25
	POST YOLK-SAC	--	--	5	0.12
UNID STICKLEBACK	YOLK-SAC	2	1.57	75	1.84
	POST YOLK-SAC	--	--	100	2.46
	LARVAE	1	0.79	0	0.00
UNID *LEPOMIS*	POST YOLK-SAC	1	0.79	0	0.00

Table 2-2 (Continued)

Taxa	Life Stage	Entrainment		Offshore Contours	
		No.	%	No.	%
YELLOW PERCH	YOLK-SAC	--	--	362	8.90
UNID PERCIDAE	LARVAE	--	--	2	0.05
SLIMY SCULPIN	POST YOLK-SAC	1	0.79	31	0.76
DEEPWATER SCULPIN	POST YOLK-SAC	--	--	1	0.02
UNID SCULPIN	POST YOLK-SAC	1	0.79	9	0.22
UNIDENTIFIED	EGG	6	4.72	20	0.49
	YOLK-SAC	--	--	1	0.02
	LARVAE	1	0.79	31	0.76
TOTAL ICHTHYOPLANKTON		127	100.00	4,069	100.00

Table 2-3. Species Listed as Threatened or Endangered by the U.S. Fish and Wildlife Service for Manitowoc County, Wisconsin (updated October 2016).

Scientific Name	Common Name	Status
Myotis septentrionalis	Northern long-eared bat	Threatened
Calidris canutus rufa	Rufa red knot	Threatened
Cirsium pitcheri	Pitcher's thistle	Threatened
Charadrius melodus	Piping plover	Endangered

Source: https://www.fws.gov/midwest/endangered/lists/wisc-spp.html

Table 2-4. Fish Listed as Threatened or Endangered in Wisconsin by the Wisconsin Department of Natural Resources.

Common Name	Scientific Name	Listing Status
Skipjack Herring	*Alosa chrysochloris*	Endangered
Crystal Darter	*Crystallaria asprella*	Endangered
Gravel Chub	*Erimystax x-punctatus*	Endangered
Bluntnose Darter	*Etheostoma chlorosoma*	Endangered
Starhead Topminnow	*Fundulus dispar*	Endangered
Goldeye	*Hiodon alosoides*	Endangered
Pallid Shiner	*Hybopsis amnis*	Endangered
Striped Shiner	*Luxilus chrysocephalus*	Endangered
Black Redhorse	*Moxostoma duquesnei*	Endangered
Slender Madtom	*Noturus exilis*	Endangered
Blue Sucker	*Cycleptus elongatus*	Threatened
Black Buffalo	*Ictiobus niger*	Threatened
Longear Sunfish	*Lepomis megalotis*	Threatened
Redfin Shiner	*Lythrurus umbratilis*	Threatened
Shoal Chub	*Macrhybopsis hyostoma*	Threatened
River Redhorse	*Moxostoma carinatum*	Threatened
Pugnose Shiner	*Notropis anogenus*	Threatened
Ozark Minnow	*Notropis nubilus*	Threatened
Gilt Darter	*Percina evides*	Threatened
Paddlefish	*Polyodon spathula*	Threatened

Source: http://dnr.wi.gov/files/PDF/pubs/er/ER001.pdf

Table 2-5. Mussels Listed as Threatened or Endangered in Wisconsin by the Wisconsin Department of Natural Resources.

Endangered	
Spectaclecase**	*Cumberlandia monodonta*
Purple Wartyback	*Cyclonaias tuberculata*
Butterfly	*Ellipsaria lineolata*
Elephant-Ear	*Elliptio crassidens*
Snuffbox**	*Epioblasma triquetra*
Ebonyshell	*Fusconaia ebena*
Higgins Eye**	*Lampsilis higginsi*
Yellow/Slough Sandshell	*Lampsilis teres*
Sheepnose**	*Plethobasus cyphyus*
Winged Mapleleaf**	*Quadrula fragosa*
Rainbow	*Villosa iris*
Threatened	
Slippershelf Mussel	*Alasmidonta viridis*
Rock-Pocketbook	*Arcidens confragosus*
Monkeyface	*Quadrula metanevra*
Wartyback	*Quadrula nodulata*
Salamander Mussel	*Simpsonaias ambigua*
Buckhorn	*Tritogonia verrucosa*
Fawnsfoot	*Truncilla donaciformis*
Ellipse	*Venustaconcha ellipsiformis*

Source: http://dnr.wi.gov/files/PDF/pubs/er/ER001.pdf
**Also Federally-listed.

3. STUDY AREA

Point Beach Nuclear Plant is located on the western shore of Lake Michigan about 80 miles north of Milwaukee in Manitowoc County, Wisconsin (Figure 3-1). The plant has two steam generating reactor units, together rated to generate approximately 1,246 megawatts of power. Once-through cooling water is withdrawn from Lake Michigan through an intake crib that is 1,750 feet offshore in about 22 feet of water (Figure 3-2). The intake crib has a 110-ft outside diameter and consists of two annular rings of steel piles driven into the lakebed, with the annulus filled with limestone blocks (Figure 3-3). Water is drawn through the limestone blocks and concrete encased 30-in corrugated galvanized steel pipes (Figure 3-4 and Figure 3-5). Water flows from the intake to the pumphouse through two, 14-ft diameter, corrugated galvanized structural steel pipes buried beneath the lakebed (Figure 3-6).

The total design capacity of the cooling water pumps is 1,248.48 mgd. Water passes through vertical bar racks (3/8-in by 4-in, with 2¼-in spacing on center) in the onshore forebay and eight traveling bar screens (3/8-in mesh, 11-ft wide) at the pumphouse (Figure 3-7). The traveling screens use an 80 psi screen wash that discharges to the lake via a return trough.

Approach velocities in the vicinity of the crib have been measured as high as 2.0 ft/sec, but most velocities measured in the vicinity of the crib are much lower (Bootsma 2001). Based on the measured velocities, it has been estimated that approximately one-half of the intake flow occurs through the cap with the other half through the walls of the intake crib.

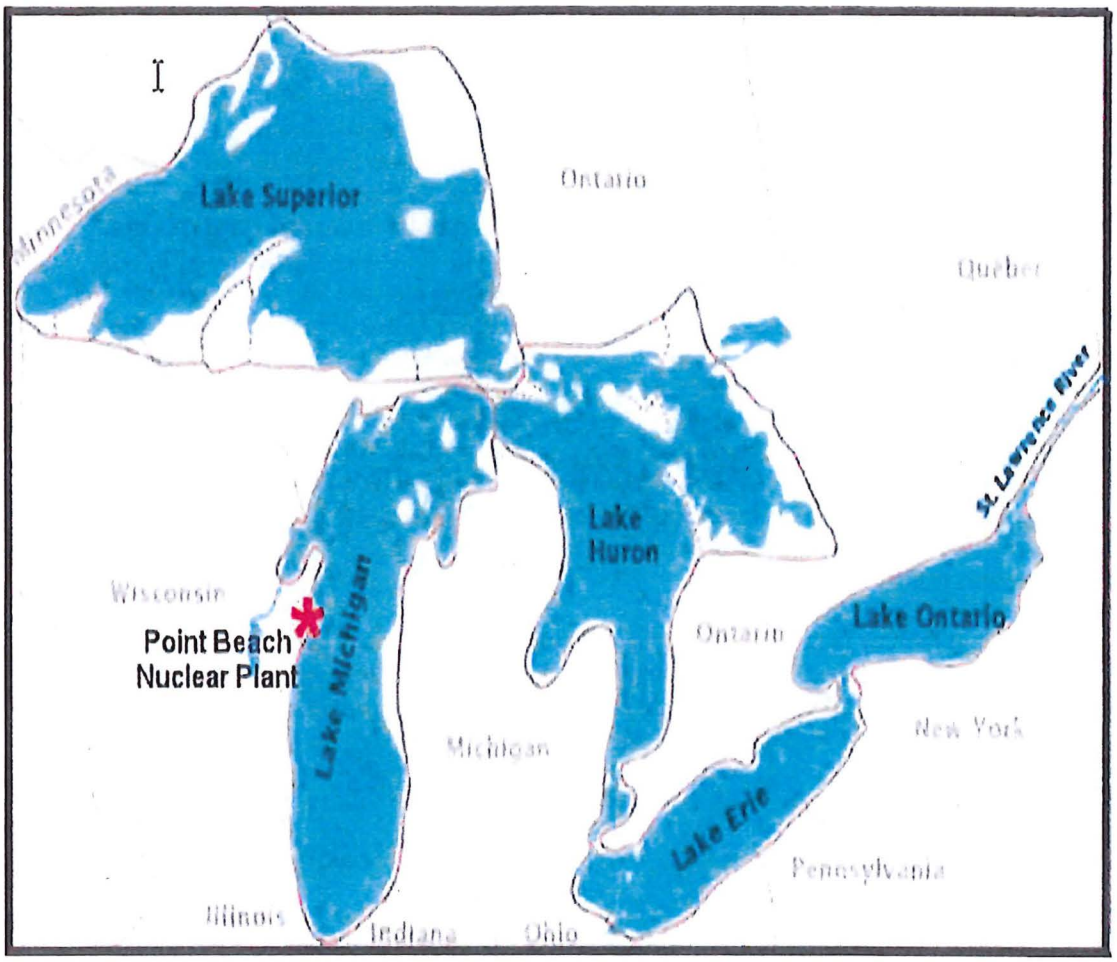
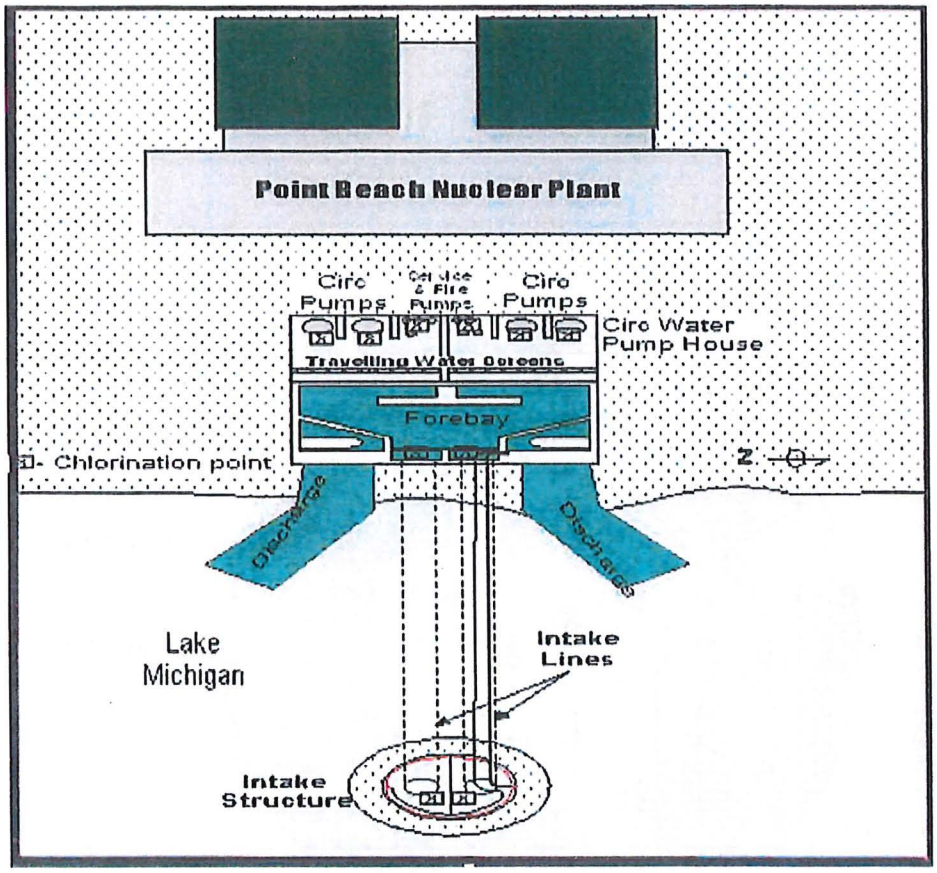
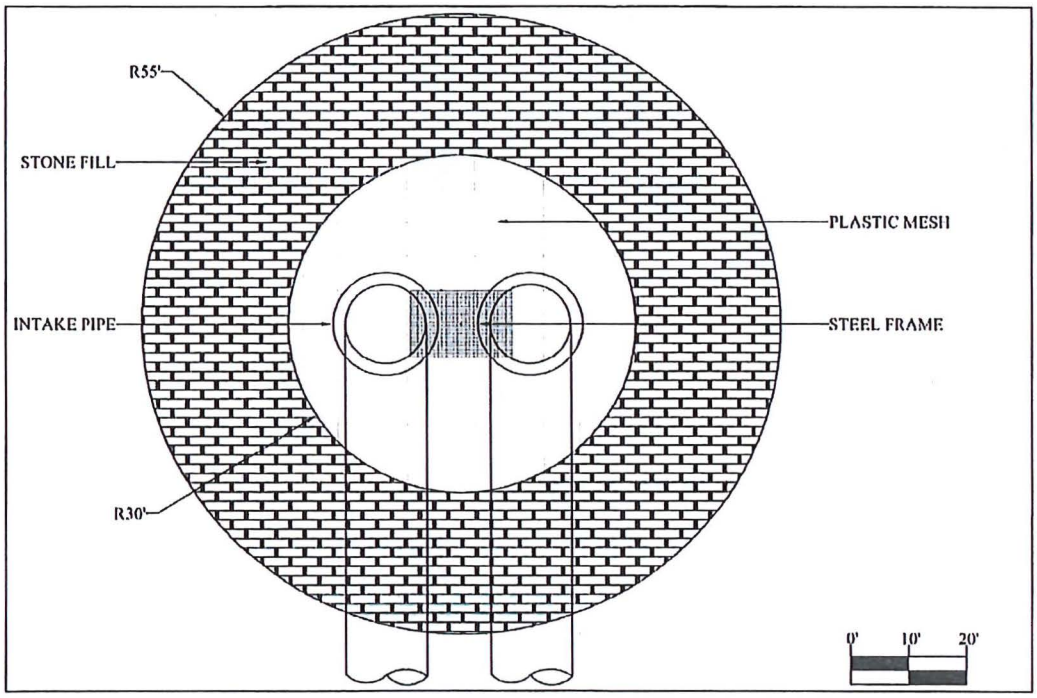


Figure 3-1. General Location Map for Point Beach Nuclear Plant.



Source: Alden Research Laboratory, Inc.

Figure 3-2. General Layout of the Point Beach Nuclear Plant Cooling Water Intake Structure.



Source: Alden Research Laboratory, Inc.

Figure 3-3. Point Beach Nuclear Plant Offshore Intake Crib – Plan View

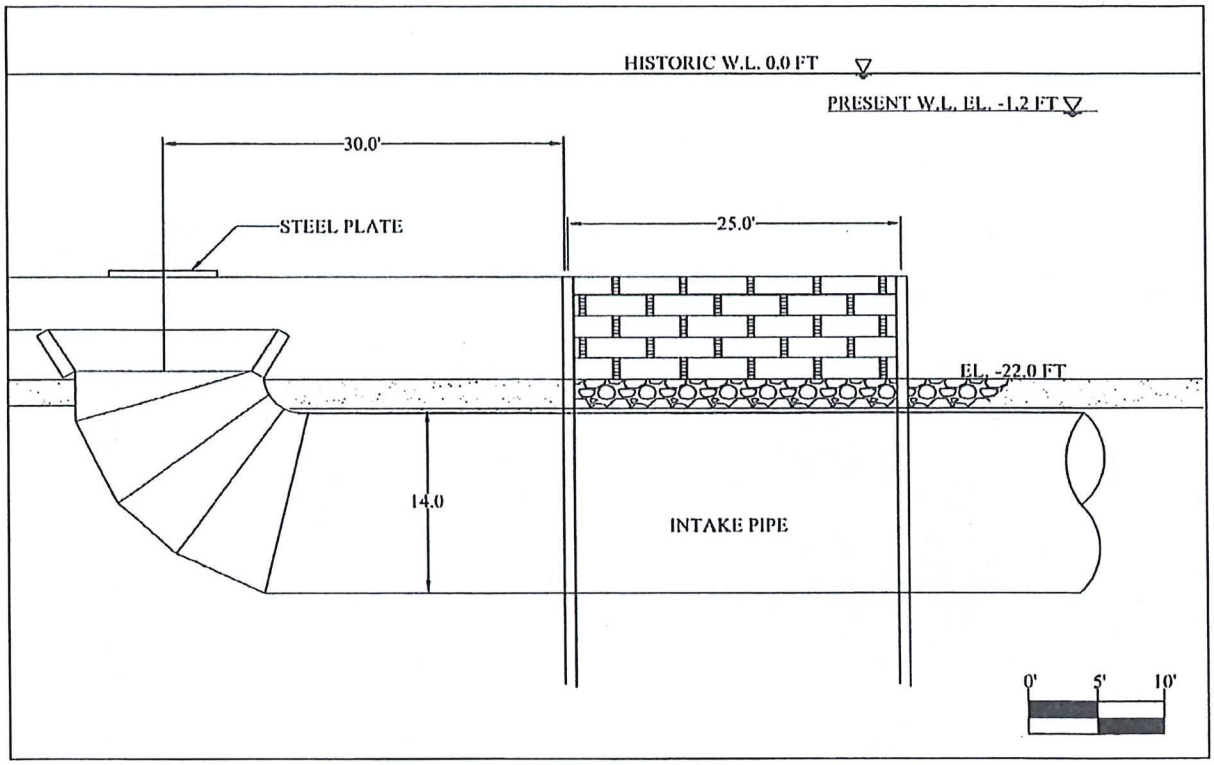


Figure 3-4. Point Beach Nuclear Plant Offshore Intake Crib – Section View

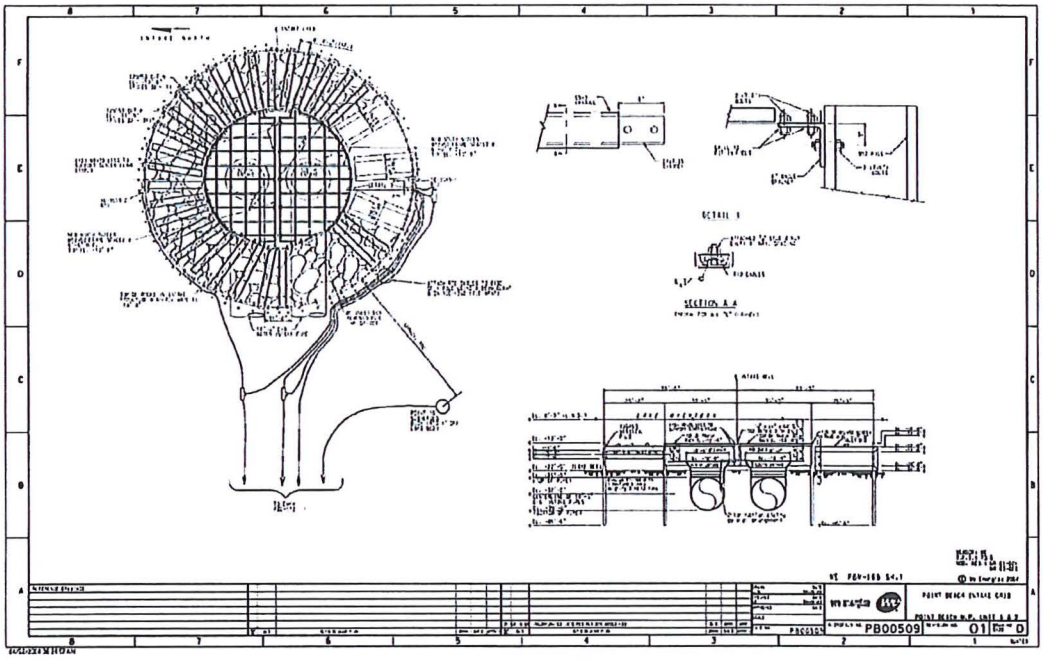


Figure 3-5. Point Beach Nuclear Plant Offshore Intake Crib—Porous Structure.

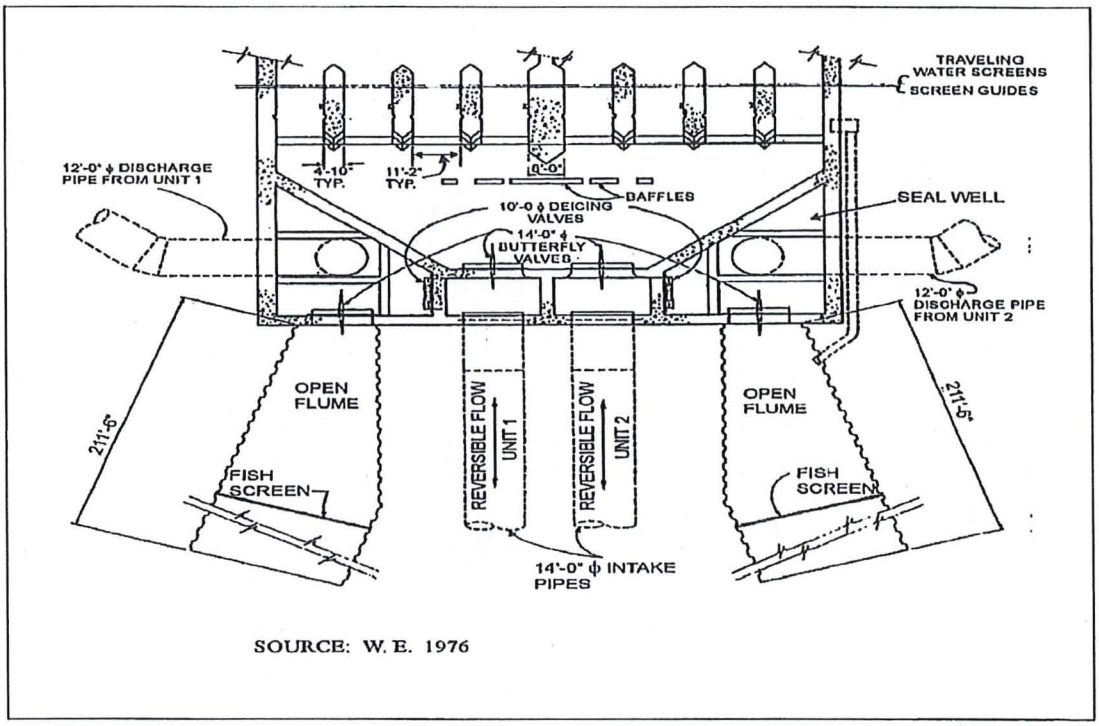


Figure 3-6. Point Beach Nuclear Plant Pumphouse – Plan View.

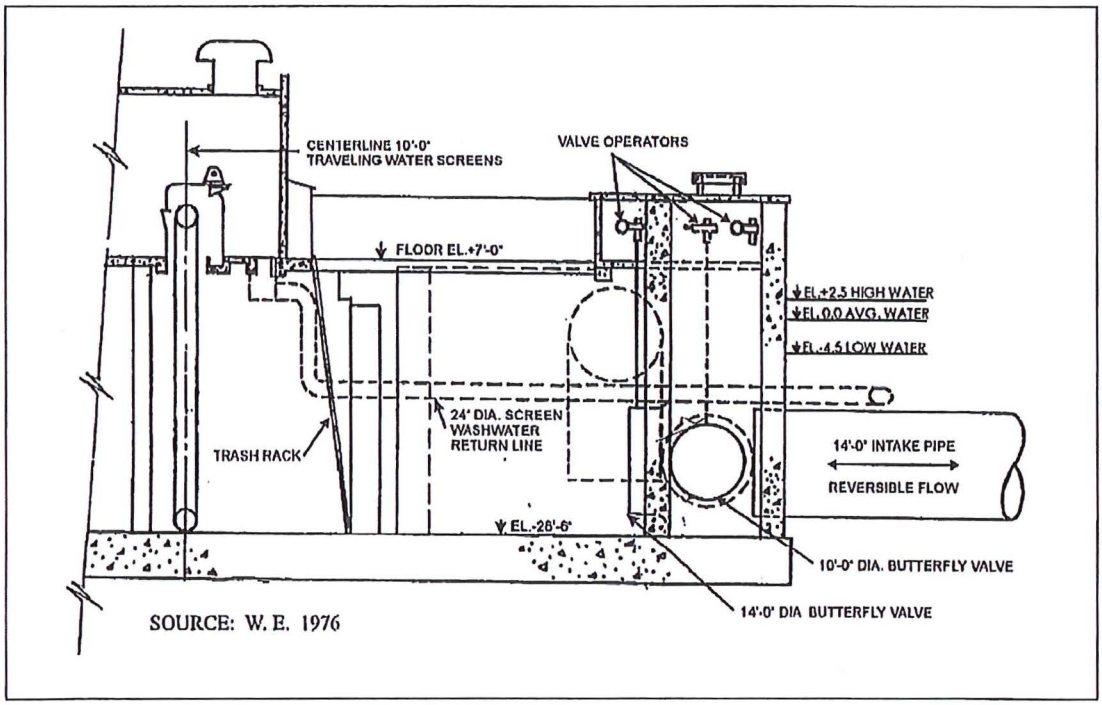


Figure 3-7. Point Beach Nuclear Plant Pumphouse – Section View.

4. METHODS AND MATERIALS

The following summary of the entrainment sampling program is intended to provide sufficient information to understand the proposed program including its conformance with the requirements of the §316(b) existing facilities Rule and the draft guidelines for implementing §316(b) in Wisconsin (WDNR 2016). In developing this plan, EA has applied its experience with the 2006 entrainment study at PBNP (EA 2007). The program outlined below applies the same onshore entrainment sampling methods used in 2006.

4.1. ENTRAINMENT SAMPLING LOCATION

The intent of entrainment sampling under the final Rule is to collect, identify, and count organisms that are being entrained. The final Rule states that entrainment "*[o]ccurs when any life stages of fish and shellfish are drawn into the intake water flow entering and passing through a cooling water intake structure and into a cooling system*". EPRI (2014) provides four conceptual locations for sampling entrained organisms: 1) within the hydraulic zone or area of influence[7] in the source waterbody just prior to entering the intake (Area of Influence [AOI] sampling); 2) as or after organisms enter the intake (intake sampling), 3) between the cooling water pumps and condenser (condenser sampling), and 4) from the cooling water system downstream of the condensers (discharge sampling). The advantages and disadvantages of each potential sampling location are presented in Table 4-1.

The 2006 study at PBNP was conducted in accordance with a sampling plan outlined in the Proposal for Information Collection (PIC) submitted to the WDNR in December 2004 (ENSR 2004). WDNR provided comments to the PIC and the sampling plan was subsequently revised (Hellman 2005). The 2006 entrainment samples at PBNP were collected by pumping water from the intake forebay (EA 2007), a sampling approach that represents intake sampling (Table 4-1). The 2006 approach was chosen for the 2017 entrainment study so that the new data would be consistent with the 2006 results. The primary advantage of intake sampling is that there is low potential for damage to or loss of entrained organisms resulting from passage through the cooling water system and there is certainty that all organisms collected will be entrained based on approach velocities within the intake system.

4.2. SAMPLING FREQUENCY AND PERIOD

The Rule requires that existing facilities obtain site-specific information "*...sufficient to characterize the annual, seasonal and diel variations in ... entrainment...*" The Rule does not specify sampling frequency for existing facilities, but for new units at existing facilities that elect to install open cycle cooling (or comply under 40 CFR 125.94(e)(2)): "*[s]amples will be collected no less than biweekly[8] during the primary period of reproduction, larval recruitment, and peak abundance identified during the Source Water Baseline Biological Characterization*

[7] The area of influence (AOI) is generally considered to be the portion of the source water body directly affected by the withdrawal of water by the CWIS or where the natural water velocity vectors are measurably deflected toward the CWIS.

[8] Biweekly is defined as every other week (EPRI 2014).

Data required under §122.21(r)(4)"[9]. The draft WDNR guidance specifies biweekly sampling at facilities with AIF >125 mgd. Therefore, biweekly sampling will be conducted in 2017 from April through September, a schedule that is consistent with the primary spawning season of common Lake Michigan fishes known to occur in the vicinity of the PBNP (Wenholz 2007). Because entrainment often varies on a diel basis, the sampling program addresses diel patterns as required by the final Rule and is consistent with the draft WDNR guidance. As in 2006, the sampling events will be segregated into four, six-hour intervals (0000-0600, 0600-1200, 1200-1800, and 1800-0000 hours) over each 24-hour sampling event. The 2017 program includes identification and enumeration of ichthyoplankton and shellfish in a total of 48 samples (four diel sampling periods per event x 12 sampling events).

4.3. SAMPLE COLLECTION

Entrainment samples will be collected at mid-depth from the intake forebay with an electric powered pump rated at about 240 gallons per minute (gpm). Selection of mid-depth sampling in 2006 was based on an assumption that the source water (and therefore ichthyoplankton and shellfish) were well-mixed due to turbulence in the forebay as well as mixing that very likely occurs in the offshore crib and the pipes connecting the crib to the forebay. Pumped water will be discharged into a 0.5 m diameter plankton net with 335 µm mesh that will be partially submerged in a 200 gallon tank to minimize turbulence and possible damage to pumped organisms. A schematic of the pump, hoses, and net assembly used in 2006 and proposed for this effort is shown in Figure 4-2. Figure 4-3 shows the entrainment sampling equipment set on a scaffold placed alongside the intake forebay in order to raise the sampling equipment near the top of the forebay wall.

The target sample volume for each six-hour sampling event will be 100 m^3. A flowmeter (e.g., Signet 8150 Flow Totalizer) will be installed in a pipe attached to the discharge hose to measure the volume of water pumped. When the target volume is reached, the pump will be turned off and the net washed down to concentrate the sample into the collection bucket at the cod end of the plankton net. The sample will be transferred to pre-labeled sample containers and preserved with 10% buffered formalin and rose bengal.

Water temperatures will be measured during each diel sampling event using a calibrated thermistor by inserting the probe into the collection tank. Cooling water volumes as well as intake and discharge water temperatures will be provided by PBNP on a per-sample event and per-week (i.e., Sunday through Saturday) basis. Mean, minimum, and maximum water temperatures will be calculated for each sampling period.

[9] Federal Register, Vol. 79 No. 158, August 15, 2014, Page 48378.

Table 4-1. Advantages and Disadvantages of Four Conceptual Locations for Sampling Entrained Organisms (EPRI 2014).

Conceptual Location	Advantages include:	Disadvantages include:
AOI	• No potential for damage to or loss of entrained organisms resulting from passage through the cooling water system. • Frequency of already dead or moribund organisms can be assessed at this location given appropriate sampling techniques. • May be useful to develop estimates of technology efficacy (fractional reduction in entrainment densities).	• Knowledge of AOI required to ensure sampling takes place in appropriate location and depths. • Low water velocities in the AOI may allow avoidance of stationary sampling gear by more motile larval and early juvenile stages. • Potential uncertainties as to whether organisms collected are actually being entrained.
Intake	• No potential for damage to or loss of entrained organisms resulting from passage through the cooling water system. • Frequency of already dead or moribund organisms can be assessed at this location given appropriate sampling techniques. • Samples only organisms that are actually entrained.	• Non-random vertical distribution necessitates depth-stratified sampling and knowledge of vertical distribution of cooling water withdrawals. • Low water velocities associated with many CWISs increase likelihood of active gear avoidance for more motile larval and early juvenile stages.
Condenser	• Sampling equipment very simple and easily deployed if sufficient space is available. • Due to location, stratification issues are removed. • Samples only organisms that are actually entrained.	• Potential damage to organisms during passage through cooling water pumps or valves used to control sampling rates. • Pressures and tap sizes may not be ideal for desired sampling rates.
Discharge	• Certainty that all organisms collected were actually entrained. • Turbulence reduces potential bias resulting from non-random distribution of entrained organisms. • Higher velocities and darkness reduces potential bias from gear avoidance by live organisms.	• Potential loss or damage of organisms passing through cooling water system. • Potential access difficulties. • Potential high water velocity, causing extrusion or damage if nets are used as the sampling gear. • Potential high water velocity increases difficulty of stabilizing sampling gear.

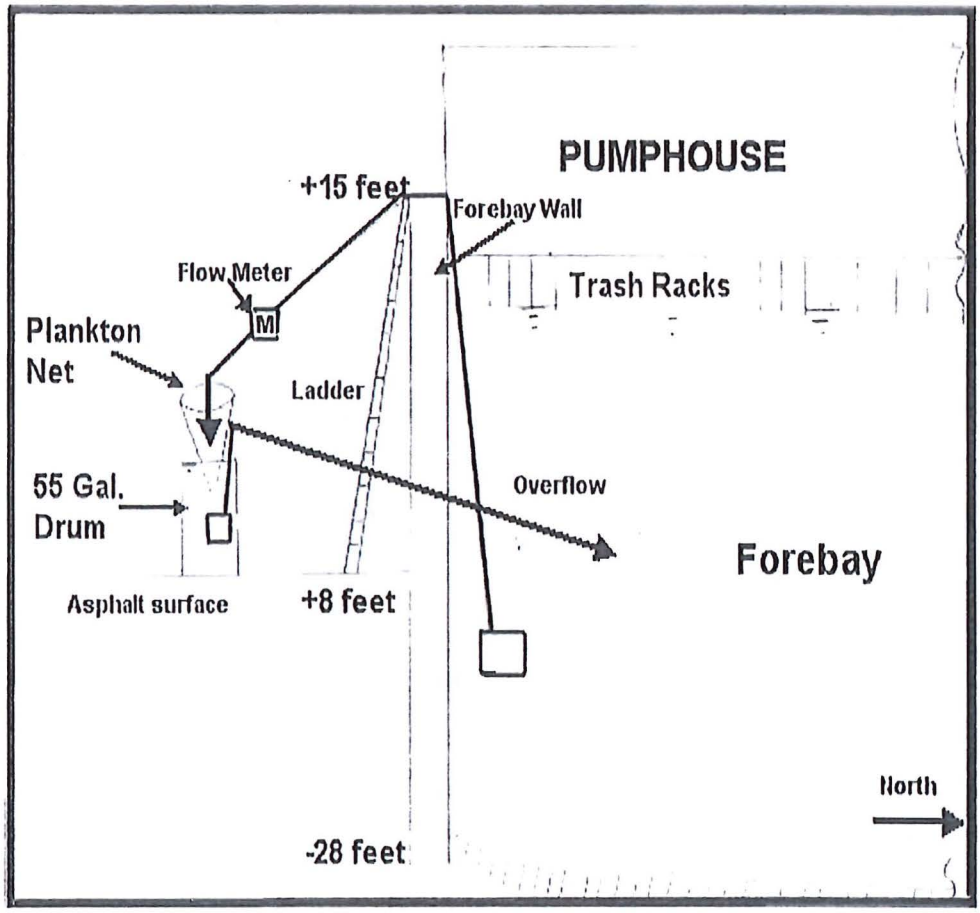


Figure 4-1. Schematic Layout of Entrainment Sampling at Point Beach Nuclear Plant, April through September 2006.

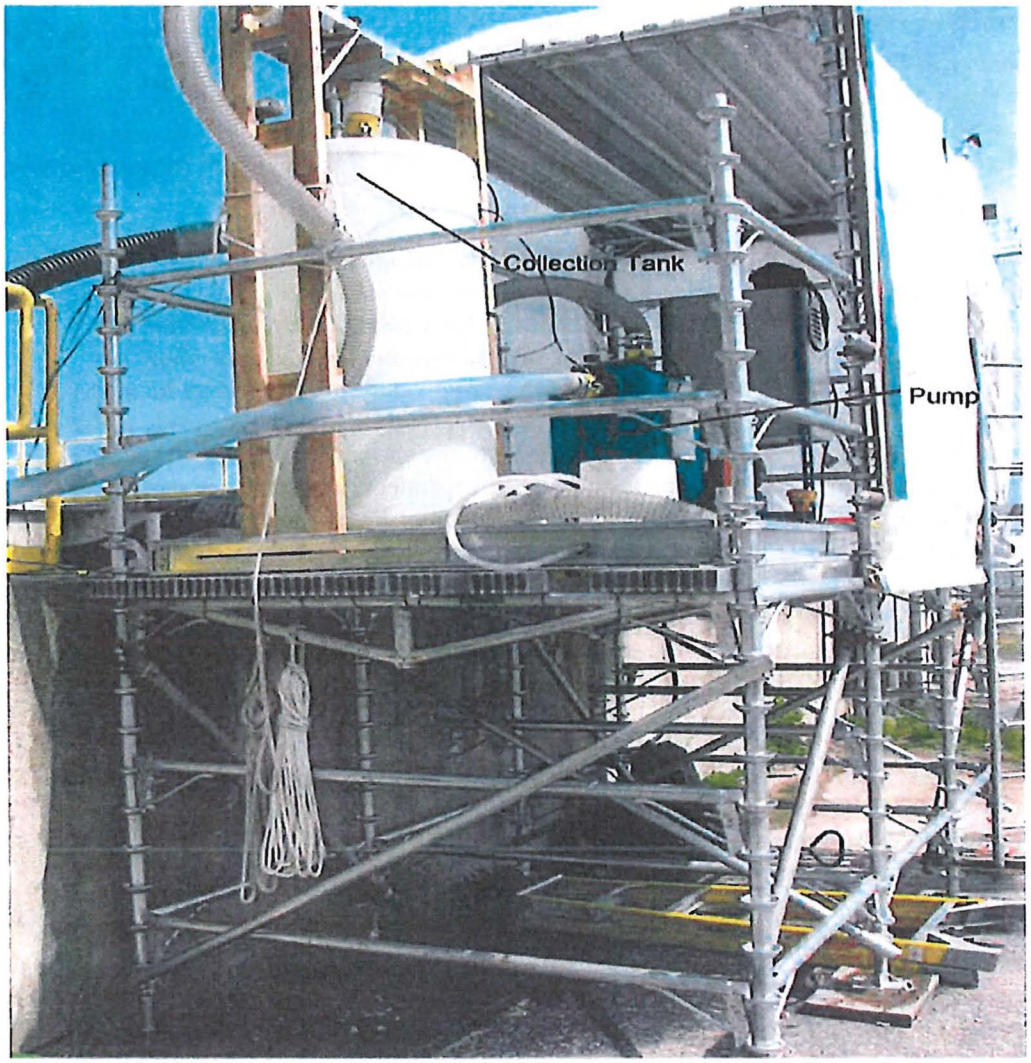


Figure 4-2. Entrainment Sampling Equipment on Scaffolding Alongside Intake Forebay.

4.4. SAMPLE PROCESSING

Entrainment samples will be logged on a sample control sheet. Prior to processing, the samples will be rinsed through a 335 µm mesh sieve to remove excess detritus and formalin. The rinsed samples will then be sorted for shellfish and ichthyoplankton with the aid of an illuminated magnifier or dissecting microscope and placed in labeled vials. Ten percent of the samples will be resorted for quality assurance purposes.

Sorted shellfish and ichthyoplankton will be enumerated and identified with the aid of dissecting microscopes equipped with polarizing lenses. Characters used to describe early life stages of fishes are qualitative, rather subjective, and change as early development progresses (e.g., pigmentation patterns). Quantitative characters such as myomere counts often show considerable overlap among species and can vary geographically and temporally for a given species (Bosley and Connor 1984). Thus, identifications for this study will be made to the lowest possible taxon, which for larval fish, could be to the species level, but often to the genus level (e.g., *Lepomis* or *Coregonus* cannot typically be separated to species), and occasionally higher levels (e.g., family). "Type" identifications may be made when characters of a specimen agree with a taxon to which it was assigned, but the taxonomist cannot be 100 percent certain that it in fact it is that taxon (Table 2-2). Thus, a "type" designation may not be the taxon indicated, but rather a taxon that shares many of the same larval characteristics with that taxon. Fish eggs typically cannot be identified to species or genus, but attempts will be made to provide at least family level egg identifications (Table 2-2).

Ichthyoplankton identifications will be made using applicable references and taxonomic keys (e.g., Auer 1982, Wallus et al. 1990, Kay et al. 1994, Simon and Wallus 2003 and 2006, and Wallus and Simon 2006 and 2008). Life stages of fish will be categorized as egg, yolk-sac larvae, post yolk-sac larvae, and juveniles. A voucher series will be compiled and verified by noted ichthyoplankton expert and author Robert Wallus.

EPA has not defined "shellfish" in either the Phase II or current rule. The term is generally understood to include organisms used for human consumption such as shrimp, crayfish, and clams. Although EPA has not provided a definition, "shellfish" for this study will include crayfish, amphipods, and *Mysis* to be consistent with the position WDNR has taken regarding what constitutes shellfish in Lake Michigan. Invertebrate taxonomic keys will include Balcer et al. (1984), Page (1985), and Smith (2001).

For each sample, up to 20 specimens per taxon and life stage will be measured to the nearest 0.1 mm (total length and head capsule depth of larvae and egg diameters).

4.5. DATA SUMMARIES AND ANALYSIS

Tabular summaries will be provided that include total numbers, densities (number per 100 m^3), and relative abundance by species or taxon and life stage for: 1) the study as a whole; 2) each sampling event; and 3) the four diel periods. Plant-supplied operating data will be summarized on a per-event basis and cooling water volumes will be summarized on a daily and biweekly basis for each diel period. Mean, minimum, and maximum water temperatures will be calculated for each sampling event. Tabular and/or graphical summaries will be prepared that compare the

diel and daily densities of commonly entrained ichthyoplankton and shellfish among sampling events. The daily diel densities will be expanded based on cooling water volume to yield biweekly diel estimates, which will be summed to yield study estimates for each diel period and for diel periods combined. The biweekly diel entrainment estimates for each taxon and life stage will be calculated using the following formula:

Biweekly Diel Estimate = Diel Density x Biweekly Diel Cooling Water Volume.

The size measurements of ichthyoplankton (i.e., larval length and head capsule depth, and egg diameters) will be summarized as ranges and means and for common taxa frequency distributions by 1.0 mm size classes.

4.6. REPORTING

The Entrainment Characterization Report will document the measured rates of entrainment in 2017 of all life stages of fish, shellfish, and any species protected under Federal, State, or Tribal law (including threatened or endangered species). To fulfill requirements of the final Rule the report will:

- identify and document "*all methods and quality assurance/quality control procedures for data collection and data analysis*";
- present and discuss all ancillary data, including "*the flows associated with the data collection*";
- describe the ichthyoplankton and shellfish composition in the entrainment samples, "*including a description of their abundance and their temporal and spatial characteristics in the vicinity of the cooling water intake structure(s)*";
- note the presence of any aquatic species protected under Federal, State, or Tribal law (including threatened or endangered species) , "*including a description of their abundance and their temporal and spatial characteristics in the vicinity of the cooling water intake structure(s)*";
- discuss the collection of recreationally important taxa (e.g., salmonids), forage base taxa (e.g., alewife), and other commonly entrained taxa;
- provide size (larval length and head capsule depth, egg diameters) distributions for the commonly entrained taxa;
- provide entrainment estimates for all taxa combined and by taxon and life stage, and "*identify and document all assumptions and calculations used to determine the total entrainment*";
- assume 100 percent mortality for all taxa entrained;
- "*characterize annual, seasonal, and diel variations in entrainment*"; and

- provide appendices on a CD that include all raw data, including plant operating and other ancillary data.

The Entrainment Characterization Report will also incorporate entrainment data collected at Point Beach in 2006 under the Phase II effort. A CD of the 2006 raw data will also be provided to facilitate quantitative analysis of the two data sets anticipated in the technology assessment.

5. QUALITY ASSURANCE AND QUALITY CONTROL

5.1. PROGRAM OVERVIEW

The Point Beach Nuclear Plant Entrainment Characterization Study will be managed under a quality assurance/quality control (QA/QC) program responsive to the Rule regarding data used in and generated for the study. Quality Assurance (QA) is an integrated system of management activities that involves planning, implementation, assessment, reporting, and quality improvement to ensure that data are of the type and quality necessary for application to their intended use. Quality control (QC) is the system of activities that measures the QA program activities to verify that they meet project specifications. In addition to requiring QA/QC procedures, the Rule has set some objectives for data quality by stating that the sampling and analytical methods must be appropriate for a quantitative survey.

This study plan meets the intent of EA's Corporate Quality Management Plan, in that it is the site-specific document that presents the study design, methodologies, and guidance from sample collection and processing through data analysis and reporting, as well as the QA/QC activities and health and safety concerns. It provides the mechanism whereby the project Team and the WDNR will resolve questions and concerns pertaining to the study design (e.g., methodologies, gear specifications, data analysis, reporting content/format) prior to the start of the study, thereby minimizing the potential for disagreements and misunderstandings after the study is completed.

A Standard Operating Procedures (SOP) manual will be established prior to collecting entrainment samples. The study plan described herein will form the basis of the SOP and will be augmented by the addition of project-specific checklists, datasheets, forms, and instructions on how to fill them out, review them, and store them. The SOP will also provide a more detailed ("cookbook") approach for mobilization, communication, sample collection, sample processing and identification, data management, QA/QC procedures and documentation, and health and safety. The SOP will be written in a concise, step-by-step, easy-to-read format and provided to appropriate project personnel. Information will be conveyed clearly and explicitly to remove any doubt as to what is required. The following sections provide general discussions of key components for the QA/QC section of the SOP.

5.2. EQUIPMENT CALIBRATION

All equipment used during the entrainment characterization study will be calibrated and/or maintained according to established procedures or manufacturer's recommendations. Calibrations will be appropriately documented and maintained in the project file. Equipment for this study that will require calibration include flowmeter totalizers and water temperature thermistors.

5.3. FIELD SAMPLING

Field sampling will be conducted by trained EA crew members experienced with entrainment sampling, use of the sampling equipment, and sample preparation. Crew members are expected to have read and have on hand at all times a copy of the SOP as well as the WDNR scientific

collection permit. A field audit will be conducted by a senior biologist to assure that field sampling is following the SOP.

The SOP will provide detailed sample collection procedures and a field equipment checklist so that the field crew has all the appropriate equipment needed for sampling. It will also provide a site-specific list of plant personnel that will be contacted prior to each sampling event. In addition, it will contain health and safety information; including an emergency response plan (see Section 6).

5.4. LABORATORY ANALYSIS

Entrainment samples will be logged on sample control/sorting forms prior to processing. All ichthyoplankton and shellfish will be hand-picked from the debris and the sorted sample will be re-preserved and saved for subsequent QA/QC checks. Ten percent of each sorter's samples will be re-sorted by a different sorter. If less than 90 percent of the ichthyoplankton or shellfish were originally found by a sorter, that person's samples will be re-sorted until at least 90 percent efficiency is achieved. Re-sorts will be appropriately documented and maintained in the project file.

Mr. Bob Wallus, a noted larval fish expert who has co-authored all six volumes of the *Reproductive Biology and Early Life History of Fishes in the Ohio River Drainage* (Wallus et al. 1990, Kay et al. 1994, Simon and Wallus 2003 and 2006, and Wallus and Simon 2006 and 2008), will re-identify ichthyoplankton from 10 percent of the samples and verify the ichthyoplankton voucher collection prepared by EA taxonomists. Shellfish samples will be identified and a voucher collection verified by different EA taxonomists. The verifications and re-identifications will be appropriately documented and maintained in the project file.

5.5. DATA MANAGEMENT

Hard copy field and laboratory data sheets will be entered into a Microsoft Access database. Access queries will be used to create proof sets that will be double-checked against the hard copy field and laboratory data sheets. Only documented Access queries will be used to generate tabular summaries that will be imported into other Microsoft Office products to produce tables and figures for the report.

5.6. REPORT

The report will be prepared by an EA biologist with §316(b) experience to meet the requirements in §122.21(r)(9). It will undergo independent EA senior technical review and will also be reviewed by ECT and NextEra Energy before it is submitted to WDNR.

6. HEALTH AND SAFETY

6.1. OVERVIEW

Field personnel may potentially be exposed to a variety of hazards associated with working around a power plant intake structure and nighttime sampling. Crew safety is of the utmost importance, therefore, no personnel will be required to or instructed to work in surroundings or under conditions that are unsafe or dangerous to his or her health and the buddy system will be strictly enforced during all field work. Crew members will be responsible for complying with applicable safety requirements, wearing prescribed safety equipment including a Personal Floatation Device (PFD), and preventing avoidable accidents. In particular, appropriate safety gear (e.g., hard hats, safety glasses, ear protection, gloves, and composite or steel-toed boots) will be worn while on plant property. Field personnel will be expected to follow all safety procedures applicable to the plant. Plant-specific health and safety requirements will be incorporated into the SOP.

6.2. WEATHER HAZARDS

Weather conditions will be taken into consideration during each sampling event. Heavy rains, electrical storms, high winds, and extreme temperatures, for example, may create dangerous situations for crew members. Whenever unfavorable conditions arise, the Crew Leader will evaluate both the safety hazards and ability of the crew and/or equipment to perform effectively under such conditions and immediately contact the Project Manager.

6.3. CHEMICAL HAZARDS

Any chemicals brought into the study areas (e.g., alcohol and formalin) will be handled in accordance with their respective material safety data sheet (MSDS), which will be included in an appendix of the SOP. All chemicals will be subject to prior approval of the Chemical Control Coordinator and the Site Project Manager.

6.4. THERMAL PROTECTION

Illness resulting from exposure to extreme cold or heat is possible during field operations. Field personnel will be familiar with heat stress and hypothermia.

6.4.1. Heat Stress

The signs, symptoms, and preventive measures of heat stress will be summarized in the SOP. If a heat-related illness is suspected or observed, the affected person must be moved to a cool or shaded area and given plenty of liquids to consume. If symptoms of a heat stroke are observed, the victim will be cooled immediately and transported to the hospital. Driving directions to hospitals from appropriate points near each study area will be provided in the SOP.

6.4.2. Hypothermia

Inadequate protection from precipitation, even in relatively warm conditions, may result in hypothermia if the body core temperature drops below 95°F. Symptoms of hypothermia will be summarized in the SOP.

Treatment of hypothermia requires that the victim be immobilized, wrapped in blankets, and the airway kept open. Apply basic life support, CPR when needed, and call for help and immediate transport. If the victim is alert, provide warm liquids unless very cold—then avoid due to possibility of ventricular tachycardia.

6.5. BIOLOGICAL HAZARDS

Protective outer clothing such as gloves and coveralls can reduce the potential for insect bites and stings. Insect bite symptoms may include redness, rash, swelling, chills, fever, diarrhea, and vomiting. Any worker who has been bitten or stung and shows symptoms of a severe reaction should seek medical assistance immediately. Staff with allergies to insect bites and stings is expected to advise their supervisor and the Crew Leader prior to field activities, and should carry an antidote kit, as necessary.

6.6. EMERGENCY RESPONSE PLAN

In the unlikely event of an emergency, the information available must be properly evaluated and the appropriate steps taken to implement an emergency response plan. Field personnel will assume command of the situation, contact appropriate Plant personnel either by cell phone or by the intra-plant system, notify first responders of their location, evacuate personnel as needed, and take other steps needed to gain control of the emergency such as administering appropriate first aid. Once the emergency is under control, the project manager and/or other health and safety corporate personnel will be notified. The emergency response plan will be updated in the SOP following site-specific safety training.

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Appendix B

Point Beach Entrainment Field Data

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Trip: 1

Entrainment Field Data Sheet - Point Beach Generating Station - Nextera

Project No. 15260.04 Date: 4/12 Crew Initials: NP, LB, KJ, BM

Serial Number	Diel Period	Date	Temp (C)	Start (hh:mm)	End (hh:mm)	Sample Volume (~~L~~ Gal):	Jars (#)	Remarks
PB-001	0600-1200	4/12/2016	4.7	0823	1103	26447 Gal	1	
Weather: ☒ Clear ☐ Partly Cloudy ☐ Overcast ☐ Precipitation ☐ Thunderstorms					Wind Direction: 6MPH Wind Speed: W			Air Temperature: 41°F Target Volume (L): 100,000
PB-002	1200-1800	4/12/2016	5.2	12:50	1530	26521 Gal	1	
Weather: ☒ Clear ☐ Partly Cloudy ☐ Overcast ☐ Precipitation ☐ Thunderstorms					Wind Direction: 9MPH Wind Speed: E			Air Temperature: 49°F Target Volume (L): 100,000
PB-003	1800-0000	4/12/2016	7.9	18:20	2109	26606		~~260~~
Weather: ☐ Clear ☐ Partly Cloudy ☒ Overcast ☐ Precipitation ☐ Thunderstorms Light rain					Wind Direction: S Wind Speed: 7			Air Temperature: 41°F Target Volume (L): 100,000
PB-004	0000-0600	4/13/2017	6.8	0009	0301	27447		
Weather: ☐ Clear ☐ Partly Cloudy ☒ Overcast ☐ Precipitation ☐ Thunderstorms Rain (light)					Wind Direction: E Wind Speed: 4			Air Temperature: 41°F Target Volume (L): 100,000

Field Notes: - overcast, some light rain ~ 2030 and ~ 0330

Trip: 2

Entrainment Field Data Sheet - Point Beach Generating Station - Nextera

Project No. 15260.04 Date: 4/24/17 Crew Initials: LH, LB / NR, KJ

Serial Number	Diel Period	Date	Temp (C)	Start (hh:mm)	End (hh:mm)	Sample Volume (gal):	Jars (#)	Remarks
PB-005	0600-1200	4/25/17	7.9	0633	0917	27071	1	
Weather: ☐ Clear ☐ Overcast ☐ Thunderstorms ☒ Partly Cloudy ☐ Precipitation					Wind Direction: SSE Wind Speed: 12 mph			Air Temperature: 49°F Target Volume (gal): 26420
PB-006	1200-1800	4/25/17	6.7	1200	1440	26444	1	
Weather: ☒ Clear ☐ Overcast ☐ Thunderstorms ☐ Partly Cloudy ☐ Precipitation					Wind Direction: SSE Wind Speed: 14 mph			Air Temperature: 52°F Target Volume (gal): 26420
PB-007	1800-0000	4/24/17	9.3	1914	2212	26020	1	
Weather: ☐ Clear ☐ Overcast ☐ Thunderstorms ☒ Partly Cloudy ☐ Precipitation					Wind Direction: SE Wind Speed: 9 mph			Air Temperature: 51°F Target Volume (gal): 26420
PB-008	0000-0600	4/25/17	8.5	0037	0336	26456	1	
Weather: ☐ Clear ☐ Overcast ☐ Thunderstorms ☒ Partly Cloudy ☐ Precipitation					Wind Direction: SE Wind Speed: 2 mph			Air Temperature: 44°F Target Volume (gal): 26420

Switch Depth @ 8800 Gallons And 17600 Gallons; Wash-Downs should be performed every 30 min or at Depth Changes, whichever comes first.

Field Notes:- 0600 - 1200 = overcast to partly sunny skies; ~55 ~~[illegible]~~°F, SSE wind @ ~12-20 mph;
- @ ~0800-0845, plant staff removed ladder from discharge side of scaffold
- 1200 - 1800: clear to partly cloudy; ~55°F SSE @ ~14 mph

PB-007 - hose stuck behind ladder

Trip: 3

Entrainment Field Data Sheet - Point Beach Generating Station - Nextera

Project No. 15260.04 Date: 5/8/17 Crew Initials: NR/KJ / LB/BM

Serial Number	Diel Period	Date	Temp (C)	Start (hh:mm)	End (hh:mm)	Sample Volume	Jars (#)	Remarks
PB-009	0600-1200	5/9/2017	8.5C	0643	0937	26432	1	
Weather: ☒ Clear ☐ Partly Cloudy		☐ Overcast ☐ Precipitation	☐ Thunderstorms		Wind Direction: SW Wind Speed: 3 mph			Air Temperature: 37F Target Volume (gal): 26420
PB-010	1200-1800	5/9/17	9.0C	1200	1454	26431	1	
Weather: ☐ Clear ☒ Partly Cloudy		☐ Overcast ☐ Precipitation	☐ Thunderstorms		Wind Direction: SSE Wind Speed: 9			Air Temperature: 50F Target Volume (gal): 26420
PB-011	1800-0000	5/8/17	9.4°C	1908	2150	26438	1	
Weather: ☒ Clear ☐ Partly Cloudy		☐ Overcast ☐ Precipitation	☐ Thunderstorms		Wind Direction: S Wind Speed: 8 MPH			Air Temperature: 45°F Target Volume (gal): 26420
PB-012	0000-0600	5/9/17	8.5°C	0000	0241	26429	1	
Weather: ☒ Clear ☐ Partly Cloudy		☐ Overcast ☐ Precipitation	☐ Thunderstorms		Wind Direction: WSW Wind Speed: 1 MPH			Air Temperature: 39°F Target Volume (gal): 26420

Switch Depth @ 8800 Gallons And 17600 Gallons; Wash-Downs should be performed every 30 min or at Depth Changes, whichever comes first.

Field Notes:

Trip: 4

Entrainment Field Data Sheet - Point Beach Generating Station - Nextera

Project No. 15260.04 Date: 5/23/17 Crew Initials: LH NR LS KJ

Serial Number	Diel Period	Date	Temp (C)	Start (hh:mm)	End (hh:mm)	Sample Volume	Jars (#)	Remarks
PB-013	0600-1200	5/23/17	9.33°C	08:49	11:40	28295	1	
Weather: ☐ Clear ☒ Overcast ☐ Thunderstorms ☐ Partly Cloudy ☐ Precipitation					Wind Direction: ENE	Wind Speed: 3mph		Air Temperature: 52°F; Target Volume (gal): 26420
PB-014	1200-1800	5/23/17	10.03°C	1200	1445	27546	1	
Weather: ☐ Clear ☒ Overcast ☐ Thunderstorms ☐ Partly Cloudy ☐ Precipitation					Wind Direction: NNE	Wind Speed: 9mph		Air Temperature: 53°F; Target Volume (gal): 26420
PB-015	1800-0000	5/23/17	9.17°C	1900	2149	26463	1	
Weather: ☐ Clear ☐ Overcast ☐ Thunderstorms ☐ Partly Cloudy ☒ Precipitation					Wind Direction: N	Wind Speed: 7mph		Air Temperature: 47°F; Target Volume (gal): 26420
PB-016	0000-0600	5/24/17	9.09	0000	0252	26801	1	
Weather: ☐ Clear ☒ Overcast ☐ Thunderstorms ☐ Partly Cloudy ☒ Precipitation					Wind Direction: NNE	Wind Speed: 11mph		Air Temperature: 48°F; Target Volume (gal): 26420

Switch Depth @ 8800 Gallons And 17600 Gallons; Wash-Downs should be performed every 30 min or at Depth Changes, whichever comes first.

Field Notes:

Trip: 5

Entrainment Field Data Sheet - Point Beach Generating Station - Nextera

Project No. 15260.04

Date: 6/6/2017 Crew Initials: LH, BSM

Serial Number	Diel Period	Date	Temp (C)	Start (hh:mm)	End (hh:mm)	Sample Volume (gal):	Jars (#)	Remarks
PB-017	0600-1200	6/6/2017	12.0	0827	1140	26428	1	8644 = 1/3 17449 = 2/3
Weather: ☒ Clear ☐ Partly Cloudy	☐ Overcast ☐ Precipitation	☐ Thunderstorms			Wind Direction: N Wind Speed: 11 mph			Air Temperature: 64 F Target Volume (gal): 26420
PB-018	1200-1800	6/6/2017	12.3	1200	1567	26453	1	1255 - 8321 - 1/3 1406 - 1403 - 17406 - 2/3
Weather: ☒ Clear ☐ Partly Cloudy	☐ Overcast ☐ Precipitation	☐ Thunderstorms			Wind Direction: NNE Wind Speed: 12 mph			Air Temperature: 70 F Target Volume (gal): 26420
PB-019	1800-0000	6/6/2017	12.6	1804	2100	26552	1	- Water Level Kept Fluctuating in Tank - Algae Blockage
Weather: ☒ Clear ☐ Partly Cloudy	☐ Overcast ☐ Precipitation	☐ Thunderstorms			Wind Direction: NE Wind Speed: 11 MPH			Air Temperature: 68 F Target Volume (gal): 26420
PB-020	0000-0600	6/7/2017	12.7	0000	0301	26454		
Weather: ☒ Clear ☐ Partly Cloudy	☐ Overcast ☐ Precipitation	☐ Thunderstorms			Wind Direction: N Wind Speed: 4MPH			Air Temperature: 58 F Target Volume (gal): 26420

Switch Depth @ 8800 Gallons And 17600 Gallons; Wash-Downs should be performed every 30 min or at Depth Changes, whichever comes first.

Field Notes:

8807 465 6910
17614 1030
2642 1148

Trip: 6 Entrainment Field Data Sheet - Point Beach Generating Station - Nextera

Project No. 15260.04 Date: 6/20/17 Crew Initials: NR/RCK

Serial Number	Diel Period	Date	Temp (C)	Start (hh:mm)	End (hh:mm)	Sample Volume	Jars (#)	Remarks
PB-021	0600-1200	6/20/17	9.5	08:47	11:29	26677	1	Heavy filamentous algae
Weather: ☐ Clear ☒ Overcast ☐ Thunderstorms ☐ Partly Cloudy ☐ Precipitation					Wind Direction: NA Wind Speed: Ø			Air Temperature: 63 F Target Volume (gal): 26420
PB-022	1200-1800	06/20/17	9.8	12:15	14:58	26545	1	
Weather: ☐ Clear ☒ Overcast ☐ Thunderstorms ☐ Partly Cloudy ☐ Precipitation					Wind Direction: W Wind Speed: 11			Air Temperature: 70°F Target Volume (gal): 26420
PB-023	1800-0000	6/20/17	9.3	1855	2144	28120	1	[illegible]
Weather: ☐ Clear ☐ Overcast ☐ Thunderstorms ☒ Partly Cloudy ☐ Precipitation					Wind Direction: NW Wind Speed: 7 mph			Air Temperature: 68°F Target Volume (gal): 26420
PB-024	0000-0600	6/21/17	10.3	0001	0250	26418	1	Heavy filamentous algae
Weather: ☒ Clear ☐ Overcast ☐ Thunderstorms ☐ Partly Cloudy ☐ Precipitation					Wind Direction: SW Wind Speed: 1 mph			Air Temperature: 55°F Target Volume (gal): 26420

Switch Depth @ 8800 Gallons And 17600 Gallons; Wash-Downs should be performed every 30 min or at Depth Changes, whichever comes first.

Field Notes: Partly cloudy, no wind at start
1800 - 0000:
- Clear, mild; ~55°F - 62°F
- light breeze (1-10 mph) throughout

Trip: 7

Entrainment Field Data Sheet - Point Beach Generating Station - Nextera

Project No. 15260.04 Date: 06-Jul-17 Crew Initials: KJ, BM, NR, LB

Serial Number	Diel Period	Date	Temp (C)	Start (hh:mm)	End (hh:mm)	Sample Volume	Jars (#)	Remarks
PB-025	0600-1200	06-Jul-17	9.0	0841	1136	26490	1 2qt	
Weather: ☐ Clear ☐ Overcast ☐ Thunderstorms ☒ Partly Cloudy ☐ Precipitation					Wind Direction: WSW Wind Speed: 9mph			Air Temperature: 77°F Target Volume (gal): 26420
PB-026	1200-1800	06-Jul-17	8.2	1303	1600	26545	1 2qt	
Weather: ☒ Clear ☐ Overcast ☐ Thunderstorms ☐ Partly Cloudy ☐ Precipitation					Wind Direction: SW Wind Speed: 7mph			Air Temperature: 84°F Target Volume (gal): 26420
PB-027	1800-0000	06-Jul-17	10.7	1800	2253	27529	1 2qt	
Weather: ☒ Clear ☐ Overcast ☐ Thunderstorms ☐ Partly Cloudy ☐ Precipitation					Wind Direction: N Wind Speed: 2mph			Air Temperature: 75°F Target Volume (gal): 26420
PB-028	0000-0600	07-Jul-17	8.8	0006	0252	26426	1 2qt	
Weather: ☒ Clear ☐ Overcast ☐ Thunderstorms ☐ Partly Cloudy ☐ Precipitation					Wind Direction: NW Wind Speed: 5mph			Air Temperature: 70°F Target Volume (gal): 26420

Switch Depth @ 8800 Gallons And 17600 Gallons; Wash-Downs should be performed every 30 min or at Depth Changes, whichever comes first.

Field Notes:

Trip: 8

Entrainment Field Data Sheet - Point Beach Generating Station - Nextera

Project No. 15260.04 Date: 07/18/17 Crew Initials: LH, LB, KJ, NR

Serial Number	Diel Period	Date	Temp (C)	Start (hh:mm)	End (hh:mm)	Sample Volume	Jars (#)	Remarks
PB-029	0600-1200	07/18/17	19.8	0849	1134	26532	2	Heavy algae
Weather: ☒ Clear ☐ Partly Cloudy ☐ Overcast ☐ Precipitation ☐ Thunderstorms					Wind Direction: SSW Wind Speed: 5mph			Air Temperature: 72°F Target Volume (gal): 26420
PB-030	1200-1800	07/18/17	20.1	1200	1509	29567	2	Heavy algae
Weather: ☒ Clear ☐ Partly Cloudy ☐ Overcast ☐ Precipitation ☐ Thunderstorms					Wind Direction: S Wind Speed: 11 mph			Air Temperature: 78°F Target Volume (gal): 26420
PB-031	1800-0000	7/18/17	20.1	1819	2127	26843	1	* T-storms + N/NE, Rain @ ~ 1930 - 2130
Weather: ☐ Clear ☐ Partly Cloudy ☒ Overcast ☐ Precipitation ☒ Thunderstorms to the North @ 8800					Wind Direction: S Wind Speed: 14mph			Air Temperature: 75°F Target Volume (gal): 26420
PB-032	0000-0600	7/19/17	19.1	0000	0247	26429		* Some light rain @ ~ 0000 - 0130
Weather: ☐ Clear ☐ Partly Cloudy ☐ Overcast ☒ Precipitation ☐ Thunderstorms					Wind Direction: [illegible] Wind Speed: 4			Air Temperature: 70°F Target Volume (gal): 26420

Switch Depth @ 8800 Gallons And 17600 Gallons; Wash-Downs should be performed every 30 min or at Depth Changes, whichever comes first.

Field Notes:

6795

Trip: 9

Entrainment Field Data Sheet - Point Beach Generating Station - Nextera

Project No. 15260.04 Date: 08/01/2017 Crew Initials: LG, RK / KJ / NR

Serial Number	Diel Period	Date	Temp (C)	Start (hh:mm)	End (hh:mm)	Sample Volume	Jars (#)	Remarks
PB-033	0600-1200	08/01/2017	20.3	0907	1207	26428	1-½	
Weather: ☒ Clear ☐ Partly Cloudy		☐ Overcast ☐ Precipitation	☐ Thunderstorms		Wind Direction: East Wind Speed: Light			Air Temperature: 75 F Target Volume (gal): 26420
PB-034	1200-1800	8/1/2017	19.0	1404	1702	26423	1½	
Weather: ☒ Clear ☒ Partly Cloudy		☐ Overcast ☐ Precipitation	☐ Thunderstorms		Wind Direction: East Wind Speed: Light			Air Temperature: 75 F Target Volume (gal): 26420
PB-035	1800-0000	8/1/2017	20.9	1800	2102	27394	1½	
Weather: ☐ Clear ☒ Partly Cloudy		☒ Overcast ☐ Precipitation	☐ Thunderstorms T-storms to NE/E		Wind Direction: SSW Wind Speed: 9mph			Air Temperature: 78 °F Target Volume (gal): 26420
PB-036	0000-0600	8/2/17	19.5	0001	0257	26438	1½	
Weather: ☐ Clear ☒ Partly Cloudy		☒ Overcast ☐ Precipitation	☐ Thunderstorms		Wind Direction: SW Wind Speed: 6MH			Air Temperature: 70 Target Volume (gal): 26420

Switch Depth @ 8800 Gallons And 17600 Gallons; Wash-Downs should be performed every 30 min or at Depth Changes, whichever comes first.

Field Notes: - Some filamentous algae in all 4 diel periods/samples
- ~2130-2300 - light rain & t-showers

Trip: 10

Entrainment Field Data Sheet - Point Beach Generating Station - Nextera

Project No. 15260.04 Date: 08/15/2017 Crew Initials: KMJ, CSZ, LB, NR

Serial Number	Diel Period	Date	Temp (C)	Start (hh:mm)	End (hh:mm)	Sample Volume	Jars (#)	Remarks
PB-037	0600-1200	8/15/2017	20.4	09:16	12:11	26719	2	past noon due to sewering delay
Weather: ☐ Clear ☐ Overcast ☐ Thunderstorms ☒ Partly Cloudy ☐ Precipitation					Wind Direction: NW → NE			Air Temperature: 65°F
					Wind Speed: 5-10 mph			Target Volume (gal): 26420
PB-038	1200-1800	8/15/2017	22.1	13:17	16:20	26462	2	started ½ hr. late due to late start/end for AM sample.
Weather: ☐ Clear ☐ Overcast ☐ Thunderstorms ☒ Partly Cloudy ☐ Precipitation					Wind Direction: N			Air Temperature: 71°F
					Wind Speed: 5-10 mph			Target Volume (gal): 26420
PB-039	1800-0000	08/15/2017	20.6	1820	2109	26427	1	
Weather: ☐ Clear ☐ Overcast ☐ Thunderstorms ☒ Partly Cloudy ☐ Precipitation					Wind Direction: NE			Air Temperature: 68°F
					Wind Speed: 5			Target Volume (gal): 26420
PB-040	0000-0600	08/16/2017	21.3	0000	0247	26432	1	
Weather: ☐ Clear ☐ Overcast ☐ Thunderstorms ☒ Partly Cloudy ☐ Precipitation					Wind Direction: NE			Air Temperature: 63°F
					Wind Speed: 3			Target Volume (gal): 26420

Switch Depth @ 8800 Gallons And 17600 Gallons; Wash-Downs should be performed every 30 min or at Depth Changes, whichever comes first.

Field Notes:

Delayed upon entry because truck swab tested positive for explosive substance; nothing was found.

Trip: 11

Entrainment Field Data Sheet - Point Beach Generating Station - Nextera

Project No. 15260.04 Date: 8/29/17 Crew Initials: LH/KS NR/LB

Serial Number	Diel Period	Date	Temp (C)	Start (hh:mm)	End (hh:mm)	Sample Volume	Jars (#)	Remarks
PB-041	0600-1200	8/29/17	17.2	0829	1125	26941	2-1½	
Weather: ☐ Clear ☐ Overcast ☐ Thunderstorms ☒ Partly Cloudy ☐ Precipitation					Wind Direction: NNW Wind Speed: 5 mph			Air Temperature: 64°F Target Volume (gal): 26420
PB-042	1200-1800	8/29/17	17.6	1204	1503	26438	2-1½	
Weather: ☒ Clear ☐ Overcast ☐ Thunderstorms ☐ Partly Cloudy ☐ Precipitation					Wind Direction: NE Wind Speed: 6 mph			Air Temperature: 69°F Target Volume (gal): 26420
PB-043	1800-0000	08/29/17	19.7	1812	2108	26555	1-1½	
Weather: ☒ Clear ☐ Overcast ☐ Thunderstorms ☐ Partly Cloudy ☐ Precipitation					Wind Direction: NE Wind Speed: 5 mph			Air Temperature: 67°F Target Volume (gal): 26420
PB-044	0000-0600	08/30/17	18.0	0001	0257	26616	1½	
Weather: ☒ Clear ☐ Overcast ☐ Thunderstorms ☐ Partly Cloudy ☐ Precipitation					Wind Direction: SSW Wind Speed: 2 mph			Air Temperature: 61°F Target Volume (gal): 26420

Switch Depth @ 8800 Gallons And 17600 Gallons; Wash-Downs should be performed every 30 min or at Depth Changes, whichever comes first.

Field Notes:

Trip: 12

Entrainment Field Data Sheet - Point Beach Generating Station - Nextera

Project No. 15260.04 Date: 9/12/2017 Crew Initials: NR, RK / LH, KJ

Serial Number	Diel Period	Date	Temp (C)	Start (hh:mm)	End (hh:mm)	Sample Volume	Jars (#)	Remarks
PB-045	0600-1200	9/12/2017	17.4	0940	1228	26481	1	
Weather: ☐ Clear ☐ Overcast ☐ Thunderstorms ☒ Partly Cloudy ☐ Precipitation					Wind Direction: E Wind Speed: 5MPH			Air Temperature: 72 Target Volume (gal): 26420
PB-046	1200-1800	9/12/2017	18.0	1330	16:28	27191	1	
Weather: ☐ Clear ☐ Overcast ☐ Thunderstorms ☒ Partly Cloudy ☐ Precipitation					Wind Direction: E Wind Speed: 6MPH			Air Temperature: 70 Target Volume (gal): 26420
PB-047	1800-0000	9/12/2017	17.9	1815	2115	26428		
Weather: ☒ Clear ☐ Overcast ☐ Thunderstorms ☐ Partly Cloudy ☐ Precipitation					Wind Direction: SE Wind Speed: 4 MPH			Air Temperature: 69 Target Volume (gal): 26420
PB-048	0000-0600	9/13/17	17.9	0000	0259	26818		
Weather: ☒ Clear ☐ Overcast ☐ Thunderstorms ☐ Partly Cloudy ☐ Precipitation					Wind Direction: SE Wind Speed: 1 mph			Air Temperature: 56 Target Volume (gal): 26420

Switch Depth @ 8800 Gallons And 17600 Gallons; Wash-Downs should be performed every 30 min or at Depth Changes, whichever comes first.

Field Notes:

Trip: 13

Entrainment Field Data Sheet - Point Beach Generating Station - Nextera

Project No. 15260.04 Date: 9/26/17 9/26/17 Crew Initials: LH RK / NR CSZ

Serial Number	Diel Period	Date	Temp (C)	Start (hh:mm)	End (hh:mm)	Sample Volume	Jars (#)	Remarks
PB-049	0600-1200	9/26/17	14.8	08:37	1130	26431	1	Partly cloudy Calm winds
Weather: ☐ Clear ☐ Overcast ☐ Thunderstorms ☒ Partly Cloudy ☐ Precipitation					Wind Direction: S Wind Speed: 2 MPH			Air Temperature: 62°F Target Volume (gal): 26420
PB-050	1200-1800	9/26/17	14.3	13:12	16:10	26977	1	Light algae in comparison to 49
Weather: ☐ Clear ☒ Overcast ☐ Thunderstorms ☐ Partly Cloudy ☐ Precipitation					Wind Direction: S Wind Speed: 5 MPH			Air Temperature: 70°F Target Volume (gal): 26420
PB-051	1800-0000	9/26/17	15.1	18:05	20:59	26427	1	
Weather: ☐ Clear ☒ Overcast ☐ Thunderstorms ☐ Partly Cloudy ☐ Precipitation					Wind Direction: W Wind Speed: 9 mph			Air Temperature: 78°F Target Volume (gal): 26420
PB-052	0000-0600	9/27/17	14.5	00:00	02:48	26434	1	
Weather: ☐ Clear ☒ Overcast ☐ Thunderstorms ☐ Partly Cloudy ☐ Precipitation					Wind Direction: WNW Wind Speed: 12 mph			Air Temperature: 65°F Target Volume (gal): 26420

Switch Depth @ 8800 Gallons And 17600 Gallons; Wash-Downs should be performed every 30 min or at Depth Changes, whichever comes first.

Field Notes:

Appendix C

Point Beach Entrainment Data

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Table C-1. Density of Shellfish and Ichthyoplankton Entrained at Point Beach by Sampling Event, April-September 2017.

	Taxa	Life Stage	Sampling Trip 1				Sampling Trip 2			
			12-13 Apr 2017				24-25 Apr 2017			
			0600-1200	1200-1800	1800-0000	0000-6000	0600-1200	1200-1800	1800-0000	0000-6000
SHELLFISH	Gammaridae sp.		--	--	--	--	--	--	--	--
	Echinogammarus ischnus		539.39	358.59	1,093.78	635.24	117.10	299.70	480.85	409.40
	Gammarus sp.		--	--	--	--	--	--	--	--
	Hemimysis anomala		--	--	1,093.78	221.37	--	--	29.44	9.99
	Mysis diluviana		--	--	--	--	--	--	--	9.99
ICHTHYOPLANKTON	CLUPEIDAE sp.	Larvae	--	--	--	--	--	--	--	--
	ALEWIFE	Post Yolk-sac Larvae	--	--	--	--	--	--	--	--
		Juveniles	--	--	--	--	--	--	--	--
		Adult	--	--	--	--	--	--	--	--
	RAINBOW SMELT	Post Yolk-sac Larvae	--	--	--	--	--	--	--	--
		Juveniles	--	--	--	--	--	--	--	--
		Adult	--	--	--	--	58.55	9.99	9.81	19.97
		Larvae	--	--	--	--	--	--	--	--
	BURBOT	Yolk-sac Larvae	--	--	--	--	--	--	--	--
		Post Yolk-sac Larvae	--	--	--	--	--	--	--	--
		Larvae	--	--	--	--	--	--	--	--
	ROUND GOBY	Juveniles	--	--	9.93	--	--	--	--	--
		Adult	--	--	9.93	--	--	--	--	9.99
	UNIDENTIFIED	Eggs (viable)	--	--	--	--	--	--	--	--
		Larvae	--	--	--	--	--	--	--	--

Table C-1 (Cont)

	Taxa	Life Stage	Sampling Trip 3				Sampling Trip 4			
			8-9 May 2017				23-24 May 2017			
			0600-1200	1200-1800	1800-0000	0000-6000	0600-1200	1200-1800	1800-0000	0000-6000
SHELLFISH	Gammaridae sp.		9.99	--	--	--	--	--	--	--
	Echinogammarus ischnus		269.85	239.87	199.84	339.85	112.04	86.31	399.31	818.11
	Gammarus sp.		--	--	--	--	--	--	--	--
	Hemimysis anomala		--	--	--	--	--	--	--	--
	Mysis diluviana		--	--	--	--	--	--	--	--
ICHTHYOPLANKTON	CLUPEIDAE sp.	Larvae	--	--	--	--	--	--	--	--
	ALEWIFE	Post Yolk-sac Larvae	--	--	--	--	--	--	9.98	--
		Juveniles	--	--	--	--	--	--	--	--
		Adult	--	--	--	--	--	--	--	--
	RAINBOW SMELT	Post Yolk-sac Larvae	--	--	--	--	--	--	--	--
		Juveniles	--	--	--	--	--	--	--	--
		Adult	--	39.98	--	--	9.34	--	--	--
		Larvae	--	--	--	--	--	9.59	--	--
	BURBOT	Yolk-sac Larvae	19.99	9.99	--	--	--	19.18	--	--
		Post Yolk-sac Larvae	--	--	--	--	--	--	--	--
		Larvae	--	--	--	--	46.68	9.59	9.98	--
	ROUND GOBY	Juveniles	--	--	--	--	--	--	--	--
		Adult	--	--	--	--	--	--	--	--
	UNIDENTIFIED	Eggs (viable)	--	--	--	--	--	--	--	--
		Larvae	--	--	--	--	--	--	--	--

Table C-1 (Cont)

Taxa		Life Stage	Sampling Trip 5				Sampling Trip 6			
			6-7 Jun 2017				20-21 Jun 2017			
			0600-1200	1200-1800	1800-0000	0000-6000	0600-1200	1200-1800	1800-0000	0000-6000
SHELLFISH	Gammaridae sp.		--	--	--	12.48	--	19.90	9.39	--
	Echinogammarus ischnus		379.84	309.58	1,074.52	1,135.92	984.60	885.72	883.08	1,115.97
	Gammarus sp.		--	--	--	24.97	56.59	--	--	60.00
	Hemimysis anomala		--	--	--	--	--	--	9.39	--
	Mysis diluviana		--	--	--	--	--	--	--	--
	Total									
ICHTHYOPLANKTON	CLUPEIDAE sp.	Larvae	--	--	--	--	--	--	--	--
	ALEWIFE	Post Yolk-sac Larvae	--	--	--	--	--	--	--	--
		Juveniles	--	--	--	--	--	--	--	--
		Adult	--	--	--	--	--	--	--	--
	RAINBOW SMELT	Post Yolk-sac Larvae	--	--	--	--	--	--	--	--
		Juveniles	--	--	--	--	--	--	--	--
		Adult	--	--	--	--	--	--	--	10.00
		Larvae	--	--	--	--	--	--	--	10.00
	BURBOT	Yolk-sac Larvae	--	--	--	--	--	--	--	--
		Post Yolk-sac Larvae	--	--	--	--	--	9.95	--	--
		Larvae	--	--	--	--	9.90	29.86	9.39	--
	ROUND GOBY	Juveniles	--	--	--	--	--	--	--	--
		Adult	--	--	--	--	--	--	--	--
	UNIDENTIFIED	Eggs (viable)	--	--	--	--	--	--	--	--
		Larvae	--	--	--	--	--	--	--	--

Table C-1 (Cont)

Taxa		Life Stage	Sampling Trip 7				Sampling Trip 8			
			6-7 Jul 2017				18-19 Jul 2017			
			0600-1200	1200-1800	1800-0000	0000-6000	0600-1200	1200-1800	1800-0000	0000-6000
SHELLFISH	Gammaridae sp.		--	--	--	--	--	35.74	13.78	29.99
	Echinogammarus ischnus		239.27	258.75	778.40	579.81	1,520.67	1,715.46	1,391.57	3,418.48
	Gammarus sp.		--	--	--	--	--	--	--	29.99
	Hemimysis anomala		--	--	--	39.99	--	--	--	--
	Mysis diluviana		--	--	--	--	--	--	--	--
ICHTHYOPLANKTON	CLUPEIDAE sp.	Larvae	--	--	--	--	--	--	--	--
	ALEWIFE	Post Yolk-sac Larvae	--	--	--	--	--	--	--	--
		Juveniles	--	--	--	--	--	--	--	--
		Adult	--	--	--	--	--	8.93	--	--
	RAINBOW SMELT	Post Yolk-sac Larvae	--	--	--	--	--	--	--	--
		Juveniles	--	--	--	--	--	--	--	--
		Adult	--	--	9.49	--	--	--	--	--
		Larvae	--	--	--	--	--	--	9.84	39.98
	BURBOT	Yolk-sac Larvae	--	--	--	--	--	--	--	--
		Post Yolk-sac Larvae	--	--	--	--	--	--	--	--
		Larvae	--	--	9.49	--	--	--	--	--
	ROUND GOBY	Juveniles	--	--	--	--	--	--	--	--
		Adult	--	--	--	--	--	--	--	--
	UNIDENTIFIED	Eggs (viable)	--	--	18.99	--	--	--	--	--
		Larvae	--	--	--	--	--	17.87	19.68	10.00

Table C-1 (Cont)

Taxa		Life Stage	Sampling Trip 9				Sampling Trip 10			
			1-2 Aug 2017				15-16 Aug 2017			
			0600-1200	1200-1800	1800-0000	0000-6000	0600-1200	1200-1800	1800-0000	0000-6000
SHELLFISH	Gammaridae sp.		--	--	19.29	--	--	--	--	--
	Echinogammarus ischnus		939.62	979.79	887.20	889.30	6,960.49	1,5972.92	4,9901.52	2,9423.54
	Gammarus sp.		1,119.54	659.86	1,388.65	89.93	9,333.38	15,972.92	19,192.89	4,477.49
	Hemimysis anomala		--	--	--	--	--	--	--	--
	Mysis diluviana		--	--	--	--	--	--	--	--
ICHTHYOPLANKTON	CLUPEIDAE sp.	Larvae	--	20.00	--	--	--	--	--	--
	ALEWIFE	Post Yolk-sac Larvae	--	--	--	--	--	--	--	--
		Juveniles	--	--	--	--	--	--	--	--
		Adult	--	--	9.64	--	--	--	--	--
	RAINBOW SMELT	Post Yolk-sac Larvae	--	--	--	--	--	--	--	--
		Juveniles	--	--	--	--	--	--	--	--
		Adult	--	--	--	--	--	--	--	--
		Larvae	--	--	--	--	--	--	--	--
	BURBOT	Yolk-sac Larvae	--	--	--	--	--	--	--	--
		Post Yolk-sac Larvae	--	--	--	--	--	--	--	--
		Larvae	--	--	--	--	--	--	--	--
	ROUND GOBY	Juveniles	--	--	--	--	--	--	--	--
		Adult	--	--	--	9.99	--	--	--	19.99
	UNIDENTIFIED	Eggs (viable)	--	--	--	--	--	--	--	--
		Larvae	--	--	--	--	--	--	--	--

Table C-1. (Cont).

Taxa		Life Stage	Sampling Trip 11				Sampling Trip 12			
			29-30 Aug 2017				12-13 Sep 2017			
			0600-1200	1200-1800	1800-0000	0000-6000	0600-1200	1200-1800	1800-0000	0000-6000
SHELLFISH	Gammaridae sp.		--	--	--	--	--	--	--	--
	Echinogammarus ischnus		3,451.56	8,100.29	1,764.13	1,3180.82	20,430.67	16,166.47	7,996.74	10,591.32
	Gammarus sp.		11,296.03	7,993.71	1,671.28	2,540.88	2,766.65	4,767.04	3,305.32	1,765.22
	Hemimysis anomala		--	--	--	--	--	--	106.62	--
	Mysis diluviana		--	--	--	--	--	--	--	--
ICHTHYOPLANKTON	CLUPEIDAE sp.	Larvae	--	--	--	--	--	--	--	--
	ALEWIFE	Post Yolk-sac Larvae	--	--	--	--	--	--	--	--
		Juveniles	--	19.98	9.95	--	--	--	10.00	9.85
		Adult	--	--	--	--	--	--	--	--
	RAINBOW SMELT	Post Yolk-sac Larvae	--	--	--	9.93	--	--	--	--
		Juveniles	--	--	19.90	--	--	--	--	--
		Adult	--	--	--	--	--	--	--	--
		Larvae	--	--	19.90	9.93	--	--	--	--
	BURBOT	Yolk-sac Larvae	--	--	--	--	--	--	--	--
		Post Yolk-sac Larvae	--	--	--	--	--	--	--	--
		Larvae	--	--	--	--	--	--	--	--
	ROUND GOBY	Juveniles	--	--	--	--	--	--	--	--
		Adult	--	--	--	--	--	--	--	--
	UNIDENTIFIED	Eggs (viable)	--	--	--	--	--	--	--	--
		Larvae	--	--	--	--	--	--	--	--

Table C-1. (Cont).

Taxa		Life Stage	Sampling Trip 13 26-27 Sep 2017			
			0600-1200	1200-1800	1800-0000	0000-6000
SHELLFISH	Gammaridae sp.		--	--	--	--
	Echinogammarus ischnus		7,276.20	3,486.13	5,821.84	3,877.54
	Gammarus sp.		319.83	117.51	447.83	239.85
	Hemimysis anomala		--	--	--	79.95
	Mysis diluviana		--	--	--	--
ICHTHYOPLANKTON	CLUPEIDAE sp.	Larvae	--	--	--	--
	ALEWIFE	Post Yolk-sac Larvae	--	--	--	--
		Juveniles	--	--	--	--
		Adult	--	--	--	--
	RAINBOW SMELT	Post Yolk-sac Larvae	--	--	--	--
		Juveniles	--	--	--	--
		Adult	--	--	--	--
		Larvae	--	--	--	--
	BURBOT	Yolk-sac Larvae	--	--	--	--
		Post Yolk-sac Larvae	--	--	--	--
		Larvae	--	--	--	--
	ROUND GOBY	Juveniles	--	--	--	--
		Adult	--	--	--	--
	UNIDENTIFIED	Eggs (viable)	--	--	--	--
		Larvae	--	--	--	--

Table C-2. Entrainment Estimates of Shellfish and Ichthyoplankton by Extrapolation Period, April-September 2017.

	Taxa	Life Stage	Extrapolation Period 1				Extrapolation Period 2			
			1-15 Apr				16-29 Apr			
			0600-1200	1200-1800	1800-0000	0000-6000	0600-1200	1200-1800	1800-0000	0000-6000
SHELLFISH	Gammaridae sp.		--	--	--	--	--	--	--	--
	Echinogammarus ischnus		3,634,900	2,416,505	7,370,882	4,280,792	1,664,457	4,259,806	6,834,657	5,819,094
	Gammarus sp.		--	--	--	--	--	--	--	--
	Hemimysis anomala		--	--	7,370,882	1,491,791	--	--	418,448	141,929
	Mysis diluviana		--	--	--	--	--	--	--	141,929
ICHTHYOPLANKTON	CLUPEIDAE sp.	Larvae	--	--	--	--	--	--	--	--
	ALEWIFE	Post Yolk-sac	--	--	--	--	--	--	--	--
		Juveniles	--	--	--	--	--	--	--	--
		Adult	--	--	--	--	--	--	--	--
	RAINBOW SMELT	Post Yolk-sac	--	--	--	--	--	--	--	--
		Juveniles	--	--	--	--	--	--	--	--
		Adult	--	--	--	--	--	--	--	--
		Larvae	--	--	--	--	832,229	141,994	139,483	283,858
	BURBOT	Yolk-sac	--	--	--	--	--	--	--	--
		Post Yolk-sac	--	--	--	--	--	--	--	--
		Larvae	--	--	--	--	--	--	--	--
	ROUND GOBY	Juveniles	--	--	66,911	--	--	--	--	141,929
		Adult	--	--	66,911	--	--	--	--	--
	UNIDENTIFIED	Eggs (viable)	--	--	--	--	--	--	--	--
		Larvae	--	--	--	--	--	--	--	--
Diel Period Total			**3,634,900**	**2,416,505**	**14,875,585**	**5,772,584**	**2,496,686**	**4,401,799**	**7,392,588**	**6,528,739**

Table C-2 (Cont)

Taxa		Life Stage	Extrapolation Period 3				Extrapolation Period 4			
			30 Apr-13 May				14-27 May			
			0600-1200	1200-1800	1800-0000	0000-6000	0600-1200	1200-1800	1800-0000	0000-6000
SHELLFISH	Gammaridae sp.		144,439	--	--	--	--	--	--	--
	Echinogammarus ischnus		3,899,843	3,466,658	2,888,117	4,911,471	1,619,142	1,247,376	5,770,777	11,823,348
	Gammarus sp.		--	--	--	--	--	--	--	--
	Hemimysis anomala		--	--	--	--	--	--	--	--
	Mysis diluviana		--	--	--	--	--	--	--	--
ICHTHYOPLANKTON	CLUPEIDAE sp.	Larvae	--	--	--	--	--	--	--	--
	ALEWIFE	Post Yolk-sac	--	--	--	--	--	--	--	--
		Juveniles	--	--	--	--	--	--	--	--
		Adult	--	--	--	--	--	--	144,269	--
	RAINBOW SMELT	Post Yolk-sac	--	--	--	--	--	138,597	--	--
		Juveniles	--	--	--	--	--	--	--	--
		Adult	--	--	--	--	--	--	--	--
		Larvae	--	577,776	--	--	134,928	--	--	--
	BURBOT	Yolk-sac	--	--	--	--	674,642	138,597	144,269	--
		Post Yolk-sac	--	--	--	--	--	--	--	--
		Larvae	288,877	144,444	--	--	--	277,195	--	--
	ROUND GOBY	Juveniles	--	--	--	--	--	--	--	--
		Adult	--	--	--	--	--	--	--	--
	UNIDENTIFIED	Eggs (viable)	--	--	--	--	--	--	--	--
		Larvae	--	--	--	--	--	--	--	--
Diel Period Total			4,333,159	4,188,879	2,888,117	4,911,471	2,428,713	1,801,765	6,059,316	11,823,348

Table C-2 (Cont)

	Taxa	Life Stage	Extrapolation Period 5				Extrapolation Period 6			
			28 May-10 Jun				11-24 Jun			
			0600-1200	1200-1800	1800-0000	0000-6000	0600-1200	1200-1800	1800-0000	0000-6000
SHELLFISH	Gammaridae sp.		--	--	--	179,870	--	288,503	136,172	--
	Echinogammarus ischnus		5,473,430	4,460,947	15,483,417	16,368,179	14,271,736	12,838,369	12,800,152	16,175,840
	Gammarus sp.		--	--	--	359,740	820,215	--	--	869,669
	Hemimysis anomala		--	--	--	--	--	--	136,172	--
	Mysis diluviana		--	--	--	--	--	--	--	--
ICHTHYOPLANKTON	CLUPEIDAE sp.	Larvae	--	--	--	--	--	--	--	--
	ALEWIFE	Post Yolk-sac	--	--	--	--	--	--	--	--
		Juveniles	--	--	--	--	--	--	--	--
		Adult	--	--	--	--	--	--	--	--
	RAINBOW SMELT	Post Yolk-sac	--	--	--	--	--	--	--	144,945
		Juveniles	--	--	--	--	--	--	--	--
		Adult	--	--	--	--	--	--	--	--
		Larvae	--	--	--	--	--	--	--	144,945
	BURBOT	Yolk-sac	--	--	--	--	143,538	432,754	136,172	--
		Post Yolk-sac	--	--	--	--	--	144,251	--	--
		Larvae	--	--	--	--	--	--	--	--
	ROUND GOBY	Juveniles	--	--	--	--	--	--	--	--
		Adult	--	--	--	--	--	--	--	--
	UNIDENTIFIED	Eggs (viable)	--	--	--	--	--	--	--	--
		Larvae	--	--	--	--	--	--	--	--
Diel Period Total			5,473,430	4,460,947	15,483,417	16,907,789	15,235,488	13,703,877	13,208,667	17,335,399

Table C-2 (Cont)

	Taxa	Life Stage	Extrapolation Period 7				Extrapolation Period 8			
			25 Jun-8 Jul				9-22 Jul			
			0600-1200	1200-1800	1800-0000	0000-6000	0600-1200	1200-1800	1800-0000	0000-6000
SHELLFISH	Gammaridae sp.		--	--	--	--	--	521,230	200,943	437,338
	Echinogammarus ischnus		3,489,593	3,773,699	11,352,537	8,456,161	22,178,046	25,019,040	20,295,279	49,856,530
	Gammarus sp.		--	--	--	--	--	--	--	437,338
	Hemimysis anomala		--	--	--	583,184	--	--	--	--
	Mysis diluviana		--	--	--	--	--	--	--	--
ICHTHYOPLANKTON	CLUPEIDAE sp.	Larvae	--	--	--	--	--	--	--	--
	ALEWIFE	Post Yolk-sac	--	--	--	--	--	130,307	--	--
		Juveniles	--	--	--	--	--	--	--	--
		Adult	--	--	--	--	--	--	--	--
	RAINBOW SMELT	Post Yolk-sac	--	--	--	--	--	--	143,531	583,117
		Juveniles	--	--	--	--	--	--	--	--
		Adult	--	--	--	--	--	--	--	--
		Larvae	--	--	138,446	--	--	--	--	--
	BURBOT	Yolk-sac	--	--	138,446	--	--	--	--	--
		Post Yolk-sac	--	--	--	--	--	--	--	--
		Larvae	--	--	--	--	--	--	--	--
	ROUND GOBY	Juveniles	--	--	--	--	--	--	--	--
		Adult	--	--	--	--	--	--	--	--
	UNIDENTIFIED	Eggs (viable)	--	--	276,891	--	--	--	--	--
		Larvae	--	--	--	--	--	260,615	287,062	145,779
Diel Period Total			**3,489,593**	**3,773,699**	**11,906,319**	**9,039,344**	**22,178,046**	**25,931,192**	**20,926,815**	**51,460,102**

Table C-2 (Cont)

Taxa		Life Stage	Extrapolation Period 9				Extrapolation Period 10			
			23 Jul-5 Aug				6-19 Aug			
			0600-1200	1200-1800	1800-0000	0000-6000	0600-1200	1200-1800	1800-0000	0000-6000
SHELLFISH	Gammaridae sp.		--	--	281,288	--	--	--	--	--
	Echinogammarus ischnus		13,703,775	14,289,618	12,939,248	12,969,943	101,514,746	232,956,048	727,785,475	429,125,628
	Gammarus sp.		16,327,902	9,623,620	20,252,737	1,311,567	136,122,045	232,956,048	279,917,490	65,301,726
	Hemimysis anomala		--	--	--	--	--	--	--	--
	Mysis diluviana		--	--	--	--	--	--	--	--
ICHTHYOPLANKTON	CLUPEIDAE sp.	Larvae	--	291,625	--	--	--	--	--	--
	ALEWIFE	Post Yolk-sac	--	--	140,644	--	--	--	--	--
		Juveniles	--	--	--	--	--	--	--	--
		Adult	--	--	--	--	--	--	--	--
	RAINBOW SMELT	Post Yolk-sac	--	--	--	--	--	--	--	--
		Juveniles	--	--	--	--	--	--	--	--
		Adult	--	--	--	--	--	--	--	--
		Larvae	--	--	--	--	--	--	--	--
	BURBOT	Yolk-sac	--	--	--	--	--	--	--	--
		Post Yolk-sac	--	--	--	--	--	--	--	--
		Larvae	--	--	--	--	--	--	--	--
	ROUND GOBY	Juveniles	--	--	--	145,730	--	--	--	291,526
		Adult	--	--	--	--	--	--	--	--
	UNIDENTIFIED	Eggs (viable)	--	--	--	--	--	--	--	--
		Larvae	--	--	--	--	--	--	--	--
Diel Period Total			**30,031,678**	**24,204,863**	**33,613,917**	**14,427,240**	**237,636,791**	**465,912,095**	**1,007,702,965**	**494,718,879**

Table C-2 (Cont)

Taxa		Life Stage	Extrapolation Period 11				Extrapolation Period 12			
			20 Aug-2 Sept				3-16 Sept			
			0600-1200	1200-1800	1800-0000	0000-6000	0600-1200	1200-1800	1800-0000	0000-6000
SHELLFISH	Gammaridae sp.		--	--	--	--	--	--	--	--
	Echinogammarus ischnus		50,339,120	118,138,211	25,728,872	192,234,777	297,969,795	235,778,833	116,627,874	154,468,362
	Gammarus sp.		164,746,212	116,583,761	24,374,721	37,057,306	40,350,076	69,524,528	48,206,188	25,744,727
	Hemimysis anomala		--	--	--	--	--	--	1,555,038	--
	Mysis diluviana		--	--	--	--	--	--	--	--
ICHTHYOPLANKTON	CLUPEIDAE sp.	Larvae	--	--	--	--	--	--	--	--
	ALEWIFE	Post Yolk-sac	--	--	--	--	--	--	--	--
		Juveniles	--	291,459	145,088	--	--	--	145,785	143,665
		Adult	--	--	--	--	--	--	--	--
	RAINBOW SMELT	Post Yolk-sac	--	--	290,175	144,755	--	--	--	--
		Juveniles	--	--	290,175	--	--	--	--	--
		Adult	--	--	--	144,755	--	--	--	--
		Larvae	--	--	--	--	--	--	--	--
	BURBOT	Yolk-sac	--	--	--	--	--	--	--	--
		Post Yolk-sac	--	--	--	--	--	--	--	--
		Larvae	--	--	--	--	--	--	--	--
	ROUND GOBY	Juveniles	--	--	--	--	--	--	--	--
		Adult	--	--	--	--	--	--	--	--
	UNIDENTIFIED	Eggs (viable)	--	--	--	--	--	--	--	--
		Larvae	--	--	--	--	--	--	--	--
Diel Period Total			**215,085,333**	**235,013,431**	**50,829,031**	**229,581,594**	**338,319,872**	**305,303,361**	**166,534,886**	**180,356,754**

Table C-2 (Cont)

Taxa		Life Stage	Extrapolation Period 13			
			17-30 Sept			
			0600-1200	1200-1800	1800-0000	0000-6000
SHELLFISH	Gammaridae sp.		--	--	--	--
	Echinogammarus ischnus		106,119,320	50,843,217	84,908,305	56,551,680
	Gammarus sp.		4,664,585	1,713,816	6,531,408	3,498,042
	Hemimysis anomala		--	--	--	1,166,014
	Mysis diluviana		--	--	--	--
ICHTHYOPLANKTON	CLUPEIDAE sp.	Larvae	--	--	--	--
	ALEWIFE	Post Yolk-sac	--	--	--	--
		Juveniles	--	--	--	--
		Adult	--	--	--	--
	RAINBOW SMELT	Post Yolk-sac	--	--	--	--
		Juveniles	--	--	--	--
		Adult	--	--	--	--
		Larvae	--	--	--	--
	BURBOT	Yolk-sac	--	--	--	--
		Post Yolk-sac	--	--	--	--
		Larvae	--	--	--	--
	ROUND GOBY	Juveniles	--	--	--	--
		Adult	--	--	--	--
	UNIDENTIFIED	Eggs (viable)	--	--	--	--
		Larvae	--	--	--	--
Diel Period Total			**110,783,905**	**52,557,033**	**91,439,714**	**61,215,736**

Document Request 12

Affected SLRA Sections: None

SLRA Page Number: N/A

Description of Change: Existing reference provided for docketing.

Existing Reference

PBN. 2017b. Updated Site Conceptual Model, NextEra Energy Point Beach LLC, AECOM, January 2017.

AECOM

Updated Site Conceptual Model

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January 2017

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1. Introduction

1.1 Purpose and Scope of Services

This report presents an update of the Site Conceptual Model (SCM) for the NextEra energy Resources, LLC Point Beach Nuclear Plant (Point Beach) located at 6610 Nuclear Road, Two Rivers, Wisconsin. Point Beach is a nuclear power plant for the generation of electricity.

The work performed by AECOM Technical Services, Inc. (AECOM) is part of an effort to maintain a groundwater monitoring program consistent with the Groundwater Protection Initiative (GPI) developed by the Nuclear Energy Institute (NEI). Guidance for implementing a GPI is contained in the document entitled, "Groundwater Protection Guidelines for Nuclear Power Plants, Final Report, November 2007" and Revision 1 of the report dated October 2013, prepared by the Electric Power Research Institute, Inc. (EPRI). This report is intended to address portions of Section 4 of the EPRI guidance "Establishing a Site Conceptual Model." Section 4 includes the following items:

EPRI 4.1 Developing the Initial Site Conceptual Model
EPRI 4.2 Aerial Photos and Engineering Drawings
EPRI 4.3 Previous Hydrogeologic Reports
EPRI 4.4 Potential On-Site and Off-Site Receptors of Groundwater Contamination
EPRI 4.5 State and Local Regulations
EPRI 4.6 Preliminary Estimates of Groundwater Flow Characteristics
EPRI 4.7 Site-Specific Groundwater Flow Profile
EPRI 4.8 Measurement of Physical Parameters
EPRI 4.9 Fate and Transport Numerical Modeling

EPRI developed a graded approach for the implementation of a groundwater monitoring program. The graded approach suggests a baseline program consisting of elements that are commonly included in any monitoring program. An elevated program with additional elements is recommended at sites with a higher contamination risk. Sites where an elevated program may be justified may have complex geology, existing impacts close to the property boundary, or significant sources of contamination.

1.2 Report Format

For ease of reference, the following section headers include the EPRI guidance section numbers. EPRI Section 4.1 Developing the Site Conceptual Model is addressed generally through this document. Section 4.5, State and Local Regulations, is not discussed as an independent section but is addressed in applicable sections throughout this report. For instance, while describing the STS 2007 monitoring well installation services, Wisconsin Administrative Code Chapter NR 141, Monitoring Well Installation, is referenced. Portions of the EPRI guidance, for example, EPRI Sections 4.7.3 - Vertical Distribution and Movement; 4.7.4 - Flow Regimes, Connectivity, and Hydraulic Conductivity; and, 4.9 Fate and Transport Numerical Monitoring are considered elevated items and are not addressed based on current site data. Recommendations for additional work are provided that, when performed, will address these items.

2. Existing Conditions

2.1 Site Location and Primary Operations

The Point Beach facility is located on the west shoreline of Lake Michigan east of Two Creeks, Wisconsin. Figure 1 (attached) is a site location map. The facility is located in Section 24, Township 21 North, Range 24 East in Manitowoc County, Wisconsin. The site is located about 30 miles east of the City of Green Bay and 90 miles north-northeast of the City of Milwaukee with coordinates of N44.2811° latitude and W87.5369° longitude. Figures 2 and 3 depict various features at the site.

The main operations at the facility relate to the generation of electric power. The plant has two pressurized reactors producing approximately 1,080 mega-watts of power. The first reactor went into operation in December 1970 and the second in October 1972. Cooling water is obtained from Lake Michigan to the east. Heated non-contact water is discharged back into Lake Michigan. According to the Point Beach Final Safety Analysis Report, (FSAR) updated as of July 8, 2008, the site is comprised of approximately 1,260 contiguous acres.

2.2 Review of Aerial Photos and Engineering Drawings

AECOM reviewed readily available aerial photographs from published sources. Figure 2 is a portion of the 2015 US Department of Agriculture National Agriculture Imagery Program (NAIP) coverage of Manitowoc County, Wisconsin, that depicts the facility with locations of the main roads including East Tapawingo Road and former Lakeshore Road. The facility buildings are visible including the main plant, primary auxiliary building, ISFISI storage building just north of Tapawingo Road, various service buildings, and the visitor center. Parking lots are visible around the buildings. Mature wooded areas surround the property to the west, north, and south. Intermittent creeks are visible along with the locations of the cooling water discharge structures. Beyond the mature wooded areas immediately surrounding the plant, are agricultural properties north, south, and west of the facility.

AECOM also reviewed the United States Geological Survey 7.5-minute quadrangle map of Two Creeks, Wisconsin (2015), for site topographic features. Figure 1 was prepared from a portion of that map. The ground surface elevation around the main buildings of the facility is approximately 600 feet mean sea level (MSL). A high point of the facility is at about 625 feet MSL. Ground surface elevation slopes toward Lake Michigan which in January 2016 had an approximate water elevation of 579 feet MSL.

Point Beach provided AECOM with a series of about 20 facility engineering drawings which AECOM reviewed. The drawings depict the turbine building, primary auxiliary building, external service buildings, parking lot layouts, utility corridors, the switchyard area, cooling water intake/discharge, a former retention pond, retention pond sludge disposal pits, among other site features. Buried structures are discussed further in Section 4.0 Potential Receptors. Figure 3 depicts the significant features located on site and referenced in this document.

AECOM was also provided with 4 historic construction aerial photographs dated August 15, 1969. The photographs depict the construction from four directions, south, west, southwest, and northeast. Copies of the photographs are included in Appendix A. The photos depict the lake shoreline along with ongoing construction of the turbine building, primary auxiliary building, reactor Units 1 and 2, pump house and water discharge areas, and the switchyard. Parking lot area grading was also evident around the structures.

Other documents provided by Point Beach also reference a yard drain system connected to beach drains and an exterior foundation drain along the building foundations with sub drain sumps beneath the plant. Based on discussions with Point Beach personnel, the yard drains and exterior foundation drain are used for hydraulic pressure release and for collection of stormwater and roof drainage. The exterior foundation drains, yard drains, and beach drains are shown on Figure 3.

2.3 Regional Geology and Hydrogeology

The Wisconsin Geological and Natural History Survey (WGNHS) document titled "Water Resources of Wisconsin - Lake Michigan Basin Hydrologic Atlas HA-432" by E.L. Skinner and R.G. Borman (1973) reports that shallow soils in the area are primarily comprised of glacial lake deposits (lacustrine) consisting of silt, sand, and clay extending to depths ranging from 50 to 100 feet below ground surface (BGS). The lacustrine soils are underlain by approximately 600 feet of undifferentiated Silurian dolomite, the upper portion of which is called the Niagara Dolomite. Below the Silurian dolomite is Ordovician shale and dolomite followed by Cambrian sandstone. Precambrian granite lies beneath the sandstone. The bedrock units dip to the east and represent the western portion of the Michigan basin, which is centered in the lower peninsula of Michigan.

The hydrogeologic framework of the region is described in the WGNHS document "Hydrogeology and Ground-Water Use and Quality, Brown County, Wisconsin" by J.T. Krohelski. The Quaternary deposits and Silurian formations are identified as the upper aquifer relative to the confining unit of the Ordovician shales. A regional bedrock map and geologic cross-section from the Krohelski report are included in Appendix B as Figures B1 and B2, respectively. Regional groundwater flow in the area is generally east, toward Lake Michigan.

2.4 Area Groundwater Use

Nearby residents have private wells that are used for consumptive purposes. However, most nearby residents are located hydraulically up-gradient to the west (see following section) of the operating facility. The cities of Two Rivers and Manitowoc obtain water from Lake Michigan and have backup groundwater supply systems.

The Wisconsin Geological and Natural History Survey (WGNHS) maintains records of water supply wells, which in Wisconsin are called Well Construction Reports (WCRs) or Geologic Well Logs. AECOM requested copies of WCRs and Geologic Well Logs from the immediate vicinity of Point Beach (North half Section 24, T21N, R24E and NE1/4 Section 23 T21N, R24E). WGNHS provided 4 copies of WCRs and 3 copies of geologic logs for the area. In addition, Point Beach provided documents describing four high capacity supply wells on Point Beach property. The following table provides information about the four high capacity wells. Additional details of the well installation design are included in Appendix C. The locations of the four supply wells are shown on Figure 3.

Monitoring Sample ID	Site [1] Well #	WUWN [2]	Point Beach ID	Site Location	Installation Date	Casing Depth (feet)	Glacial Overburden Depth (feet)	Total well depth (feet)	Approximate Monthly Pump rate (gallons) [3,4]
GW-04	005	MY344	EIC Well	Energy Information center	11/18/1998	93	93	262	22,044
GW-06	003	BE655	SBCC Well	Site Boundary Control Center	5/10/1983	118	106	300	11,570
-	001	FB703	E10	Main offices	5/15/1967	112	109	257	453,667
GW-05	004	FY404	Warehouse 6	Warehouse 6/Former Lakeside Training	8/7/1993	105	105	480	14,040

Notes
1 From WDNR November 8, 2007 Well Summary Letter
2 Wisconsin Unique Well No. (also from November 8, 2007 WDNR letter)
3 Well pumping volume data provided by Point Beach
4 All wells used for human consumption and sewage processing

Based on available geologic logs, it appears that these wells have similar installation designs. The geologic logs report unconsolidated silt, sand, and clay to the depths listed above and dolomite to the well termination depths. Casings were installed to the bottom of the glacial overburden and in some cases into bedrock. Water from the four wells is drawn from the bedrock aquifer. Approximately 500,000 gallons of water per month, or 17,000 gallons per day, are pumped from the dolomite bedrock aquifer. No WCRs for private residential wells were provided by WGNHS.

3. Previous Hydrogeologic Reports

A 1966 Dames & Moore Report entitled, "Report of Foundation Investigation, Proposed Nuclear Power Plant, Point Beach Nuclear Power Station, Two Creeks, Wisconsin for the Wisconsin Michigan Power Company," appears to be one of the earliest geologic/hydrogeologic studies of the property. The report is an attachment in a portion of the original permit application for the facility. Soil borings conducted as part of the study were advanced in September and October 1966. The Dames & Moore report included a summary section describing the advancement of 52 soil borings, the testing of recovered soil samples, coring of bedrock, observations of groundwater levels, and testing of field soil permeability. Four soil boring cross sections were included in the 1966 report. Stratigraphy was comprised of an approximate 1-foot thick topsoil layer across the site. Below the topsoil, a silty clay, described as glacial till, extended to about 13 to 15 feet below the original ground surface. Below the till, a 25 to 30-foot thick layer of lacusterine silty clay was observed. Beneath the lacustrine unit, an approximate 50-foot thick layer of glacial till (silty clay) and a layer of glacial outwash (sand and gravel) were present above the Silurian Dolomite of the Niagara Formation. These borings were advanced primarily within the footprint of the reactor, turbine, and auxiliary buildings.

The Dames & Moore report indicated that groundwater levels increased to the west of the site with water present at about 5 to 13 feet below the original ground surface. Permeability testing indicated hydraulic conductivity values of $1x10^{-7}$ to $1x10^{-6}$ centimeters per second (cm/s). The elevations stated in the text were referenced to Lake Michigan level and not mean sea level as is now commonly used.

Several reports were prepared by HARZA Engineering Company, Chicago, Illinois in 1966 relating to regional weather patterns and surface water flow. The reports addressed about 12 to 13 different sites which were being considered at that time for possible development of the nuclear plant. The sites were located in eastern Wisconsin and Michigan's Upper Peninsula. The intent of the submittals was primarily related to potential flooding issues and did not present much detail about groundwater flow patterns.

Point Beach provided AECOM with a copy of Section 2.0 from their FSAR report entitled, SITE AND ENVIRONMENT. Section 2 of the FSAR report discusses a number of environmental related topics including site location and boundaries, topography, area population, land use, hydrogeology, meteorology, environmental radioactivity studies, site geology, and seismology.

The FSAR report indicates a tidal range of less than 2 inches in Lake Michigan. Littoral drift (sediment movement) is primarily to the north. The local weather is controlled by prevailing weather patterns of the northern tier of the United States with primarily eastward movement of precipitation and heating/cooling events. Surface water movement on Lake Michigan is primarily in response to wind direction.

In October 1991, Coleman Engineering, Iron Mountain, Michigan, prepared a report entitled, "Summary Report of Monitoring Well Installation, Point Beach Nuclear Power Facility, Kewaunee, Wisconsin" for Wisconsin Electric Power Company. Although not specifically mentioned in the October 1991 report, a September 1, 1992 Wisconsin Electric internal memorandum indicated that soil samples collected from the four monitoring borings were analyzed for pH, chlorides, redox potential, sulfates, and resistivity to assess the potential for corrosion around the reactors. An introductory statement in the memorandum indicated that, "The wells were installed to evaluate the groundwater fluctuations and any potential subsurface corrosion effects on the containment structure and steel H-piles." A summary statement in the memorandum stated, "In general, the soil analyses show no signs of aggressive chemical exposure to the subsurface systems around the containment structures at PBNP (Point Beach Nuclear Plant)."

Coleman installed the four hand auger groundwater monitoring well borings around the two reactors. The monitoring wells have become known as the Façade Wells. Two Façade Wells are located in each operating unit. Appendix D contains documentation about the wells. The following table, produced from soil boring log information in the 1991 report, provides a summary of the façade well depth information.

Monitoring Sample ID	Coleman Soil Boring Number	Point Beach ID	Site Location	Coleman Installation Dates	Coleman Soil Boring Depth (feet)	Coleman Well Casing Depth (feet)
GW-10	B-1	2Z-361A	Containment Unit 2	9/19/91 to 10/2/91	26.5	26.8
GW-10	B-2	2Z-361B	Containment Unit 2	9/17/91 to 9/27/91	25	25
GW-09	B-3	1Z-361A	Containment Unit 1	10/1/91 to 10/9/91	26	29.1
GW-09	B-4	1Z-361B	Containment Unit 1	10/2/91 to 10/7/91	26	26

According to soil boring logs, beneath the concrete slabs by the reactors, approximately 10 feet of sand and gravel fill soil were observed overlying gray and reddish-brown to brown silty clay (assumed to be natural material) to the boring termination depths (25 to 26.5 feet BGS). Groundwater was noted at depths of 3 to 5 feet below the concrete slabs on the boring log forms.

The facility maintained a retention pond (now abandoned) associated with the on-site wastewater treatment system. The pond was permitted for the receipt of sewage treatment discharges and miscellaneous system drains, such as turbine and façade building sumps. Sludge was removed from the pond in 1975 as part of pond maintenance and was disposed of in two pits on site. The locations of the abandoned retention pond and the two sludge disposal pits are shown on Figure 3. Also depicted on the figure are two abandoned discharge lines from the plant to the retention pond. Subsurface conditions in the vicinity of the retention pond were remediated to existing state requirements and federal standards.

In February 1999, Wisconsin Electric Company (the owner of the facility at the time) issued a report entitled, "Assessment of Radioactive Material in the Area of the Retention pond at the Point Beach Nuclear Power Plant." The first paragraph of the report states that, "The purpose of this report is to provide an assessment of the low levels of radioactive materials identified in the vicinity of the on-site retention pond at the Point Beach Nuclear Power Plant (PBNP). The contamination was associated with past releases of slightly radioactive water from the plant to the pond.

The report described the radioisotope analyses of soil, water, sediment, and vegetative samples collected near the pond. The analyses yielded detectable concentrations of Cesium-137, Cesium-134, and Cobalt-60 but at concentrations "below guidelines for acceptable residual radioactive material contamination for decommissioning, with the exception of the several isolated areas in close proximity to the pond where additional evaluation was needed for remediation". Cs-137 in surficial soils (0.5 to 1.0 feet) was the primary compound of concern immediately adjacent to the lagoon. Tritium was also detected around the pond area but the concentrations decreased sharply with distance from the pond and approached applicable levels approximately 700 feet southeast of the pond. A conclusion in the report indicated that due to the location, access, and fencing around the pond, there was no pathway of exposure to the general public. Field observations, consistent with published information, indicated the presence of a low permeability till unit beneath sandy material that effectively prevented the vertical migration of tritium impacted water to greater depths. In addition, the report indicated that radiological contamination was not anticipated with the original pond permitting and is considered an operational occurrence as described in 10CFR 50.75(g). The summary section of the report included a statement that, "determinations will be made concerning disposition of the radioactive material content of the pond and appropriate clean-up and remediation of the surrounding environs."

On November 24, 2002, J. Stewart Bland Associates, Inc., Annapolis, Maryland, issued a report entitled, "Remediation of the Surrounding Area of the Retention Pond at the Point Beach Nuclear Plant." The report indicated that further assessment was performed to address the Cs-137 impacted soil. The report stated that about 0.5' to 1.0 feet of surface soil adjacent to the pond was removed as a remedial action and transported off site to a licensed disposal facility. Because post-remediation soil sample results were below NRC screening values, the report included the statement, "in conclusion, all areas were remediated to levels of residual Cs-137 contamination below the 11 pCi/g Screening Level." Information provided by

Point Beach personnel indicates that sludge that remained in the pond was stabilized using cement and left in place. A surface layer of clay followed by topsoil was placed over the pond and seeded.

4. Potential Receptors and Contamination Pathways

Available report information and discussions with Point Beach personnel identified four potential sources of tritium impacts to the subsurface. The potential sources are:

- The primary auxiliary building and reactor units;
- The abandoned retention pond;
- The retention pond sludge disposal pits;
- Washout/recapture of airborne effluent.

Releases from source areas may travel along the ground surface or through preferential flow paths in the subsurface to impact receptors such as points of use of groundwater, groundwater discharge areas (hydraulically connected surface water bodies), or areas where groundwater may collect such as utility trenches or sumps. A review of the engineering drawings indicates that there are many locations of building footings and/or buried utilities or other structures that could be preferential flow paths to potential receptors if contamination was released to the surface or subsurface.

It is reasonable to assume, that locations of primary concern are those areas where subsurface conduits are immediately adjacent to and hydraulically connected to the turbine, auxiliary, and reactor buildings. Tritium analyses of samples collected from the façade wells in Units 1 and 2, shown on Figure 3, indicate some low concentrations of tritium. Subsurface conduits near the reactor units and the turbine building are shown on Figure 3 as the yard drain system (connected to the beach drains) and the exterior foundation drain.

Possible conduits in the area around the now abandoned retention pond include the abandoned discharge lines from the plant to the pond. Previous studies (see above) identified tritium detections in the vicinity of the former pond. In August 2007, Monitoring Well GW-15 was installed east (regionally down-gradient) of the abandoned retention pond (Figure 3). Tritium levels measured in GW-15 between January 2008 and October 2015 ranged between <0 and 615 pCi/L, below the MCL but above concentrations in other wells such as GW-13 (24 to 136 pCi/L) and GW-12 (-64 to 2 pCi/L) to the west (regionally upgradient) of GW-15. Monitoring well GW-16 is in the vicinity of the south discharge line and has tritium concentrations ranging from 66 to 382 pCi/L,

Other possible pathways for inadvertent releases are the foundations and utility lines immediately down gradient of the reactor building in the vicinity of the cooling water intake and discharge structures. Supply wells located on site, which are used for consumptive purposes, are also potential pathways that could have the most direct impact on employees and the general public. However, due to the historical releases being confined to near surface soils and the presence of a significant thickness of fine-grained soils over the bedrock aquifer, it is unlikely that impacts related to the releases will migrate to the on-site supply wells. These supply wells are monitored by Point Beach. During several sampling events between 2006 and 2008 tritium concentrations ranged from below detection to 185 pCi/L.

The potential of washout/recapture of airborne tritium to be a source was studied by Point Beach during 2010 and 2011. Tritium data from 12 sample locations near Units 1 and 2 and from the north, south, and west property boundaries were acquired and reviewed. The highest tritium concentration observed was within a range of values related to air conditioner condensate obtained close to the plant. However, most of the result values were significantly below the range. Point Beach personnel concluded that the recapture of tritium may be a source of low tritium concentrations observed in beach drains and yard manholes, which are collection points and conduits that receive direct input of precipitation. Based on the result values acquired in 2010 and 2011, it is AECOM's position that the impact of washout/recapture of airborne tritium to groundwater is low and possibly not detectable.

Lake Michigan, east of the Point Beach facility, is a potential receptor from surface water and/or groundwater. The Point Beach Offsite Dose Calculation Manual describes the pathways and receptors

associated with the release of liquid radioactive effluents to Lake Michigan. "These pathways are ingestion of potable water at the Two Rivers, Wisconsin municipal water supply, ingestion of fish from the edge of the mixing zone of radionuclide release, ingestion of fresh and stored vegetables irrigated with water from Lake Michigan, ingestion of milk and meat from cows/cattle utilizing Lake Michigan as a drinking water source, swimming and boating activities at the edge of the mixing zone, and shoreline deposits."

5. Site Conceptual Model

The information in this section along with the included figures is a description of the site conceptual model for the FPL - Point Beach Nuclear Plant.

5.1 Estimates of Groundwater Flow Characteristics

A review of relevant information coupled with site visits permitted the development of a site conceptual model and the selection of groundwater monitoring well locations.

- The site consists of approximately 1,260 contiguous acres with both wooded and developed areas;
- The ground surface topography generally slopes to the east. Surface water and groundwater flow to the east toward Lake Michigan;
- Soil stratigraphy is interpreted to consist of approximately 100 feet of unconsolidated glacial soil deposits, mainly fine-grained with low permeability, overlying Silurian dolomitic bedrock;
- Building foundations and underground utilities interrupt the natural groundwater flow and represent local preferential flow paths for groundwater.

5.2 Site-Specific Groundwater Flow Profile

To address EPRI Section 4.7, in August 2007, AECOM installed six groundwater monitoring wells and reported the results of the installations in an October 22, 2007, report. In May 2008, AECOM measured water levels and performed hydraulic conductivity tests in the six groundwater monitoring wells. The observed water elevations indicated that horizontal groundwater movement was to the east at a rate of between 0.2 and 36 feet per year. This information was summarized in a June 13, 2008 report, a copy of which is in Appendix E. The following sections summarize the August 2007 and May 2008 findings regarding a site-specific groundwater flow profile.

5.2.1 Monitoring Well Installations

Between August 27 and 31, 2007, AECOM installed six soil borings/groundwater monitoring wells named MW-1, MW-2, MW-3, MW-4, MW-5, and MW-6. Point Beach included the wells in the groundwater monitoring program they developed as Wells GW-11, GW-12, GW-16, GW-15, GW-14, and GW-13, respectively. The wells are shown with the Point Beach identifiers on Figure 3. During all boring activities, an Environmental Geologist (Mr. Bob Mottl, Wisconsin Professional Geologist No. 225-013 or Mr. Michael Carney, Wisconsin Professional Geologist No. 328-13) was on site to monitor drilling operations.

Soil borings were advanced to depths between 18 and 25 feet BGS. The depths were selected based on available information and discussion with Point Beach staff. The effort was to avoid penetration of an upper clay layer previously identified and to intersect the water table. Screened intervals no longer than 15 feet were used to comply with Wisconsin Administrative Code Chapter NR 141, Groundwater Monitoring Well Requirements. During drilling, wet (saturated) soils were identified at the following depths: MW-1 (GW-11), 6 feet; MW-2 (GW-12), 14 feet; MW-3 (GW-16), not saturated only moist; MW-4 (GW-15), 10 feet; MW-5 (GW-14), 8 to10 feet; MW-6 (GW-13), 8 feet.

All borings were advanced using hollow-stem auger methods. Soil samples were collected using a split-spoon sampling device in general accordance with ASTM D1586, "Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils." Soil samples were transferred from the split-spoon to new, pint-size plastic jars and described in the field by AECOM personnel. Soil samples contained in the pint-size plastic jars were returned to the AECOM soils laboratory where they were examined and classified according to the Unified Soil Classification System. In accordance with Chapter NR 141, Wisconsin Administrative Code, WDNR Soil Boring Log Information Forms (Form 4400-122) were prepared. Soil

information from the boring log forms along with well installation and groundwater elevation data were used to construct a soil cross-section, Figure 4.

Monitoring wells were constructed in the six borings consisting of 2-inch-diameter, Schedule 40 PVC with flush-threaded joints. The screened portion of each well consisted of a 10 to 15-foot length of 2-inch diameter, Schedule 40 PVC with 0.006-inch, factory-cut slots. The annulus around the well casing was backfilled with uniformly graded silica sand (Badger 40/60) to a level approximately 1 to 4 feet above the top of the screen. The remainder of the annulus was backfilled with 3/8-inch chipped bentonite, allowing room for a steel, aboveground protector pipe.

Following installation, the monitoring wells were developed by purging the water from each well using a dedicated, disposable bailer. A WDNR Monitoring Well Construction Form (4400-113A) and a Well Development Form (4400-113B) was completed for each well installed. AECOM surveyed the monitoring well locations on September 5, 2007. Wisconsin State Plane Coordinates (NAD 1927, Central) and USGS mean sea level elevations were determined for each well location and were provided on the WDNR forms, as well as included on attached Table 1.

5.2.2 Measurements of Physical Parameters and Hydraulic Conductivity

Soil from groundwater Monitoring Wells MW-1, MW-2, MW-3, MW-4, and MW-5 consisted of reddish-brown to brown and dark brown silty clays with trace to little amounts of sand, fine gravel, and silt layers to the boring termination depth. In addition to the clay soils in Monitoring Well MW-6, an approximate 10-foot thick sand and gravel layer was encountered in the boring from 8 to 19 feet BGS. Soil and monitoring well information from Borings MW-1, MW-3, and MW-4 were used to prepare the cross section in Figure 4. Clayey soils were encountered in these borings to the boring termination depths. The ground surface slopes from MW-4 through MW-3 and MW-1 to the east, toward Lake Michigan. The depiction of the ground surface in Figure 4 is estimated from the USGS 7.5 minute topographic quadrangle.

On October 4 through 9, 2007, AECOM completed eight geotechnical borings at Point Beach for an unrelated construction project. The geotechnical borings were completed in the area of an existing concrete pad near the north end of the plant. The nearest of the environmental wells is MW-5, which is approximately 500 feet to the northeast of the area of the geotechnical borings.

Soils observed in the geotechnical borings were consistent with AECOM environmental perimeter borings. Natural soils in the geotechnical borings consisted of brown silty and sandy clays at depths of 10 to 20 feet BGS. Fill was observed in the geotechnical borings to depths varying between 1.5 and 10.0 feet BGS. The fill was comprised of varying thicknesses of sand, gravel, and silty clay and did not appear to be an engineered fill.

On May 19, 20, and 21, 2008, AECOM performed rising head hydraulic conductivity tests on Monitoring Wells MW-1 through MW-6. The field data and hydraulic conductivity test results are included in the report in Appendix E. Drawdown data were analyzed using the Bouwer and Rice Method (Bouwer, 1989) for a partially penetrating monitoring well in an unconfined aquifer.

Groundwater level elevations recorded in the monitoring wells by Point Beach personnel between January 2008 and July 2016 are presented on Table 2. The depth to groundwater ranged from about 1 to 12 feet below ground surface (BGS). Groundwater elevations ranged from a high of 621.9 MSL in MW-4 to a low of +586.9 MSL in MW-5. Figure 5 presents the hydrographs for the monitoring wells and clearly shows the consistent relationships of the observed water elevations. The December 2008 groundwater elevations were used to prepare a groundwater table contour map representing low groundwater conditions depicted in Figure 6. January 2016 data were used to prepare Figure 7, a groundwater table contour map depicting high groundwater conditions. Groundwater flow is generally to the east toward Lake Michigan. With a distance of approximately 580 feet between monitoring wells MW-3 and MW-4 in the center of the site, the horizontal hydraulic gradient between MW-3 and MW-4 ranges from 0.015 to 0.025 feet per foot, with an average value of 0.021 feet per foot or approximately 111 feet/mile. The gradient between Wells MW-1 and MW-2, in the southeastern portion of the property ranged from 0.005 to 0.007 feet per foot, with an average of 0.006 feet per foot or 32 feet/mile.

The calculated horizontal hydraulic conductivities ranged from a low of approximately $5.8x10^{-6}$ cm/s in Well MW-4 to approximately $8.5x10^{-4}$ cm/s in MW-6. Assuming a soil porosity of 30% and based on the hydraulic gradient of 0.006 to 0.021 feet per foot, we estimate the average linear groundwater velocity in the natural silty clay soils to range between 0.12 foot per year to about 62 feet per year.

It is the nature of fine-grained soil deposits, such as those encountered on site, that horizontal hydraulic conductivity and groundwater flow is greater than the vertical hydraulic conductivity and flow. Observations made in 1999, associated with the assessment work in the vicinity of the closed retention pond, indicated that vertical migration of tritium impacted groundwater to greater depths was not expected due to the presence of a dense, low permeability till unit.

5.3 Groundwater Quality Monitoring Results

Point Beach developed a groundwater and subsoil tritium sampling procedure for the collection of surface water and groundwater samples. Sampling locations were selected by Point Beach staff, prior to AECOM 2007 well installation services. Locations of sampling points in the area depicted in Figure 3 are shown on the figure. Point Beach provided copies of the groundwater monitoring data for the period from 2008 through 2015. Tritium data were reviewed for six monitoring wells, three drinking water wells, and four façade wells.

5.3.1 Groundwater Monitoring Wells

Groundwater monitoring wells identified as GW-11 through GW-16 were sampled monthly to quarterly during the period of record. Summary data tables and plots of the data for the individual wells are in Appendix F as Tables F-1 through F-6, and Figures F-1 throguh F-6.

Well GW-11 is the most southeastern monitoring well and is situated close to the Lake Michigan shore. Tritium concentrations ranged from -72 to 181 pCi/L, with an average concentration of 79 pCi/L. The plot of the data (Figure F-1) shows the variability of the data within the error limits for each result. A slightly decreasing linear trend is evident in the data plot.

The southwestern most monitoring well is Well GW-12, roughly 1,900 feet southwest of Units 1 and 2. The average tritium concentration was 1 pCi/L within a range of -168 to 90 pCi/L. An imperceptible negative linear trend is present in the plotted data (Figure F-2).

Located approximately 1,600 feet northwest of Units 1 and 2, Well GW-13 displays a range of -145 to 212 pCi/L of tritium with an average of 67 pCi/L. A negative linear trend is evident in the plot of the data (Figure F-3).

Well GW-14 is located near the Lake Michigan shore, north of Units 1 and 2 by approximately 1,000 feet. Tritium results ranged from -101 to 198 pCi/L, with an average of 86 pCi/L. A negative trend is also observed in the data plot (Figure F-4).

Well GW-15 is located more centrally and approximately 100 feet east, and hydraulically downgradient, of the abandoned retention pond shown on Figure 3. The tritium concentrations are in a range from -18 to 615 pCi/L, with an average value of 358 pCi/L. This well likely reflects low level impacts to groundwater from the former retention pond. The data plot (Figure F-5) shows that the concentrations have decreased significantly during the period of record. Natural attenuation of the low level impacts appears to have occurred.

East and farther downgradient of the abandoned retention pond is Well GW-16. The well is located approximately 400 feet south of Units 1 and 2. The minimum and maximum tritium concentrations are 66 and 382 pCi/L, respectively. The average tritium value is 215 pCi/L. A negative linear trend is evident in the data plot (Figure F-6).

5.3.2 Water Supply Wells

The water supply wells regularly sampled as part of the groundwater monitoring program are located at the Energy Information Center (EIC) [Well GW-04], the Site Boundary Control Center (SBCC) [Well GW-05], and Warehouse 6 (Well GW-06). Summary data tables and plots of the data are in Appendix F as Tables F-7 through F-9, and Figures F-7 through F-9. Average tritium concentrations at all three wells are low and no significant positive or negative trends are evident in the data plots (Figures F-7, F-8, F-9).

5.3.3 Façade Wells

Two Façade Wells are located inside each of the operating units. Wells GW-09A and GW-09B are in Unit 1. NextEra well designators for these two wells are 1Z-361A and 1Z-361B, respectively. Wells GW-10A and GW-10B are in Unit 2, with designators 2Z-361A and 2Z-361B, respectively. Summary data tables (Tables F-10 through F-13) and two plots, one with the data for GW-09A and B (Figure F-10), and a second with the data for GW-10A and B (Figure F-11), for the 2008 through 2015 reported samples are in Appendix F.

The GW-09A data indicated that higher but decreasing tritium concentrations were present in samples from 2008 to roughly 2011. After 2011, except for one possibly erroneous and unrepeated result, concentrations generally appear to be in the 200 to 400 pCi/L range. The range of results for Well GW-09B generally occur in a lower concentration range.

Tritium concentrations recorded in samples from Wells GW-10A and B occur in a relatively consistent and low concentration range.

6. Conclusions

This report is an update to the SCM prepared and reported by AECOM in August 2008. The report is part of an effort to implement and maintain a groundwater monitoring program consistent with the Groundwater protection Initiative (GPI) developed by the Nuclear Energy Institute (NEI). Guidance for implementing the GPI is contained in November 2007 and October 2013 EPRI documents. The information provided is intended to address Section 4.0 of the EPRI guidance.

The SCM described above is a reasonable interpretation of the site hydrogeological conditions. In general, surface water flow and groundwater flow are both to the east. Soils with horizontal hydraulic conductivity between 10^{-4} cm/s and 10^{-6} cm/s limit groundwater flow velocity to between 0.12 and 62 feet per year. The findings presented in this report appear to be consistent with initial study observations about groundwater flow regimes from the late 1960s. Although no EPA MCL exceedances have been identified during recent groundwater quality monitoring for tritium, elevated detections of tritium have been identified in isolated locations. Continued monitoring in accordance with the procedures developed by Point Beach will help to confirm results and identify trends.

This SCM is a dynamic tool to help evaluate and monitor site conditions. It should be reviewed and updated periodically as additional monitoring data become available or if operational factors suggest a change in conditions may have occurred.

7. General Qualifications

The scope of this report is limited to the project and location described herein. The conclusions in this report are based on groundwater quality data provided by Point Beach, subsurface conditions as observed in soil borings completed by AECOM, the subsurface conditions existing at the time of the study, hydraulic conductivity testing performed in May 2008, and AECOM's professional interpretation of the data. Stratification lines on the cross-section represent approximate boundaries between soil types. Variation may exist in both horizontal and vertical directions between borings. Seasonal groundwater fluctuations are likely to occur. This report should be used for the purpose intended. No other warranty is expressed or implied.

8. References

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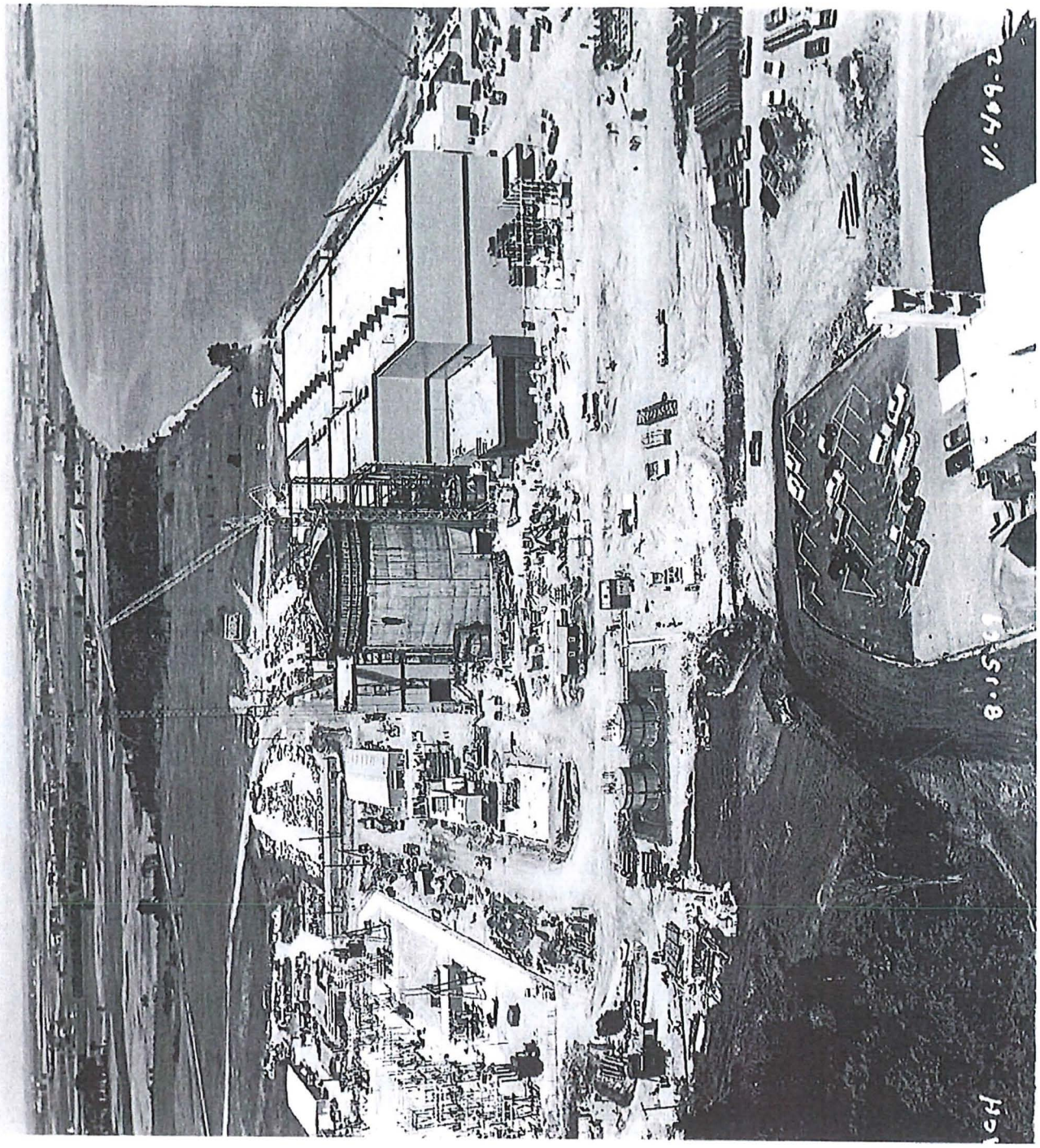
Wisconsin Electric Company, 1999, Assessment of Radioactive Material in the Area of the Retention Pond at the Point Beach Nuclear Power Plant.

U.S. Geological Survey, 1978. 7.5-minute quadrangle map of Two Creeks, Wisconsin.

Appendix A Historic Construction Photographs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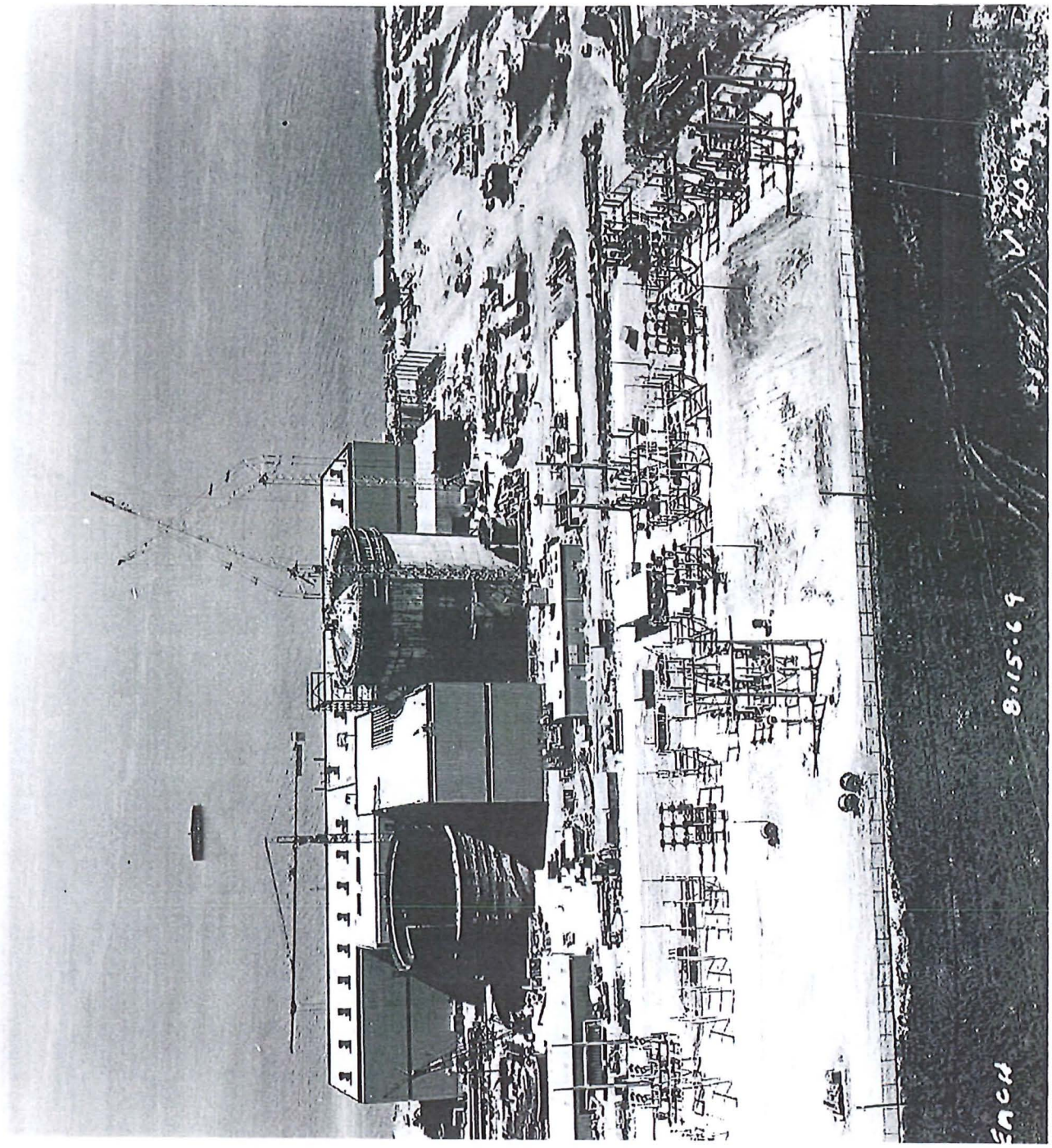
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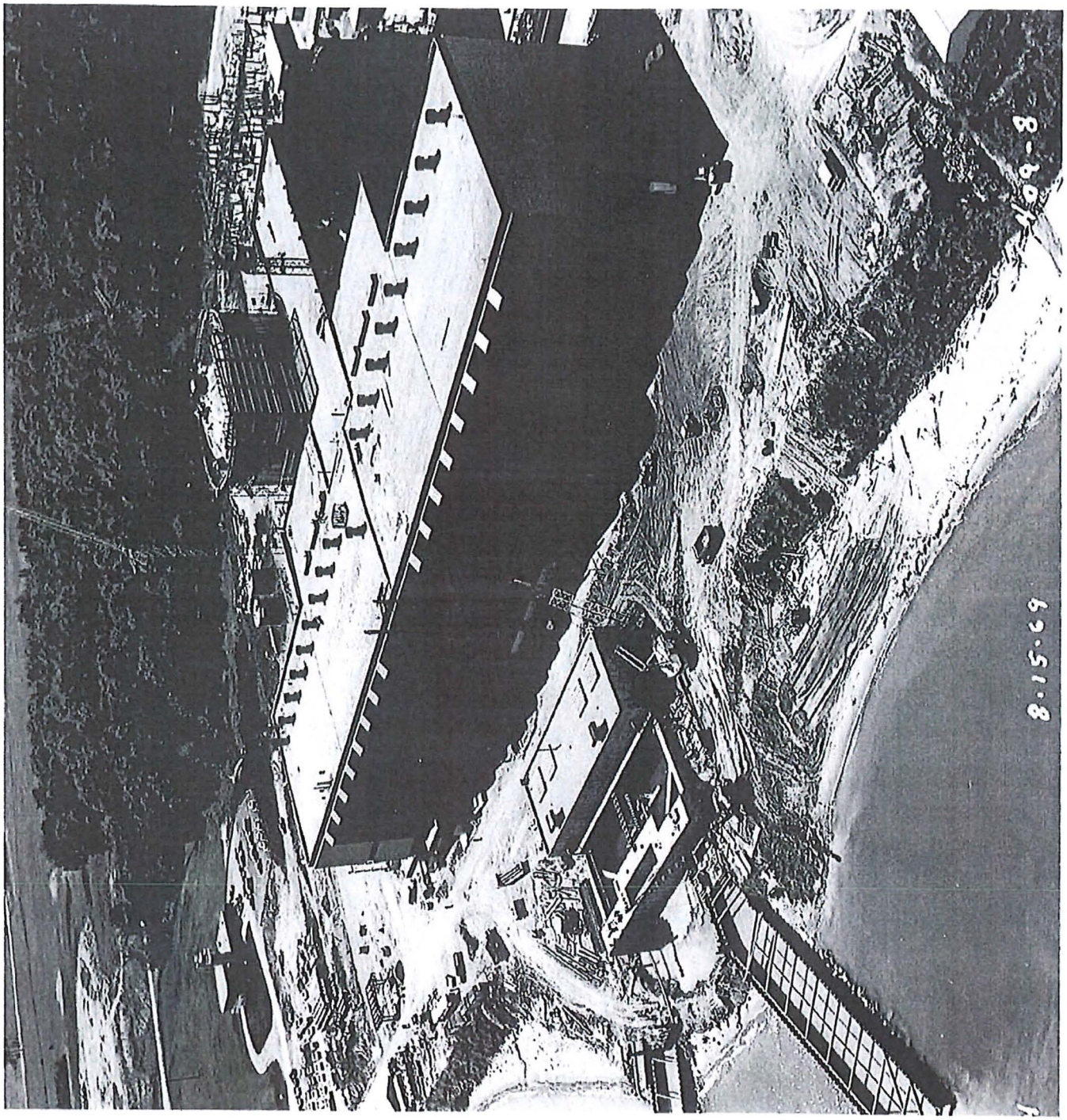
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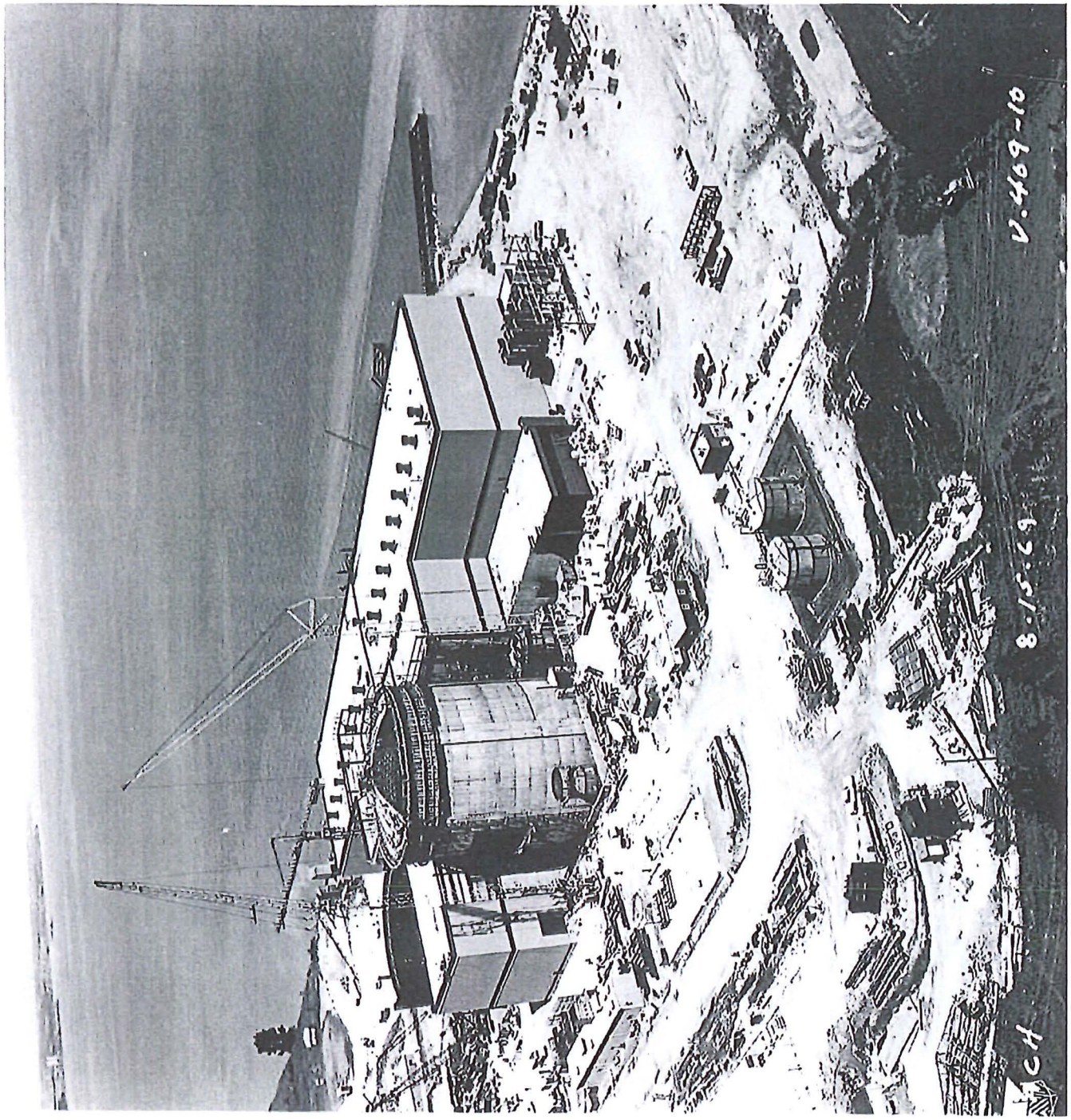
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V-469-10

Appendix B Figures from 1986 Krohelski Report

Project Management Initials: Designer: ANSI A 8.5" x 11"

EXPLANATION

SEDIMENTARY ROCKS OF PALEOZOIC AGE

DEVONIAN SYSTEM

Dc — Dolomite; *shaly limestone and shale, undivided*

SILURIAN SYSTEM

Su — Dolomite, undivided; *includes Cayugan, Niagaran and Alexandrian series*

ORDOVICIAN SYSTEM

Om — Maquoketa Formation - shale, dolomitic shale and dolomite; *includes overlying Neda Formation (age uncertain) consisting of oolitic iron oxides and shale*

Os — Sinnipee Group - dolomite with some limestone and shale; *includes Galena, Decorah and Platteville Formations*

Oa — Ancell Group - orthoquartzitic sandstone with minor limestone, shale and conglomerate; *includes Glenwood and St. Peter Formations*

Opc — Prairie du Chien Group - dolomite with some sandstone and shale; *includes Shakopee and Oneota Formations*

CAMBRIAN SYSTEM

Cu — Sandstone with some dolomite and shale, undivided; *includes Trempeleau, Tunnel City and Elk Mound Groups*

• TURNING POINT OF SECTION

A—A' LINE OF SECTION

Scale 1:1,000,000

0 10 20 30 MILES

0 10 20 30 KILOMETERS

FIGURE TAKEN FROM KROHELSKI, 1986, HYDROGEOLOGY AND GROUND-WATER USE AND QUALITY, BROWN COUNTY, WISCONSIN, INFORMATION CIRCULAR NO. 57, WISCONSIN GEOLOGICAL AND NATURAL HISTORY SURVEY

Filename: C:\Work\nextera\60519993\GIS\2016-1116 60519993_BEDROCK.mxd

NEXTERA ENERGY RESOURCES, LLC
SITE CONCEPTUAL MODEL
POINT BEACH NUCLEAR PLANT
Project No.: 60519993 Date: 2016-12-14

Bedrock Map of a Portion of Northeastern Wisconsin
Point Beach Nuclear Plant
Two Creeks, Wisconsin

AECOM

Figure: B1

Project Management Initials: Designer: ANSI A 8.5" x 11"

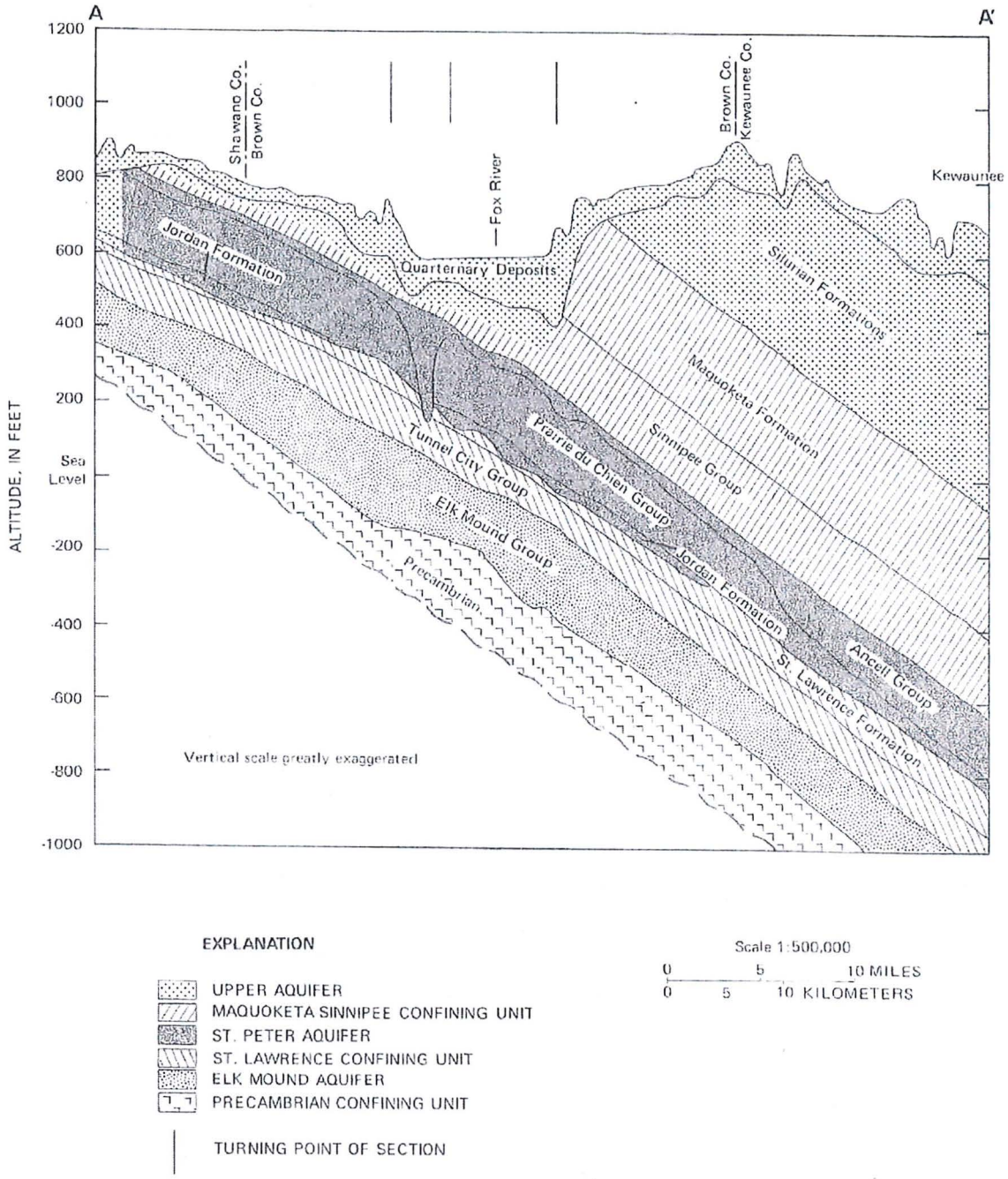

FIGURE TAKEN FROM KROHELSKI, 1986, HYDROGEOLOGY AND GROUND-WATER USE AND QUALITY, BROWN COUNTY, WISCONSIN, INFORMATION CIRCULAR NO. 57, WISCONSIN GEOLOGICAL AND NATURAL HISTORY SURVEY

Filename: C:\Work\nextera\60519993\GIS\2016-1116 60519993_BEDROCK-XSEC.mxd

NEXTERA ENERGY RESOURCES, LLC
SITE CONCEPTUAL MODEL
POINT BEACH NUCLEAR PLANT
Project No.: 60519993 Date: 2016-12-14

Regional Geologic Cross-Section
Northeastern Wisconsin
Point Beach Nuclear Plant
Two Creeks, Wisconsin

AECOM

Figure: B2

Appendix C Supply Well Records

E/C

State of Wi-Private Water Systems-DG/2
Department Of Natural Resources, Box 7921
Madison, WI 53707

Form 3300-77A
(Rev 02/02)bw

WISCONSIN UNIQUE WELL NUMBER **MY344**

Source: WELL CONSTRUCTION

Depth **262** FT

Property Owner: POINT BEACH NUCLEAR ENERGY INFO	Telephone Number: - -
Mailing Address: 6610 NUCLEAR RD	
City: TWO RIVERS	State: WI / Zip Code: 54241
County of Well Location: 36 MANITOWOC	Co Well Permit No: W / Well Completion Date: November 18, 1998
Well Constructor: VAN DE YACHT LEO WELL DRILLING INC	License #: 6097 / Facility ID (Public): 436126020
Address: 3383 OAK FOREST DR	Public Well Plan Approval#: 36-3-0017
City: GREEN BAY	State: WI / Zip Code: 54313 / Date Of Approval:
Hicap Permanent Well #: 68865	Common Well #: / Specific Capacity: .4 gpm/ft

1. Well Location

T=Town C=City V=Village: T of TWO CREEKS

Fire#:

Street Address or Road Name and Number: 6610 NUCLEAR RD

Subdivision Name: / Lot#: / Block #:

Gov't Lot or NE 1/4 of SW 1/4 of Section 24 T 21 N;R 24 E

Latitude Deg. Min.

Longitude Deg Min.

Lat/Long Method

2. Well Type 1 (See item 12 below)

1=New 2=Replacement 3=Reconstruction

of previous unique well # _____ constructed in _____

Reason for replaced or reconstructed Well?

VISTOR CENTER

1 1=Drilled 2=Driven Point 3=Jetted 4=Other

3. Well Serves N # of homes and or VISITOR CENTER (eg: barn, restaurant, church, school, industry, etc.)

M=Munic O=OTM N=NonCom P=Private Z=Other X=NonPot A=Anode L=Loop H=Drillhole

High Capacity: Well? N Property? N

4. Is the well located upslope or sideslope and not downslope from any contamination sources, including those on neighboring properties? Y

Well located in floodplain? N

Distance in feet from well to nearest: (including proposed)

1. Landfill
30 2. Building Overhang
3. 1=Septic 2= Holding Tank
4. Sewage Absorption Unit
5. Nonconforming Pit
6. Buried Home Heating Oil Tank
7. Buried Petroleum Tank
8. 1=Shoreline 2= Swimming Pool
9. Downspout/ Yard Hydrant
10. Privy
32 11. Foundation Drain to Clearwater
12. Foundation Drain to Sewer
13. Building Drain 1=Cast Iron or Plastic 2=Other
50 14. Building Sewer 1 1=Gravity 2=Pressure 1 1=Cast Iron or Plastic 2=Other
100 15. Collector Sewer: ___ units ___ in . diam.
60 16. Clearwater Sump
17. Wastewater Sump
18. Paved Animal Barn Pen
19. Animal Yard or Shelter
20. Silo
21. Barn Gutter
22. Manure Pipe 1=Gravity 2=Pressure 1=Cast iron or Plastic 2=Other
23. Other manure Storage
24. Ditch
25. Other NR 812 Waste Source

5. Drillhole Dimensions and Construction Method

Dia.(in.)	From (ft)	To (ft)
9.0	surface	93
6.0	93	262

Upper Enlarged Drillhole

X -- 1. Rotary - Mud Circulation ----------
X -- 2. Rotary - Air ----------
-- 3. Rotary - Air and Foam ----------
-- 4. Drill-Through Casing Hammer
-- 5. Reverse Rotary
-- 6. Cable-tool Bit _ n. dia ----------
-- 7. Temp. Outer Casing _ in. dia. _____ depth ft. Removed ?

Other

Lower Open Bedrock

Geology Codes	8. Geology Type, Caving/Noncaving, Color, Hardness, etc	From (ft.)	To (ft.)
__C_	CLAY	0	93
__L_	LIMESTONE	93	262

6. Casing Liner Screen

Dia. (in.)	Material, Weight, Specification Manufacturer & Method of Assembly	From (ft.)	To (ft.)
6.0	NEW BLACK STEEL PLAIN END WELDED ASTM-A-53B, 18.97 # PER FT.	surface	93

Dia.(in.)	Screen type, material & slot size	From	To

9. Static Water Level

20.0 feet B ground surface A=Above B=Below

10. Pump Test

Pumping level 200.0 ft. below surface

Pumping at 65.0 GP M 2.0 Hrs

11. Well Is: 12 in. A Grade A=Above B=Below

Developed? Y

Disinfected? Y

Capped? Y

7. Grout or Other Sealing Material

Method / Kind of Sealing Material	From (ft.)	To (ft.)	# Sacks Cement
DRILL SLURRY	surface	93.0	

12. Did you notify the owner of the need to permanently abandon and fill all unused wells on this property? N

If no, explain N/APP

13. Initials of Well Constructor or Supervisory Driller LV Date Signed 11/18/98

Initials of Drill Rig Operator (Mandatory unless same as above) TV Date Signed 11/18/98

Additonal Comments?

Owner Sent Label? Y

Variance Issued?

More Geology?

Batch 583

WISCONSIN GEOLOGICAL and NATURAL HISTORY SURVEY
3817 Mineral Point Road • Madison, WI 53705

SBCC

Log No. N153-Mn-497

Well name: Point Beach Nuclear Power Plant Well #2
Town of Two Creeks
Owner.... Wisconsin Electric Power Co.
Address.. 231 W. Michigan St.
Milwaukee, WI 53201
Driller.. Retzlaff Well Drilling, Inc.
Engineer.

County: Manitowoc
Completed... 5/10/83
Field check.
Altitude.... 620' ETM
Use..... Potable
Static w.l.. 22'
Spec. cap... 0.17 GPM/ft.

R. 24E.
T. 21 N.
Sec. 24

Quad. Two Creeks 7½'

Drill Hole						Casing & Liner Pipe or Curbing								
Dia.	from	to	Dia.	from	to	Dia.	Wgt.& Kind	from	to	Dia.	Wgt.& Kind	from	to
10"	0	116'				6"	U.S. Steel 18.97 per ft. bk. New ASTM-A-53	+2'	118'				
6"	116'	300'											

Grout	from	to
cement	0	116'

Drilling method: rotary
Samples from 0 to 300' Rec'd: 7/7/83

Studied by: Tom Hanson (0-110')
Craig S. Schwandt (110'-300')

Issued: 9/5/86

Formations: Drift, Silurian Undifferentiated.

Remarks: Well tested for 1 hour at 20 GPM with 118 feet of drawdown.
DNR Permanent Well #52825 & Manitowoc Co. Industrial #17.
Well was drilled for the steam generator replenishment building.
Local address: 6610 Nuclear Road, Two Rivers, WI 54241.

LOG OF WELL:

	Depths	Graphic Section	Rock Type	Color	Grain Size Mode	Grain Size Range	Miscellaneous Characteristics
DRIFT	0-5		Sand	Red brown	VC	Vfn/VC	Much gravel (Gran/M peb), silt. Little clay. Trace organics.
	5-10		Silt & clay	"	—	—	Calcareous. Little gravel (Gran/M peb), sand. Trace organics.
	10-15		"	"	—	—	Calcareous. Much sand. Trace granules, organics.
	15-20		"	"	—	—	Calcareous. Much sand. Little gravel (Gran/S peb). Tr organics.
	20-25		Clay	"	—	—	Calcareous. Mch sand,silt. Ltl gravel(Gran/S peb). Tr organics.
	25-30		Silt & clay	"	—	—	Calcareous. Much gravel (Gran/S peb), sand. Trace organics.
	30-35		"	"	—	—	Same.
	35-40		Sand	"	C	Vfn/VC	Much gravel (Gran/S peb), silt, clay. Trace organics.
	40-45		Silt & clay	"	—	—	Calcareous. Much gravel (Gran/S peb), sand. Trace organics.
	45-50		Sand	"	VC	Vfn/VC	Much gravel (Gran/S peb), silt, clay. Trace organics.
	50-55		Clay	"	—	—	Calcareous. Little sand. Trace granules, organics.
	55-60		Sand	"	VC	Vfn/VC	Much gravel (Gran/S peb), silt, clay. Trace organics.
	60-65		Silt & clay	"	—	—	Calcareous. Much sand. Little gravel (Gran/S peb). Tr organics.
	65-70		"	"	—	—	Same.
	70-75		"	"	—	—	Calcareous. Much sand. Little gravel (Gran/M peb). Tr organics.
	75-80		"	"	—	—	Calcareous. Much gravel (Gran/S peb), sand. Trace organics.
	80-85		"	"	—	—	Calcareous. Much sand. Little gravel (Gran/S peb). Tr organics.
	85-90		"	"	—	—	Same.
	90-95		Sand	"	VC	Vfn/VC	Much gravel (Gran/S peb), silt, clay. Trace organics.
	95-100		"	"	"	"	Much silt, clay. Little gravel (Gran/S peb). Trace organics.
	100-105		Silt & clay	"	—	—	Calcareous. Much sand. Little gravel (Gran/S peb). Tr organics.
110'	105-110		Sand	"	VC	Vfn/VC	Much gravel (Gran/S peb), silt, clay. Trace organics.
SILURIAN	110-115		Dolomite	Lt pk bn	Fn	Fn/M	Slgtly limy. Tr stylo,pyrite,gy stng,clr calcite(C),sand,silt.
	115-120		"	Light gray	"	"	Trace gray staining, sand, silt.
	120-125		"	"	"	"	Same.
	125-130		"	"	"	"	Trace stylolites, pyrite, gray staining.
	130-135		"	"	M	"	Same plus trace green staining & mining, clear calcite (M).
	135-140		"	"	"	"	Same.
	140-145		"	White	"	"	Slightly sugary. Trace clear calcite (Fn/M), clear gypsum.
	145-150		"	"	"	"	Same plus trace gray staining.
	150-155		"	Light gray	"	"	Same.
	155-160		"	"	"	"	Slightly sugary. Trace pyrite, pale green shale.

SBCC

WISCONSIN GEOLOGICAL and NATURAL HISTORY SURVEY
3817 Mineral Point Road • Madison, WI 53705

Log No. N153-Mn-497

Well name: Point Beach Nuclear Power Plant Well #2

	Depths	Graphic Section	Rock Type	Color	Grain Size Mode	Grain Size Range	Miscellaneous Characteristics
SILURIAN UNDIFF.	160-165		Dolomite	White	M	Fn/M	Sugary. Trace pyrite, clear calcite (Fn).
	165-170		"	"	"	"	Same.
	170-175		"	"	"	"	"
	175-180		"	"	"	"	"
	180-185		"	"	"	"	"
	185-190		"	"	Fn	"	"
	190-195		"	"	"	"	"
	195-200		"	"	"	"	"
	200-205		"	"	M	"	Same plus trace gray staining.
	205-210		"	"	"	"	Same.
	210-215		"	Light gray	"	"	Same plus trace brown staining.
	215-220		"	"	"	"	Slgtly sugary. Tr bn stng,wh chert,gy stng,pyrite,stylolites.
	220-225		"	"	"	"	Same but no brown staining. Plus trace clear calcite (M).
	225-230		"	"	"	"	Slgtly sugary. Tr tn stng,chalcopyrite,clr dol,fnly dissem pyr
	230-235		"	"	"	M/M	Slgtly sug. Ltl bn stng. Tr bn shale,clr dolomite(M),pyrite.
	235-240		"	"	"	"	Same plus trace gray staining.
	240-245		"	"	Fn	Fn/M	Same but no brown staining or brown shale.
	245-250		"	"	"	"	Tr pyrite,stylo w/gn shale mot,gn stng,tn stng,clr dol(Fn/M).
	250-255		"	"	"	"	Same but little brown staining.
	255-260		"	Lt bn gray	"	"	Same.
	260-265		"	Wh & gy bn	"	"	Mch gy bn stng. Ltl wh & lt gy fossif cht. Tr clr dol(Fn/M),bk
	265-270		"	"	"	"	Same plus trace drusy quartz. \ film fos frags,stylo,pyr.
	270-275		"	Pl bn gray	"	"	Mch wh & lt gy cht. Ltl bn stng. Tr pyr,drsy qtz,bk film fos
	275-280		"	"	"	"	Same. \ frags,clr dol(Fn/M).
	280-285		"	White	M	M/M	Slgtly sugary. Tr pyrite,dk gray staining,clear dolomite(Fn/M).
	285-290		"	"	"	"	Same.
	290-295		"	"	"	Fn/M	Trace pyrite, gray staining, clear dolomite (Fn/M).
190'	295-300		"	"	"	"	Same but clear dolomite is (Fn/VC).

END OF LOG

SBCC

Mn-497

State of Wisconsin
Department of Natural Resources
Private Water Supply
Box 7921
Madison, Wisconsin 53707

NOTE:
White Copy – Division's Copy
Green Copy – Driller's Copy
Yellow Copy – Owner's Copy

WELL CONSTRUCTOR'S REPORT
Form 3300–15 Rev. 2-79

JUN 9 1983 MN-497-G

1. COUNTY: Manitowoc
CHECK (✓) ONE: ☑ Town ☐ Village ☐ City
Name: Two Creeks

2. LOCATION: NW¼ of NW¼ | Section 24 | Township 21-N | Range 24-E
OR – Grid or Street No. | Street or Road Name: POINT BEACH NUCLEAR
AND – If available subdivision name, lot & block No.: POWER PLANT, WELL #2

3. NAME ☑ OWNER ☐ AGENT AT TIME OF DRILLING CHECK (✓) ONE: Wisconsin Electric Power Co.
ADDRESS: 231 W. Michigan PO Box 2046
POST OFFICE: Milwaukee, Wis. | ZIP CODE: 53201

4. Distance in feet from well to nearest: (Record answer in appropriate block)

Building	Sanitary Bldg. Drain C.I.	Sanitary Bldg. Drain Other	Sanitary Bldg. Sewer C.I.	Sanitary Bldg. Sewer Other	Floor Drain Connected To: C.I. Sewer	Floor Drain Connected To: Other Sewer	Storm Bldg. Drain C.I.	Storm Bldg. Drain Other	Storm Bldg. Sewer C.I.	Storm Bldg. Sewer Other
6	2	FERMAN. WELL #52825								

Street Sewer San.	Street Sewer Storm	Other Sewers C.I.	Other Sewers Other	Foundation Drain Connected to: Sewer	Sewage Sump	Clearwater Dr.	Clearwater Sump	Sewage Sump C.I.	Sewage Sump Other	Clearwater Sump	Septic Tank	Holding Tank 200	Sewage Absorption Unit: Seepage Pit / Seepage Bed / Seepage Trench	Manure Hopper or Retention or Pnuematic Tank

Privy	Pit Waste Pit	Pit: Nonconforming Existing: Well / Pump / Tank	Subsurface Pumproom: Nonconforming Existing	Barn Gutter	Animal Barn Pen	Animal Yard	Silo With Pit	Glass Lined Storage Facility	Silo w/o Pit	Earthen Silage Storage Trench Or Pit	Earthen Manure Basin
					MANITOWOC Co. INDUST. #17						

Temporary Manure Stack or Platform	Watertight Liquid Manure Tank or Basin	Manure Pressure Pipe	Subsurface Gasoline or Oil Tank	Waste Pond or Land Disposal Unit (Specify Type)	Manure Storage Basin / Concrete Floor Only / Concrete Floor and Partial Concrete Walls	Other (Describe)

5. Well is intended to supply water for: #2 Mobil Office STEAM GEN. REPL. BLDG.

6. DRILLHOLE

Dia. (in.)	From (ft.)	To (ft.)	Dia. (in.)	From (ft.)	To (ft.)
10	Surface	116			
6	116	300			

7. CASING, LINER, CURBING AND SCREEN
Material, Weight, Specification

Dia. (in.)	Mfg. & Method of Assembly	From (ft.)	To (ft.)
6	United States Steel 18.97 lb/ft. Black Raw ASTM-A-53	Surface	118

8. GROUT OR OTHER SEALING MATERIAL

Kind	From (ft.)	To (ft.)
Cement	Surface	116

9. FORMATIONS

Kind	From (ft.)	To (ft.)
Clay	Surface	15
sand	15	30
Clay	30	106
limestone	106	300

(BELATED)
APPROVAL DATE: MAR. 13, 1985
FILE LOCATION: TWO CREEKS
CC: TO STATE GEOLOGIST

10. TYPE OF DRILLING MACHINE USED
☐ Cable Tool ☑ Rotary-hammer w/drilling mud & air ☐ Jetting with ☐ Air ☐ Water
☐ Rotary-air w/drilling mud ☐ Rotary-hammer & air
☐ Rotary-w/drilling mud ☐ Reverse Rotary

Well construction completed on May 10 1983

11. MISCELLANEOUS DATA
Yield Test: 1 Hrs. at 20 GPM
Well is terminated 24 inches ☑ above ☐ below final grade
Depth from surface to normal water level 22 Ft.
Well disinfected upon completion ☑ Yes ☐ No
Depth of water level when pumping 140 Ft. Stabilized ☑ Yes ☐ No
Well sealed watertight upon completion ☑ Yes ☐ No
Spec. Cap. = 0.2 GPM/ft
Water sample sent to Madison Wisconsin laboratory on May 24 1983

Your opinion concerning other pollution hazards, information concerning difficulties encountered, and data relating to nearby wells, screens, seals, method of finishing the well, amount of cement used in grouting, blasting, etc., should be given on reverse side.

Signature: Jerome Ritzloff Registered Well Driller
Business Name and Complete Mailing Address: P.O. Box 81 Luxemburg, Wisconsin

1192

E10

WELL CONSTRUCTOR'S REPORT **WISCONSIN STATE BOARD OF HEALTH** Wel 6

1 COUNTY: Manitowoc

CHECK ONE: [X] Town [ ] Village [ ] City NAME: Two Creeks MN-39-G

2. LOCATION (Number and Street or ¼ section, section, township and range. Also give subdivision name, lot and block numbers when available.)
SE-NW 24 T21N ~~R25E~~ 24E R24E

3 OWNER AT TIME OF DRILLING
Wisconsin Michigan Power Co. POINT BEACH NUCLEAR POWER PLANT WELL #1 - Permanent well # 52824

4 OWNER'S COMPLETE MAIL ADDRESS
807 S. Oneida, Appleton, Wis. 54910

5. Distance in feet from well to nearest: (Record answer in appropriate block)

BUILDING	SANITARY SEWER C.I.	SANITARY SEWER TILE	FLOOR DRAIN C.I.	FLOOR DRAIN TILE	FOUNDATION DRAIN SEWER CONNECTED	FOUNDATION DRAIN INDEPENDENT	WASTE WATER DRAIN C.I.	WASTE WATER DRAIN TILE
pump house 15	-	-			250± Future		~~15'± to Stream~~ ?	

CLEAR WATER DRAIN C.I.	CLEAR WATER DRAIN TILE	SEPTIC TANK	PRIVY	SEEPAGE PIT	ABSORPTION FIELD	BARN	SILO	ABANDONED WELL	SINK HOLE
15'± to	stream	700' ±		700'					

15' to Pump house foundation

OTHER POLLUTION SOURCES (Give description such as dump, quarry, drainage well, stream, pond, lake, etc.)

6. Well is intended to supply water for: Potable Use MANITOWOC CO INDUST #17

7. DRILLHOLE

Dia. (in.)	From (ft.)	To (ft.)	Dia. (in.)	From (ft.)	To (ft.)
16	Surface	129			
10	129	257			

8. CASING, LINER, CURBING, AND SCREEN

Dia. (in.)	Kind and Weight	From (ft.)	To (ft.)
16	Steel	Surface	112
10	" .307	+2	129

10. FORMATIONS

Kind	From (ft.)	To (ft.)
Glacial	Surface	109
Limestone	109	257

MN4161

9. GROUT OR OTHER SEALING MATERIAL

Kind	From (ft.)	To (ft.)
Neat Cement, Pressure Grout	Surface	129

APPROVAL DATE: MAR 13, 1985 / Belated
FILE LOCATION: TWO CREEKS

Well construction completed on 5/15 19 67

11. MISCELLANEOUS DATA
Yield test: 27+ Hrs. at 60 GPM

Depth from surface to normal water level 12 ft.

Depth to water level when pumping 33 ft.

Well is terminated 24 inches [XX] above [ ] below final grade

Well disinfected upon completion [X] Yes [ ] No

Well sealed watertight upon completion [X] Yes [ ] No

Water sample sent to Approved Lab. #68 Spec. Cap = 2.9 gpm/ft dd laboratory on: 19

Your opinion concerning other pollution hazards, information concerning difficulties encountered, and data relating to nearby wells, screens, seals, type of casing joints, method of finishing the well, amount of cement used in grouting, blasting, subsurface pumprooms, access pits, etc., should be given on reverse side.

SIGNATURE: EGERER-GALLOWAY WELL CORP. Wm. A. Lawrence Wm. A. Lawrence/Jr. Registered Well Driller

COMPLETE MAIL ADDRESS: P. O. Box 7296, Milwaukee, Wis. 53213

Please do not write in space below

COLIFORM TEST RESULT	GAS — 24 HRS.	GAS — 48 HRS.	CONFIRMED	REMARKS
		See letter (8/28/67) & Rply (9/26/67) Questionable High Cap file 8/28/67		CC: M.E. Ostrom 8/17/67 plos

E10

UNIVERSITY OF WISCONSIN GEOLOGICAL & NATURAL HISTORY SURVEY
1815 University Avenue, Madison, Wisconsin 53706

Log No. Mn-39
Sample Nos. 276086-276134

County: Manitowoc

Well name Wisconsin Michigan Power Co.
Two Creeks, Wisconsin
Owner.... Wisconsin Michigan Power Co.
Address.. 807 S. Oneida
Appleton, Wisconsin 54910
Driller.. Egerer-Galloway Well Corp.
Engineer.

Completed... 5-15-67
Field check.
Altitude....
Use..... Drinking
Static w. l. 12'
Spec. cap... 2.8

R. 24E.
T. 21 N.
Sec. 24

Quad. Manitowoc 15'

Drill Hole						Casing & Liner Pipe or Curbing							
Dia.	from	to	Dia.	from	to	Dia.	Wgt.& Kind	from	to	Dia.	Wgt.& Kind	from	to
16"	0	129'				16"	Steel	0	112'				
10"	129'	257'				10"	Steel .307	+2"	129'				

Grout: Kind	from	to
Neat cement, pressure grout	0	129'

Samples from 0 to 255'

Date received: 6-6-67
Examined by: J. Warren

Issued: 12/68
Date: 9-8-67

Formations: Drift, Silurian

Remarks: Well tested for 27+hrs. at 60 gpm with 21 ft. of drawdown.
Corrected well depth to 257'

LOG OF WELL:

DRIFT		0-5	5	Cl,pl rd bn,F srtg,doli,tr V fn gvl;mch fn/C snd,ltl C&VC
		5-10	5	Cl,pl rd bn,F srtg,dolic,ltl Vfn/VC snd,tr fn&Vfngvl,ltl mot wh;
		10-25	15	Cl,pl rd bn,F srtg,dolic,ltl mot gry bn;ltl fn/VC snd,tr fn& V fn gvl&org mat
		25-50	25	Cl,pl gry rd,P srtg;ltl st,tr Vfn snd/fn gvl
		50-55	5	Cl,pl rd bn,P srtg,dolic,ltl st, tr Vfnsnd/fn gvl
		55-65	10	Cl,gry rd,P srtg,dolic;ltl st&Vfn snd,tr fn snd/Vfn gvl
		65-70	5	Cl,pl rd bn,P srtg,dolic; ltl st/Csnd,tr VC&Vfn gvl
		70-90	20	NO SAMPLES
		90-100	10	Cl,pl rd bn,Psrtg,dolic;lrl st/M gvl
		100-105	5	Cl,pl rd bn,P srtg,dolic;ltl fn&Vfn snd,tr M snd/fn gvl
	110'	105-110	5	Snd,wh pl gn&pl gry,P srtg,mstly doli;ltl fn&M; lrl Vfngvl
SILURIAN		110-115	5	Dol,yl gry&lt gry,dns,tr fn;tr fn xln pyr
		115-130	15	Dol,yl gry mot pl or,Vfn,dns,tr fn;
		130-135	5	Dol,pl or wh&lt gry,fn&Vfn,dns,lrl sug;trM;trVfnXln pyr
		135-140	5	Dol,Vpl or&Vlt gry,M&fn,dns,sug;
		140-150	10	Dol,wh mot Vpl gn,fn,dns,ltl sug;ltl gn sh,tr pyr
		150-160	10	Dol,wh mot Vpl gn,fn,dns,sug;ltlM,trC;ltl gn sh,tr Vfn Xln pyr
		160-170	10	Dol,wh mot Vpl gn,fn,dns,tr sug,ltlM,tr C;tr gn sh&pyr
		170-185	15	Dol,wh mot Vpl gn,fn,dns,ltlM,trC;tr gn sh
		185-190	5	Dol,wh mot Vpl gn,fn,dns,ltl sug&M,trC;ltl gn sh

UNIVERSITY OF WISCONSIN GEOLOGICAL & NATURAL HISTORY SURVEY E10 Log No. Mn-39
1815 University Avenue, Madison, Wisconsin 53706

Well name Wisconsin Michigan Power Co. Two Creeks, Wisconsin
Sample Nos. 276086 to 276134

SILURIAN		190-205	15	Dol,Vpl or,fn&Vfn,dns,ltl sug,tr M&C;
		205-215	10	Dol,mot wh,fn,dns,tr sug,ltlM,trC&Vfn;fn xln pyr
		215-220	5	Dol,Vpl or mot yl gry&wh,M&fn,dns,ltl sug;tr gn sh&pyr
		220-225	5	Dol,gry or mot wh,M&fn,dns,ltl sug;tr gn sh&wh cht
		225-230	5	Dol,Vpl,or,fn,dns,ltlM&Vfn,tr ang;tr gn sh&cht
		230-235	5	Dol,yl bn mot gry or&yl gry,fn,dns ltlM&Vfn,tr C,tr sug;tr dissem py
		235-245	10	Dol,yl gry mot lt gry yl bn,dns,ltl sft,M&sug&Vfn;tr gn sh&discem py
		245-250	5	Dol,yl gry&Vlt gry,fn&Vfn,dns,tr M&sug;tr fnxln pyr
	145	250-255	5	Dol,yl gry&Vlt gry,fn,dns,ltl sft trVfn,ltlsug;tr gn sh&xln pyr

END OF WELL

LAKESIDE TRAINING

Well Construction Report For
WISCONSIN UNIQUE WELL NUMBER FY404

State of Wisconsin
Private Water Supply - WS/2
Department of Natural Resources
Box 7921
Madison, WI 53707

SEP 9 1993

(Please type or print using a black pen.)

Property Owner: Bechtel Const. Co.
Telephone Number: (414) 755-6634
Mailing Address: P.O. Box 317
City: Two Rivers
State: WI
Zip Code: 54241
County of Well Location: Manitowoc
Co. Well Permit No. W
Well Completion Date (mm-dd-yy): 8-7-93

36

Well Constructor (Business Name): Weber Well Drilling
License #: 99
Address: W2691 Sol Clearlake Rd.
City: Cato
State: WI
Zip Code: 54204

N2

2. Mark well location with a dot in correct 40-acre parcel of section. N / W / E / S

1. Well Location — Please use decimals instead of fractions.
[X] Town [ ] City [ ] Village of Two Creeks
Fire # (If avail.)
Grid or Street Address or Road Name and Number (If avail.): 6610 Nuclear Rd.
Subdivision Name / Lot # / Block #
Gov't Lot # ____ or NW 1/4 of NW 1/4 of Section 24, T 21 N; R 24 [X] E [ ] W

3. Well Type [X] New [ ] Replacement [ ] Reconstruction
of previous unique well # ____ constructed in 19 ____
Reason for new, replaced or reconstructed well? Construction Supply Well
[X] Drilled [ ] Driven Point [ ] Jetted [ ] Other ____

4. Well serves 0 # of homes and or Construction
(Ex: barn, restaurant, church, school, industry, etc.)
High Capacity: Well? [ ] Yes [X] No; Property? [X] Yes [ ] No

5. Well located on highest point of property, consistent with the general layout and surroundings? [X] Yes [ ] No If no, explain on back side.
Well located in floodplain? [ ] Yes [X] No
Distance in Feet From Well To Nearest:

	1. Landfill		9. Downspout/Yard Hydrant
500	2. Building Overhang		10. Privy
>5000	3. Septic or Holding Tank (circle one)		11. Foundation Drain to Clearwater
	4. Sewage Absorption Unit		12. Foundation Drain to Sewer
	5. Nonconforming Pit		13. Building Drain [ ] Cast Iron or Plastic [ ] Other
	6. Buried Home Heating Oil Tank		14. Building Sewer [ ] Gravity [ ] Pressure [ ] Cast Iron or Plastic [ ] Other
	7. Buried Petroleum Tank		15. Collector or Street Sewer
	8. Shoreline/Swimming Pool		16. Clearwater Sump
	17. Wastewater Sump		
	18. Paved Animal Barn Pen		
	19. Animal Yard or Shelter		
	20. Silo - Type ____		
	21. Barn Gutter		
	22. Manure Pipe [ ] Gravity [ ] Pressure [ ] Cast Iron or Plastic [ ] Other		
	23. Other Manure Storage ____		
	Other NR 112 Waste Source		
>1000	24. Sewage Plant		

6. Drillhole Dimensions

Dia. (in.)	From (ft.)	To (ft.)
10	surface	105
6	105	480

Method of constructing upper enlarged drillhole only.
[ ] 1. Rotary - Mud Circulation
[X] 2. Rotary - Air
[ ] 3. Rotary - Foam
[ ] 4. Reverse Rotary
[ ] 5. Cable-tool Bit ____ in. dia.
[ ] 6. Temp. Outer Casing 10 in. dia.
Removed? [X] Yes [ ] No
If no, explain ____
[ ] 7. Other ____

9. Geology

DNR USE ONLY	Type, Caving/Noncaving, Color, Hardness, Etc.	From (ft.)	To (ft.)
T-	Top Soil	Surface	2
CO	Stoney Clay	2	15
QCS	Sandy Clay (caving)	15	37
RC-	Red Clay	37	105
L-	Limestone	105	480

note: well #002 Hi cap #52825 Approved 08-04-93 — specific capacity 0.9

7. Casing, Liner, Screen

Dia. (in.)	Material, Weight, Specification Manufacturer & Method of Assembly	From (ft.)	To (ft.)
6	Black Steel Steel Pipe	surface	105
	New-18.97#/ft P.E. Seamless		
	Sawhill Tube Div.		
	ASTM-A-53-Gr B		

Dia. (in.)	screen type, material & slot size	From	To

10. Static Water Level
6 ft. above ground surface
____ ft. below ground surface

11. Pump Test
Pumping Level 71 ft. below surface
Pumping at 60 GPM for 4 hours

12. Well Is:
.24 in. [X] Above [ ] Below Grade
Developed? [X] Yes [ ] No
Disinfected? [X] Yes [ ] No
Capped? [X] Yes [ ] No

8. Grout or Other Sealing Material
Method: Conductor Pipe

Kind of Sealing Material	From (ft.)	To (ft.)	# Sacks Cement
Cement Grout	surface	105	43

13. Did you permanently seal all unused, noncomplying, or unsafe wells? [ ] Yes [ ] No If no, explain ____

14. Signature of Point Driver or Licensed Supervisory Driller: Roger Weber RW — Date Signed: 8-10-93
Signature of Drill Rig Operator (Mandatory unless same as above): Rusty Dillman FF — Date Signed: 8-10-93

Make additional comments on reverse side about geology, additional screens, water quality, etc. Comments on reverse side ____ (Check ✓, if yes)

DNR

WELL CONSTRUCTION REPORT
Form 3300-77A Rev. 11-92

SEE OTHER SIDE

LAKE SIDE TRAINING

WISCONSIN UNIQUE WELL NUMBER
Source: WELL CONSTRUCTION **FY404**

State of Wi-Private Water Systems-DG/2
Department Of Natural Resources, Box 7921
Madison, WI 53707

Form 3300-77A
(Rev 02/02)bw

Depth 480 FT

Property Owner: WISCONSIN ELECTRIC POWER COMPA	Telephone Number: 414 -755-2321
Mailing Address: PBNP 6610 NUCLEAR RD	
City: TWO RIVERS	State: WI / Zip Code: 54241
County of Well Location: 36 MANITOWOC	Co Well Permit No: W / Well Completion Date: August 7, 1993
Well Constructor: ROGER WEBER	License #: 99 / Facility ID (Public):
Address: W2691 ST CHARLES RD	Public Well Plan Approval#: 36-3-0017
City: CHILTON	State: WI / Zip Code: 53014 / Date Of Approval: 08/04/1993
Hicap Permanent Well #: 1176	Common Well #: 002 / Specific Capacity: .8 gpm/ft

1. Well Location
T=Town C=City V=Village: T of TWO CREEKS
Fire#:
Street Address or Road Name and Number: 6610 NUCLEAR RD
Subdivision Name: / Lot#: / Block #:
Gov't Lot or NW 1/4 of NW 1/4 of Section 24 T 21 N;R 24 E
Latitude Deg. 44 Min. 17.021
Longitude Deg 87 Min. 32.2705

2. Well Type 1 (See item 12 below)
1=New 2=Replacement 3=Reconstruction
of previous unique well # _____ constructed in 0
Lat/Long Method: GPS008
Reason for replaced or reconstructed Well?
CONSTRUCTION SUPPLY WELL
1 1=Drilled 2=Driven Point 3=Jetted 4=Other

3. Well Serves P # of homes and or CONSTRUCTION (eg: barn, restaurant, church, school, industry, etc.)
M=Munic O=OTM N=NonCom P=Private Z=Other X=NonPot A=Anode L=Loop H=Drillhole
High Capacity: Well? N Property? Y

4. Is the well located upslope or sideslope and not downslope from any contamination sources, including those on neighboring properties? Y
Well located in floodplain? N
Distance in feet from well to nearest: (including proposed)

1. Landfill
500 2. Building Overhang
> 5000 3. 1=Septic 2= Holding Tank
4. Sewage Absorption Unit
5. Nonconforming Pit
6. Buried Home Heating Oil Tank
7. Buried Petroleum Tank
8. 1=Shoreline 2= Swimming Pool
9. Downspout/ Yard Hydrant
10. Privy
11. Foundation Drain to Clearwater
12. Foundation Drain to Sewer
13. Building Drain 1=Cast Iron or Plastic 2=Other
14. Building Sewer 1=Gravity 2=Pressure 1=Cast Iron or Plastic 2=Other
15. Collector Sewer: ___ units ___ in . diam.
16. Clearwater Sump
17. Wastewater Sump
18. Paved Animal Barn Pen
19. Animal Yard or Shelter
20. Silo
21. Barn Gutter
22. Manure Pipe 1=Gravity 2=Pressure 1=Cast iron or Plastic 2=Other
23. Other manure Storage
24. Ditch
> 1000 25. Other NR 812 Waste Source SEWAGE PLANT

5. Drillhole Dimensions and Construction Method

Dia.(in.)	From (ft)	To (ft)
10.0	surface	105
6.0	105	480

Upper Enlarged Drillhole
-- 1. Rotary - Mud Circulation ----------
X -- 2. Rotary - Air ----------
-- 3. Rotary - Air and Foam ----------
-- 4. Drill-Through Casing Hammer
-- 5. Reverse Rotary
-- 6. Cable-tool Bit _ n. dia ----------
X -- 7. Temp. Outer Casing _10 in. dia. _____ depth ft.
Removed ? X
Other

Lower Open Bedrock

Geology Codes	8. Geology Type, Caving/Noncaving, Color, Hardness, etc	From (ft.)	To (ft.)
__I_	TOPSOIL	0	2
__CG	STONEY CLAY	2	15
_QCS	SANDY CLAY CAVING	15	37
R_C_	RED CLAY	37	105
__L_	LIMESTONE	105	480

6. Casing Liner Screen

Dia. (in.)	Material, Weight, Specification Manufacturer & Method of Assembly	From (ft.)	To (ft.)
6.0	BLACK STAND. STEEL PIPE NEW 18.97#/FT P.E.SEAMLESS SAWHILL	surface	105

Dia.(in.)	Screen type, material & slot size	From	To

9. Static Water Level
6.0 feet A ground surface
A=Above B=Below

10. Pump Test
Pumping level 71.0 ft. below surface
Pumping at 60.0 GP M 4.0 Hrs

11. Well Is: 24 in. A Grade
A=Above B=Below
Developed? Y
Disinfected? Y
Capped? Y

7. Grout or Other Sealing Material
Method CONDUCTOR PIPE

Kind of Sealing Material	From (ft.)	To (ft.)	# Sacks Cement
CEMENT GROUT	surface	105.0	43 S

12. Did you notify the owner of the need to permanently abandon and fill all unused wells on this property?
If no, explain

13. Initials of Well Constructor or Supervisory Driller: RW Date Signed: 8/10/93
Initials of Drill Rig Operator (Mandatory unless same as above): FF Date Signed: 8/10/93

Additonal Comments?
Owner Sent Label? Y
Variance Issued?
More Geology?

Batch 237

LAKE SIDE TRAINING

Wisconsin Geological & Natural History Survey
3817 Mineral Point Road, Madison, WI 53705

WG&NHS Log No: MN -517

Title: Geologic Log

Site Name: Bechtel Construction Co. Well #2
Owner: Bechtel Construction Co.
Address: PO Box 217
Two Rivers, WI 54241
Driller(s): Weber Well Drilling
Engineer:

Location: **NW, NW, Sec. 24, T21N, R24E**
Topo Name: Two Creeks
Sample Nos.: X119
Perm No.: 52825
WI-Unique ID#: FY404

Samples Rec'd:
9/1/1993 0' to 500'

Studied By:
Hilary C. Sanders 105' to 500'
Jesse E. Rawling III 0' to 105'

County: MANITOWOC
Completed: 8/7/1993
Field Check:

Elevation: 620 ±10'
Well Use: construction
Static Level: 6'

Pump Test:
Pumped at 60 GPM for 4 hrs. with 65 ft. of drawdown.
On 8/1/1993 Specific Cap: 0.9 GPM/ft.

Drill Hole Dimensions

Diameter	From	To
10"	0'	105'
6"	105'	480'

Drilling Method

Method	From	To
air rotary	0'	480'

Grout

Kind	From	To
cement grout	0'	105'

Open Interval Characteristics

Diameter	From	To	Opening Type
6"	0'	480'	bedrock

Casing & Liner Information

Diameter	From	To	Casing	Weight
6"	+2'	105'	Steel	18.97

Types of records available for this site (* indicates indexing term):

Well construction report - original, Geologic log, *subsurface boring (non-core), Drill cuttings available

Formations:

Two Rivers Member, Silurian

Log Comments:

This geologic log has undergone basic review. Some information has yet to be added or further reviewed. If essential information is missing or incorrect, please contact WG&NHS at rpeters@wisc.edu or (608)-263-7387.

Version tracking:
7/8/2008 Initial digital version

Wisconsin Geological & Natural History Survey
3817 Mineral Point Road, Madison, WI 53705

WG&NHS Log No: MN -517
Site Name: Bechtel Construction Co. Well #2

Title: Geologic Log

	Depths	Graphic	RockType	Color	Mode	Range	Miscellaneous Characteristics
Two Rivers Member	0-5		gravel	red brown & gy bn	MP	Gr/LP	Limestone,dolomite,meta-sediment,trap,chert(white oolitic),calcus-cem ss Much sand,silt Little clay.
	5-10		clay	brown	--	--	Calcareous.Much silt Trace gravel (Gr/S peb),sand.
	10-15		clay	brown	--	--	Calcareous.Much gravel (Gr/M peb),silt Little sand.
	15-20		clay	brown	--	--	Calcareous.Much silt Trace gravel(Gr/M peb),sand.
	20-25		clay	brown	--	--	Calcareous.Much silt.Trace sand.
	25-30		clay	brown	--	--	Calcareous.Much silt.Little sand.Trace gravel (S peb/M peb)
	30-35		clay	brown	--	--	Calcareous.Little silt.Trace gravel (Gr/M peb),sand.
	35-40		clay	brown	--	--	Calcareous.Much silt.Little sand.Trace gravel (Gr/M peb).
	40-45		clay	brown	--	--	Calcareous.Much silt Trace gravel (Gr),sand.
	45-50		clay	brown	--	--	Calcareous.Much silt.Little sand.Trace gravel (Gr/S peb).
	50-55		clay	brown	--	--	Calcareous.Little sand,silt.Trace gravel (Gr/M peb).
	55-60		clay	brown	--	--	Calcareous.Much silt.Little gravel (Gr/M peb),sand.
	60-65		clay	red brown	--	--	Calcareous.Much gravel (Gr/M peb),sand,silt.
	65-70		clay	red brown	--	--	Calcareous.Much gravel (Gr/M peb),sand,silt.
	70-75		clay	red brown	--	--	Calcareous.Much gravel (Gr/M peb),sand,silt.
	75-80		gravel	mixed red brown	MP	Gr/LP	Limestone,dolomite,gneiss,white chert,trap.Much sand,silt,clay.
	80-85		gravel	mixed red brown	MP	Gr/LP	Limestone,fos ls,dolomite,trap,arkose,wh fosssilif chert.Much sand,silt,clay.
	85-90		clay	red brown	--	--	Calcareous.Much gravel(Gr/M peb),sand,silt.
	90-95		gravel	mxd bn gry & rd bn	MP	Gr/LP	Limestone,dolomite,chert(white),trap,meta-sediment.Much silt.Little sand,clay.
	95-100		gravel	mxd bn gry & rd bn	MP	Gr/LP	Limestone,dolomite,chert(white,tan),granodiorite.Much sand.silt.Little clay.
	100-105		gravel	mxd bn gry & rd bn	MP	Gr/LP	Limestone,fos ls,dolostone,chert(white),granite,meta-sediment,granodiorite Little sand,silt,clay.
Silurian	105-110		dolomite	light brown gray	M	Fn/M	Trace pale green shale,pyrite,calcite crystals,caved brown shale.
	110-115		dolomite	very pale brown	M	Fn/M	Trace stylolites,caved clay.
	115-120		dolomite	light gray	M	Fn/M	Trace pyrite,pale green shale partings.
	120-125		dolomite	very pale brown	M	Fn/M	Trace clear gypsum,pl gn sh,bn & dk bn sh.
	125-130		dolomite	gray	M	Fn/M	Trace black to brassy pyrite,pl gn shale.
	130-135		dolomite	white to light gray	M	Fn/M	Trace,pyrite,dk gy shale parting,caved clay.
	135-140		dolomite	gray	M	Fn/M	Trace pale green shale,dk brown shale,pyrite.

Wisconsin Geological & Natural History Survey
3817 Mineral Point Road, Madison, WI 53705

WG&NHS Log No: MN -517
Site Name: Bechtel Construction Co. Well #2

Title: Geologic Log

	Depths	Graphic	RockType	Color	Mode	Range	Miscellaneous Characteristics
Silurian	140-145		dolomite	gray	M	Fn/M	Trace pale green to green sh,pyrite,bn speckling,caved brown clay.
	145-150		dolomite	white to light gray	M	Fn/M	Trace pale green sh,pyrite,massive glauconite.
	150-155		dolomite	white to light gray	M	Fn/M	Trace pale green shale,pale brown shale,pyrite,stylolites,dark gray staining.
	155-160		dolomite	white	M	Fn/M	Slightly sugary.Trace pale green shale,pyrite,vugs,Vfn-glauc,dark gray staining,caved brown clay.
	160-165		dolomite	white to light gray	M	Fn/M	Slightly sugary.Trace pyrite,vugs,dol-xtals.
	165-170		dolomite	wh to v light gray	M	Fn/M	Slightly sugary.Trace vugs, green gray shale, pyrite,caved brown clay.
	170-175		dolomite	wh to v light gray	M	Fn/M	Slightly sugary.Trace dol-xtals,vugs,clear gypsum,pyrite,fossil mold.
	175-180		dolomite	wh to v light gray	M	Fn/M	Slightly sugary.Trace vugs,dol-xtals,green gray shale,pyrite,very dark gray staining (from pyrite).
	180-185		dolomite	wh to v lt gn gy	M	Fn/M	Slightly sugary.Trace vugs,clear gypsum,dol-xtals,pyrite,dark gray staining,pale green shale.
	185-190		dolomite	white	M	Fn/M	Slightly sugary.Trace vugs,dol-xtals,dark gray staining,clear gypsum,gray green shale.
	190-195		dolomite	light gray	M	Fn/M	Slightly sugary.Little dark gray staining.Trace vugs,dol-xtals,clear gypsum,pyrite,green shale.
	195-200		dolomite	light gray	M	Fn/M	Trace pale green shale,pyrite,dark gray staining,clear gypsum.
	200-205		dolomite	light brown gray	M	Fn/M	Much white fossilif-chert.Trace dark gray staining,pyrite,dark brown shale.
	205-210		dolomite	light gray	M	Fn/M	Trace dol-xtals,pyrite,dark gray staining (from pyrite),white fossilif-chert,stylolites.
	210-215		dolomite	light gray	M	Fn/M	Trace dark gray staining (from pyrite),pyrite,green shale,clear gypsum,dol-xtals.
	215-220		dolomite	light gray	M	Fn/M	Much white fossilif-chert.Trace dark gray staining,pyrite,dark brown shale,clear gypsum,calcite-xtals,quartz-xtals.
	220-225		dolomite	lt gy bn & dk gy bn	M	Fn/M	Trace pyrite,dark gray staining,dark brown shale,wh fossilif-chert,dk bn fossil frags,fossil molds.
	225-230		dolomite	light gray to gray	M	Fn/M	Trace brown to dark gray staining,gray shale,stylolites,pyrite,fossil fragments,clear gypsum.
	230-235		dolomite	v lt gray to lt gy	M	Fn/M	Trace pyrite,dark brown shale,dol-xtals,clear gypsum,white fossilif-chert,vugs.
	235-240		dolomite	v lt gray to lt gy	M	Fn/M	Trace dark gray staining,pyrite,dol-xtals and veins,dark brown shale,stylolites,vfn-glauconite,white chert.
	240-245		dolomite	lt gy to gy brown	M	Fn/M	Trace white fossilif-chert,stylolites,pyrite,dark brown shale,dol-xtals,dark brown fossil fragments.
	245-250		dolomite	lt gy to gy brown	M	Fn/M	Much white to brown fossilif-chert.Few dark brown fossil fragments.Trace dark brown shale,dark brown staining,dol-xtals.
	250-255		dolomite	light gray brown	M	Fn/M	Much white fossilif-chert.Trace pyrite & pyrite veins,dark brown fossil fragments,dark brown shale,dol-xtals,brown staining.
	255-260		dolomite	lt brown to gy bn	M	Fn/M	Little white to pale brown fossilif-chert.Few dark brown to black fossil fragments.Trace pyrite & pyrite veins,very dark brown shale,dol-xtals.
	260-265		dolomite	light gray brown	M	Fn/M	Much white to light brown fossilif-chert .Few dark brown fossil fragments.Trace dark brown shale,pyrite,qtz-xtals (in veins in chert).
	265-270		dolomite	light gray brown	M	Fn/M	Much white fossilif-chert.Trace pyrite,qtz-xtals (in veins in chert),gray brown shale,dark brown fossils.
	270-275		dolomite	light brown	M	Fn/M	Much white fossilif-chert (trace light brown).Trace gray to dark brown shale,pyrite,quartz-xtals.
	275-280		dolomite	white to light gray	M	Fn/M	Trace pyrite,gray staining,calcite-xtals,light brown dolomite (as above).

Wisconsin Geological & Natural History Survey
3817 Mineral Point Road, Madison, WI 53705

WG&NHS Log No: MN -517
Site Name: Bechtel Construction Co. Well #2

Title: Geologic Log

	Depths	Graphic	RockType	Color	Mode	Range	Miscellaneous Characteristics
Silurian	280-285		dolomite	white to light gray	M	Fn/M	Trace gray staining,vugs,calcite~xtals,pyrite.
	285-290		dolomite	white to light gray	M	Fn/M	Trace light gray staining,vugs,calcite~xtals,pyrite.
	290-295		dolomite	white to light gray	M	Fn/M	Slightly sugary. Trace vugs,calcite~xtals,pyrite.
	295-300		dolomite	white to light gray	M	Fn/M	Trace pyrite,clear gypsum,mass~glauconite,dol~xtals,stylolites,caved brown clay.
	300-305		dolomite	white to light gray	M	Fn/M	Slightly sugary.Trace vugs,calcite~xtals,dol~xtals,clear gypsum,dark gray staining,pyritye,stylolites,caved brown clay.
	305-310		dolomite	white to light gray	M	Fn/M	Slightly sugary.Trace vugs,calcite~xtals,dol~xtals,dark gray staining,pyritye,stylolites,clear gypsum,caved brown clay.
	310-315		dolomite	white to gray	M	Fn/M	Slightly sugary.Trace pyrite,stylolites,clear gypsum,dark gray staining,dol~xtals.
	315-320		dolomite	white to gray	M	Fn/M	Trace dark gray staining,clear gypsum,pyrite,stylolites,caved brown clay.
	320-325		dolomite	lt bn gray to gray	M	Fn/M	Trace dark gray brown shale,dark gray staining,pyrite,dol~xtals, vfn-glauc.
	325-330		dolomite	lt bn gray to gray	M	Fn/M	Trace pyrite,dark gray staining,dol~xtals,calcite~xtals,gray brown shale.
	330-335		dolomite	light gray to gray	M	Fn/M	Trace dark gray staining, pyrite,vugs,dol~xtals,gray shale,clear gypsum.
	335-340		dolomite	lt gy to gy brown	M	Fn/M	Trace dark brown shale,dark brown gray staining,dol~xtals,pyrite,dark brown fossil fragments,stylolites,vfn-glauc.
	340-345		dolomite	lt gy to dk gy br	M	Fn/M	Trace gray and brown staining,dark brown shale,dark brown fossil fragments,pyrite,dol~xtals,quartz~xtals.
	345-350		dolomite	lt bn gy to bn gy	M	Fn/M	Trace dark brown shale,pyrite,dol~xtals,brown staining,dark brown fossil fragments,calcapyrite.
	350-355		dolomite	lt gy to bn gy	M	Fn/M	Much white fossilif~chert.Trace dark brown shale,light brown staining,pyrite,dol~xtals.
	355-360		dolomite	lt gy to bn gy	M	Fn/M	Much white fossilif~chert.Trace dark brown shale,pale brown to brown staining,pyrite,dol~xtals,dark brown fossil fragments,stylolites,vfn-glauc,caved brown clay.
	360-365		dolomite	lt gy to bn gy	M	Fn/M	Little white fossilif~chert.Trace pyrite,dol~xtals,dark brown shale,stylolites,dark brown fossil fragments,clear gypsum.
	365-370		dolomite	lt gray brown	M	Fn/M	Much white fossilif~chert.Trace pyrite,dol~xtals,dark brown shale,dark brown fossil fragments,stylolites.
	370-375		dolomite	lt gy bn to gy br	M	Fn/M	Trace dark brown shale,dark brown fossil fragments,dark brown staining,pyrite,dol~xtals,clear gypsum,white chert.
	375-380		dolomite	lt gy bn to gy br	M	Fn/M	Much white fossilif~chert.Trace drusy~qtz,dark brown and pale green shale,pyrite,dol~xtals,brown staining,dark brown fossil fragments.
	380-385		dolomite	lt gy bn to gy br	M	Fn/M	Much white fossilif~chert.Trace dark brown shale,dark brown fossil fragments, pyrite,dol~xtals,brown & gray staining,stylolites.
	385-390		dolomite	lt gy bn to gy br	M	Fn/M	Much white fossilif~chert.Trace drusy~qtz,dark brown shale,dark brown fossil fragments, pyrite,dol~xtals,brown & gray staining,stylolites.
	390-395		dolomite	v pale bn to gy bn	M	Fn/M	Little white fossilif~chert,drusy~qtz (replacing coral).Trace dark brown shale,pyrite,stylolites,brown staining,dark brown fossil fragments.
	395-400		dolomite	pale bn to lt bn gy	M	Fn/M	Much white fossilif~chert.Trace dark brown shale,brown staining,dol~xtals,stylolites,clear gypsum,drusy~qtz (replacing coral),qtz~xtals,pyrite,dark brown fossil fragments.
	400-405		dolomite	white to light gray	M	Fn/M	Trace pale brown and gray staining,vugs,dol~xtals,pyrite,clear gypsum,stylolites,pale green shale.
	405-410		dolomite	white to light gray	M	Fn/M	Trace vugs,dol~xtals,dark brown shale,pyrite,gray staining,clear gypsum,stylolites.
	410-415		dolomite	white to gray	M	Fn/M	Trace dol~xtals,vugs,gray and light brown staining,dark brown shale,pyrite,qtz~xtals.
	415-420		dolomite	white to light gray	M	Fn/M	Trace dol~xtals,vugs,clear gypsum,light brown shale,pyrite,gray staining.

Wisconsin Geological & Natural History Survey
3817 Mineral Point Road, Madison, WI 53705

WG&NHS Log No: MN -517
Site Name: Bechtel Construction Co. Well #2

Title: Geologic Log

	Depths	Graphic	RockType	Color	Mode	Range	Miscellaneous Characteristics
Silurian	420-425		dolomite	pale brown	M	Fn/M	Trace dark brown shale,dark gray staining,pyrite,stylolites,dol~xtals.
	425-430		dolomite	gray brown	M	Fn/M	Trace dark brown staining,dark brown shale,vugs,pyrite,stylolites,floating qtz~sand.
	430-435		dolomite	gray brown	M	Fn/M	Trace dark brown shale,dark brown staining,pyrite,dol~xtals,vugs,stylolites,floating~qtz sand,green gray shale.
	435-440		dolomite	gray brown	M	Fn/M	Trace dark brown shale,light brown and gray staining,pyrite,dol~xtals,vugs,floating~qtz,dark brown fossil fragments.
	440-445		dolomite	gray brown	M	Fn/M	Little floating~qtz.Trace dark brown shale,dark gray staining,vugs,pyrite,dol~xtals
	445-450		dolomite	light brown	M	Fn/M	Trace light brown fossilif~chert,clear gypsum,brown staining,vugs,dol~xtals,light brown shale,pyrite,stylolites,floating~qtz.
	450-455		dolomite	lt bn gray to lt bn	M	Fn/M	Much light gray fossilif~chert.Trace dark gray staining,dark brown shale,pyrite,clear gypsum,dol~xtals.
	455-460		dolomite	lt bn gray to lt bn	M	Fn/M	Little light gray fossilif~chert.Trace dark brown shale,clear gypsum,pyrite,stylolites,dol~xtals,vugs,dark brown fossil fragments.
	460-465		dolomite	lt bn gy to pale bn	M	Fn/M	Little light gray fossilif~chert.Trace dark brown shale,clear gypsum,pyrite,dol~xtals,stylolites,qtz~xtals,dark brown fossil fragments.
	465-470		dolomite	lt bn to pale bn	M	Fn/M	Slightly sugary.Little white to light gray fossilif~chert.Trace dark brown shale,dol~xtals,stylolites.
	470-475		dolomite	lt bn to pale bn	M	Fn/M	Slightly sugary.Trace white to light gray fossilif~chert,dark brown shale,dol~xtals,dark brown fossil fragments,stylolites.
	475-480		dolomite	gray brown	M	Fn/M	Trace dark brown shale,dark brown fossil fragments,dol~xtals,pyrite.
	480-485		dolomite	lt gy bn to brown	M	Fn/M	Slightly sugary.Trace dark brown shale,vugs,dol~xtals,dark brown fossil fragments,pyrite,dark gray staining,clear gypsum,fossil molds.
	485-490		dolomite	lt gy bn to brown	M	Fn/M	Trace light gray fossilif~chert,dark brown shale,dark brown fossil fragments,pyrite,brown and gray staining,stylolites.
	490-495		dolomite	gray brown	M	Fn/M	Much white fossilif~chert.Trace dark brown shale,dark brown fossil fragments,pyrite,quartz~xtals (in veins).
	495-500		dolomite	gray brown	M	Fn/M	Trace white fossilif~chert,dark brown shale,dark brown fossil fragments,pyrite,dol~xtals.

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

WISCONSIN
DEPT. OF NATURAL RESOURCES

Jim Doyle, Governor
Matthew J. Frank, Secretary

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TTY Access via relay - 711

November 8, 2007

File Number: 36-3-0017

ALAN J. GOULD
FPL ENERGY POINT BEACH, LLC
700 UNIVERSE BLVD., PO BOX 14000
JUNO BEACH, FL 33408

SUBJECT: Industrial Facility Well Approval, Manitowoc County, Wisconsin

Dear Mr. Gould:

The Division of Water, Bureau of Drinking Water and Groundwater, has received the application you submitted on October 4, 2007. The proposal requested Department approval for continued operation and ownership change for four, potable wells having individual capacities of less than 70 gallons per minute each.

PROPOSAL SUMMARY

Operator: FPL ENERGY POINT BEACH, LLC
6610 NUCLEAR ROAD
TWO RIVERS, WI 54241

Officials: Russ B. Parker Telephone: 920-755-6795

Property Owner: FPL ENERGY POINT BEACH, LLC
700 UNIVERSE BLVD., PO BOX 14000
JUNO BEACH, FL 33408

Officials: Alan J. Gould Telephone: 561-964-4199

Property Description: The property is comprised of:

Most of the S ½ of the SE ¼ of Section 15,
Section 14,
Section 13 east of Lake Michigan,
The E ½ of Section 23,
About 10 acres in the NE ¼ of the NW ¼ of Section 23,
Section 24 east of Lake Michigan,
The NE ¼ of Section 26 except for a small parcel on the west boundary,
Most of the N ½ of Section 25, and
A narrow strip of land following the west section line of Section 25 to the south to the SW Section corner,
All located in T21N, R24E, Town of Two Creeks, Manitowoc County.

A summary table of the approved wells on the property is located at the end of this letter.

The Department of Natural Resources is authorized by chapters 280 and 281 Stats., to have general supervision and control over the waters of the state and to establish and enforce standards and rules for obtaining drinking water and protecting the public health from polluted water supplies. Chapter NR 812, Wis. Adm. Code is adopted pursuant to this authority.

REC'D FEB 22 2008

APPROVAL

Because the operation of the high capacity water supply is not expected to cause any significant reduction in groundwater availability to the nearest public utility well, you may operate the wells subject to the provisions of Ch. NR 812 , Wis. Adm. Code and the conditions noted below. The Department reserves the authority to require changes to the well construction and to limit the pumpage in any amount that may be necessary to eliminate excessive drawdown in any public utility well that may be affected. If the operation of the wells adversely affects the operation of any private wells on neighboring properties, this Department letter will not negate the protection to which private well owners are entitled under Wisconsin case law relating to groundwater. This Department letter does not relieve the property owner or well operator of any liability which may result from injury or damage suffered by any person upon operation of the wells.

Failure to comply with the requirements of ch. NR 812, Wis Adm. Code, or any condition of this approval voids the approval. Construction or operation of a high capacity well without a valid approval is a violation of s. 281.17, Stats., and is subject to potential forfeitures of $10-$5000 per day with each day being a separate offense.

CONDITIONS

1. If the Department discovers aspects of the installation that are in violation of ch. NR 812, Wis. Adm. Code, then the approval is void and it is the responsibility of the owner or licensed individuals to perform the needed corrections.

NOTICE OF APPEAL RIGHTS

If you believe that you have a right to challenge this decision, you should know that the Wisconsin statutes, administrative rules and case law establish time periods within which requests to review Department decisions must be filed. To request a contested case hearing pursuant to section 227.42, Wis. Stats., you have 30 days after the decision is mailed, or otherwise served by the Department, to serve a petition for hearing on the Secretary of the Department of Natural Resources. All requests for contested case hearings must be made in accordance with section NR 2.05(5), Wis. Adm. Code, and served on the Secretary in accordance with section NR 2.03, Wis. Adm. Code. The filing of a request for a contested case hearing is not a prerequisite for judicial review and does not extend the time period for filing a petition for judicial review.

For judicial review of a decision pursuant to sections 227.52 and 227.53, Wis. Stats., you must file your petition with the appropriate circuit court and serve the petition on the Department within the prescribed time period. A petition for judicial review must name the Department of Natural Resources as the respondent.

STATE OF WISCONSIN
DEPARTMENT OF NATURAL RESOURCES
For the Secretary

Mark F. Putra NR

Mark F. Putra, R.S., Chief
Private Water Systems Section
Bureau of Drinking Water and Groundwater

cc: Bob Barnum - NER

Table 1

Approved Well Inventory Summary

PREVIOUSLY APPROVED WELL
WELL STATUS: APPROVED WITH WELL REPORT
SITE WELL NUMBER: 003
WELL NAME: BOUNDARY CONTROL CENTER
DNR PERMANENT HIGH CAP WELL#: 52826
WUWN: BE655
PWSID NUMBER: 43603450
LOCATION: SW 1/4 SW 1/4 S24 T21N R24E
CIVIL TOWN: TWO CREEKS
COUNTY: MANITOWOC
DATE COMPLETED: 05/17/1983
WELL DEPTH: 300
PUMP CAPACITY (GPM): 20
WELL USE: DOMESTIC
AVG USE (GALLONS PER DAY): 1,000
MAX USE (GALLONS PER DAY): 1,000

PREVIOUSLY APPROVED WELL
WELL STATUS: APPROVED WITH WELL REPORT
SITE WELL NUMBER: 001
WELL NAME: POINT BEACH NUCLEAR MAIN OFFICES
DNR PERMANENT HIGH CAP WELL#: 52824
WUWN: FB703
PWSID NUMBER: 43606343
LATITUDE: 44 Deg 16.7684 Minute
LONGITUDE: 87 Deg 32.2527 Minute
LOCATION: SE 1/4 NW 1/4 S24 T21N R24E
CIVIL TOWN: TWO CREEKS
COUNTY: MANITOWOC
DATE COMPLETED: 05/15/1967
WELL DEPTH: 257
PUMP CAPACITY (GPM): 65
WELL USE: DOMESTIC
AVG USE (GALLONS PER DAY): 6,000
MAX USE (GALLONS PER DAY): 9,000

PREVIOUSLY APPROVED WELL
WELL STATUS: APPROVED WITH WELL REPORT
SITE WELL NUMBER: 004
WELL NAME: CONSTRUCTION SUPPLY/LAKESIDE TRAINING
DNR PERMANENT HIGH CAP WELL#: 01176
WUWN: FY404
PWSID NUMBER: 43612217
LATITUDE: 44 Deg 17.021 Minute 44.28168
LONGITUDE: 87 Deg 32.2705 Minute 87.53784
LOCATION: NW 1/4 NW 1/4 S24 T21N R24E
CIVIL TOWN: TWO RIVERS
COUNTY: MANITOWOC
DATE COMPLETED: 08/07/1993
WELL DEPTH: 480
PUMP CAPACITY (GPM): 60
WELL USE: DOMESTIC
AVG USE (GALLONS PER DAY): 4,000
MAX USE (GALLONS PER DAY): 8,000

WELL STATUS: APPROVED WELL WITH WELL REPORT
SITE WELL NUMBER: 005
WELL NAME: ENERGY INFORMATION CENTER
DNR PERMANENT HIGH CAP WELL#: 68865
WUWN: MY344
PWSID NUMBER: 43612602
LATITUDE: 44 Deg 16.5683 Minute
LONGITUDE: 87 Deg 31.9939 Minute
LOCATION TOLERANCE (FT): 660
LOCATION: NE 1/4 SW 1/4 S24 T21N R24E
CIVIL TOWN: TWO CREEKS
COUNTY: MANITOWOC
DATE COMPLETED: 11/18/1998
WELL DEPTH: 262
PUMP CAPACITY (GPM): 65
WELL USE: DOMESTIC
AVG USE (GALLONS PER DAY):
MAX USE (GALLONS PER DAY):

Appendix D Façade Well Records

COLEMAN ENGINEERING COMPANY
P.O. Box 607
635 Industrial Park Drive
IRON MOUNTAIN, MICHIGAN 49801
(906) 774-3440

JOB G91217-WERD - Pt. Beach NPF
SHEET NO. 1 OF 1
CALCULATED BY ARP DATE 10-22-91
CHECKED BY DATE
SCALE None

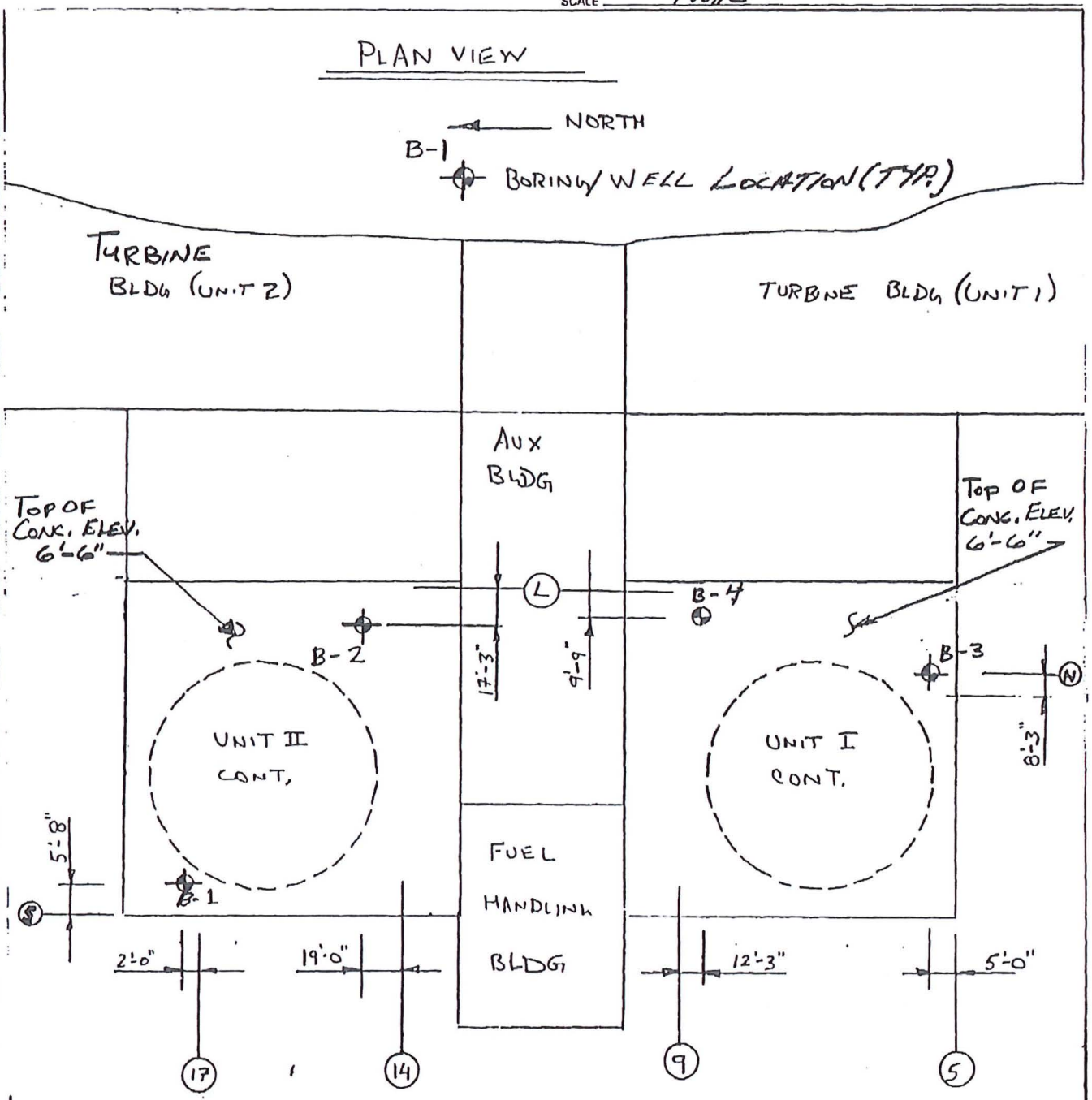


FIGURE 2: BORING LOCATION PLAN

PRODUCT 204-1 (Single Sheets) 225-1 (Padded) NEBS Inc., Groton, Mass. 01471 To Order PHONE TOLL FREE 1-800-225-6380

LOG OF TEST BORING

Project: Point Beach Nuclear Power Facility
Location: Kewaunee, Wisconsin
Soil Testing Firm: Coleman Engineering Company

Boring No.: B-1
Surface Elevation: 6' - 6"
Job No.: G-91217
Sheet: 1 of 1

Wisconsin Electric POWER COMPANY 231 W. MICHIGAN P.O. BOX 2046 MILWAUKEE, WI 53201

SAMPLE No.	Type	Recovery ↓	Moisture ↓	N	Depth	VISUAL CLASSIFICATION and Remarks	Qu	W %			D P.C.F.
						Portland cement concrete slab 9"					
						Concrete material					
						▽5.0'					
1	AS	12"	W	-	5	5					
						FILL: Sand and gravel					
						driller noted cobbles and boulders 5.2' - 8.5' 8.5'					
2	AS	12"	W	-	10						
3	AS	12"	W	-		(CL) CLAY, gray, lean 10.0'					
						(CL) CLAY, reddish brown, lean					
4	AS	12"	W	-	15						
5	AS	12"	W	-	20						
6	AS	12"	W	-		22.5'					
						(CL) CLAY, gray, lean					
7	AS	12"	W	-	25	26.5'					
						End of boring 26.5'					
					30						
					35						
					40						

WATER LEVEL OBSERVATIONS

While Drilling: 5.0'
Upon Completion of Drilling: -
Time After Drilling: -
Depth to Water: -
Depth to Cave in: -

GENERAL NOTES

Start: 9/18/91 Complete: 10/2/91
Crew Chief: D.K. Rig: -
Drilling Method:
0 - 32" Elec. Core Drill (8" Dia.)
32" - 5.2' Elec. Core Drill (6" Dia)
5.2' - 6.0' HA
0 - 9.0' DC-HW
9.0' - 26.5' HA

LOG OF TEST BORING

Project: Point Beach Nuclear Power Facility
Location: Kewaunee, Wisconsin
Soil Testing Firm: Coleman Engineering Company

Boring No.: B-2
Surface Elevation: 6' - 6"
Job No.: C-91217
Sheet: 1 of 1

Wisconsin Electric POWER COMPANY 231 W. MICHIGAN P.O. BOX 2046 MILWAUKEE, WI 53201

SAMPLE No.	Type	Recovery ↓	Moisture ↓	N	Depth	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES Qu	W %			D P.C.F.
						Portland cement concrete slab 0.5'					
						FILL: Sand and gravel with cobbles and boulders with small amount of debris including steel 3.0'					
						strap barn hinges, other pieces of metal and a piece of wood 5.0'					
1	AS	12"	W	-	5						
						(CL) CLAY, gray, lean					
2	AS	12"	W	-	10						
3	AS	12"	W	-	15	16.0'					
4	AS	12"	W	-							
						(CL) CLAY, brown, lean					
5	AS	12"	W	-	20						
6	AS	12"	W	-	25	25.0'					
						End of boring 25.0'					
					30						
					35						
					40						

WATER LEVEL OBSERVATIONS

While Drilling: 3.0'
Upon Completion of Drilling: -
Time After Drilling: -
Depth to Water: -
Depth to Cave in: -

GENERAL NOTES

Start: 9/17/91 Complete: 9/27/91
Crew Chief: D.K. Rig: -
Drilling Method:
0 - 0.5' Elec. Core Drill, 0.5-4' HA
0 - 6.5' DC-HW, 6.5'-8.0' HA & RB
8.0' - 25.0' HA & ST

LOG OF TEST BORING

Project: Point Beach Nuclear Power Facility
Location: Kewaunee, Wisconsin
Soil Testing Firm: Coleman Engineering Company

Boring No. B-3
Surface Elevation: 6' - 6"
Job No. C-91217
Sheet 1 of 1

Wisconsin Electric POWER COMPANY 231 W. MICHIGAN P.O. BOX 2046 MILWAUKEE, WI 53201

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
Recovery			Moisture								
No.	Type	↓	↓	N	Depth		Qu	W %			D P.C.F.
						Portland cement concrete slab					
						3'-7"					
1	AS	12"	W	-	5	4.0'					
						FILL: Sand and gravel with boulders and cobbles					
2	AS	12"	W	-	10						
						14.5'					
3	AS	12"	W	-	15	(CL) CLAY, brown, lean					
4	AS	12"	W	-	20						
5	AS	12"	W	-	25						
						26.0'					
						End of boring 26.0 '					
					30						
					35						
					40						

WATER LEVEL OBSERVATIONS

While Drilling 4.0'
Upon Completion of Drilling -
Time After Drilling -
Depth to Water -
Depth to Cave in -

GENERAL NOTES

Start 10/1/91 Complete 10/9/91
Crew Chief D.K. Rig -
Drilling Method
0 - 18" Elec. Core Drill (8" Dia.)
18" - 3'-7" Elec. Core Drill (6" Dia)
0-15' DC-5", 15.0' - 26.0' HA

LOG OF TEST BORING

Project: Point Beach Nuclear Power Facility
Location: Kewaunee, Wisconsin
Soil Testing Firm: Coleman Engineering Company

Boring No.: B-4
Surface Elevation: 6' - 6"
Job No.: C-91217
Sheet: 1 of 1

Wisconsin Electric POWER COMPANY 231 W. MICHIGAN P.O. BOX 2046 MILWAUKEE, WI 53201

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
Recovery			Moisture								
No.	Type	↓	↓	N	Depth		Qu	W %			D P.C.F.
1	AS	12"	M	-		Portland cement concrete slab 0.5'					
						FILL: Sand					
						▽ 3.5'					
2	AS	12"	W	-	5	FILL: Sand and gravel with boulders and cobbles 6.0'					
3	AS	12"	W	-		(CL) CLAY, brown, lean 8.0'					
4	AS	12"	W	-	10	(CL) CLAY, gray, lean					
5	AS	12"	W	-	15						
6	AS	12"	W	-	20						
7	AS	12"	W	-	25						
8	AS	12"	W	-		26.0'					
						End of boring 26.0'					
					30						
					35						
					40						

WATER LEVEL OBSERVATIONS

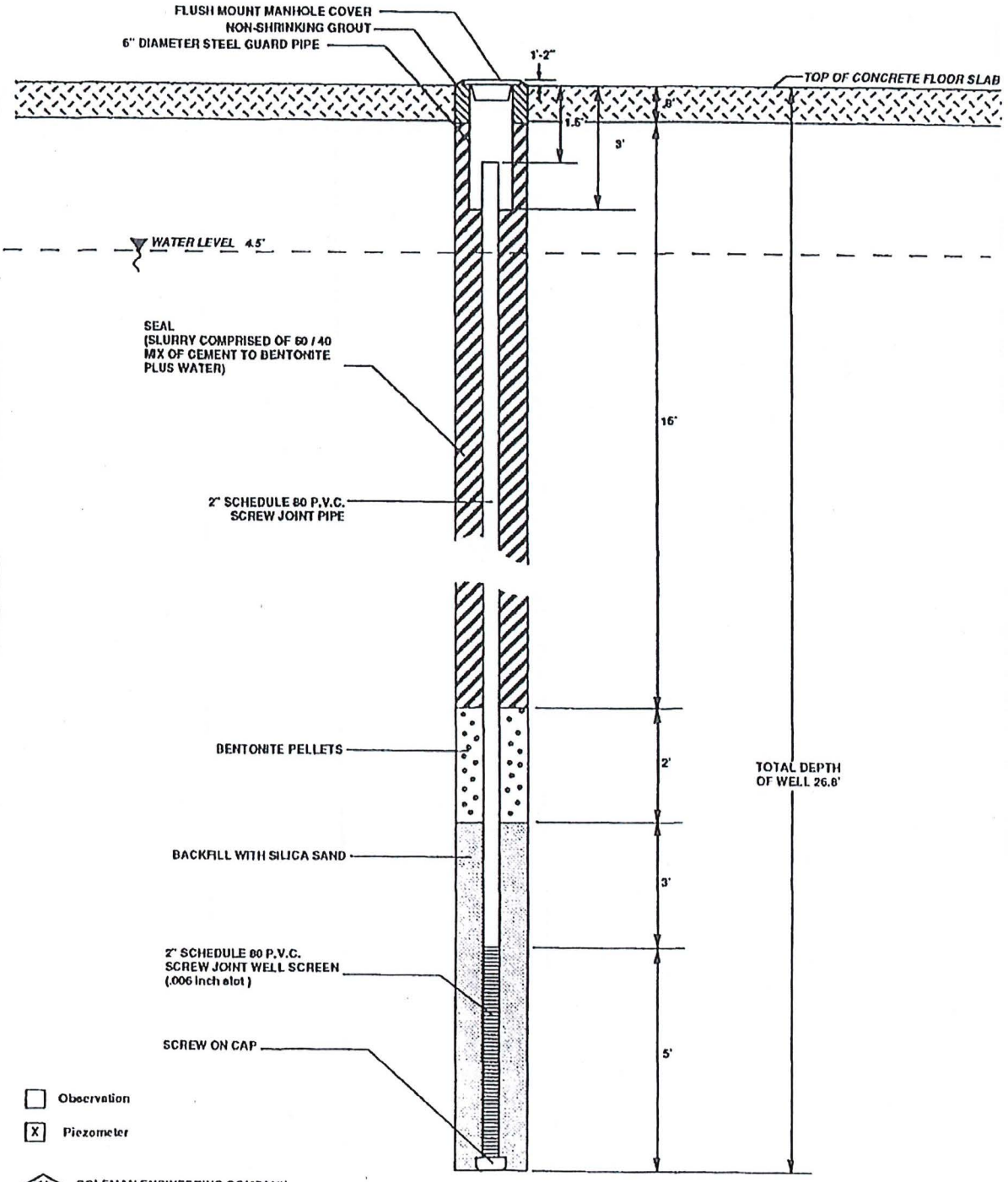
While Drilling: 3.5'
Upon Completion of Drilling: -
Time After Drilling: -
Depth to Water: -
Depth to Cave in: -

GENERAL NOTES

Start: 10/2/91 Complete: 10/7/91
Crew Chief: D.K. Rig: -
Drilling Method:
0-0.5' Elec. Core Drill,
0-5.5' DC-5", 5.5' - 26' HA

GROUNDWATER QUALITY MONITORING WELL B-1
CONSTRUCTION DETAIL

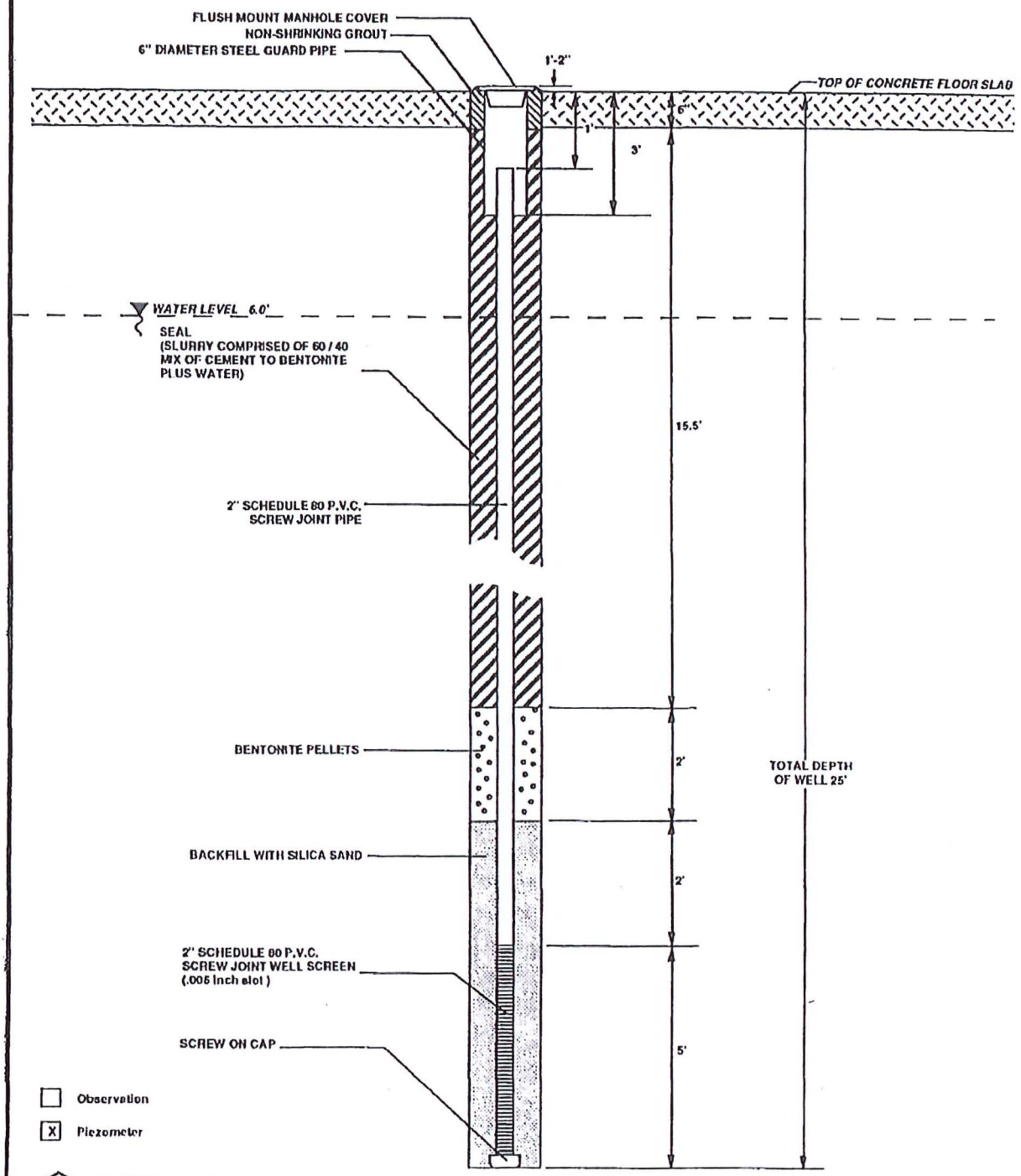
NOT TO SCALE



COLEMAN ENGINEERING COMPANY
207 EAST BROWN STREET
IRON MOUNTAIN, MICHIGAN 49801

WEPCO - POINT BEACH
JOB NO. G-01217
DATE: 10/7/91

GROUNDWATER QUALITY MONITORING WELL B-2
CONSTRUCTION DETAIL
NOT TO SCALE

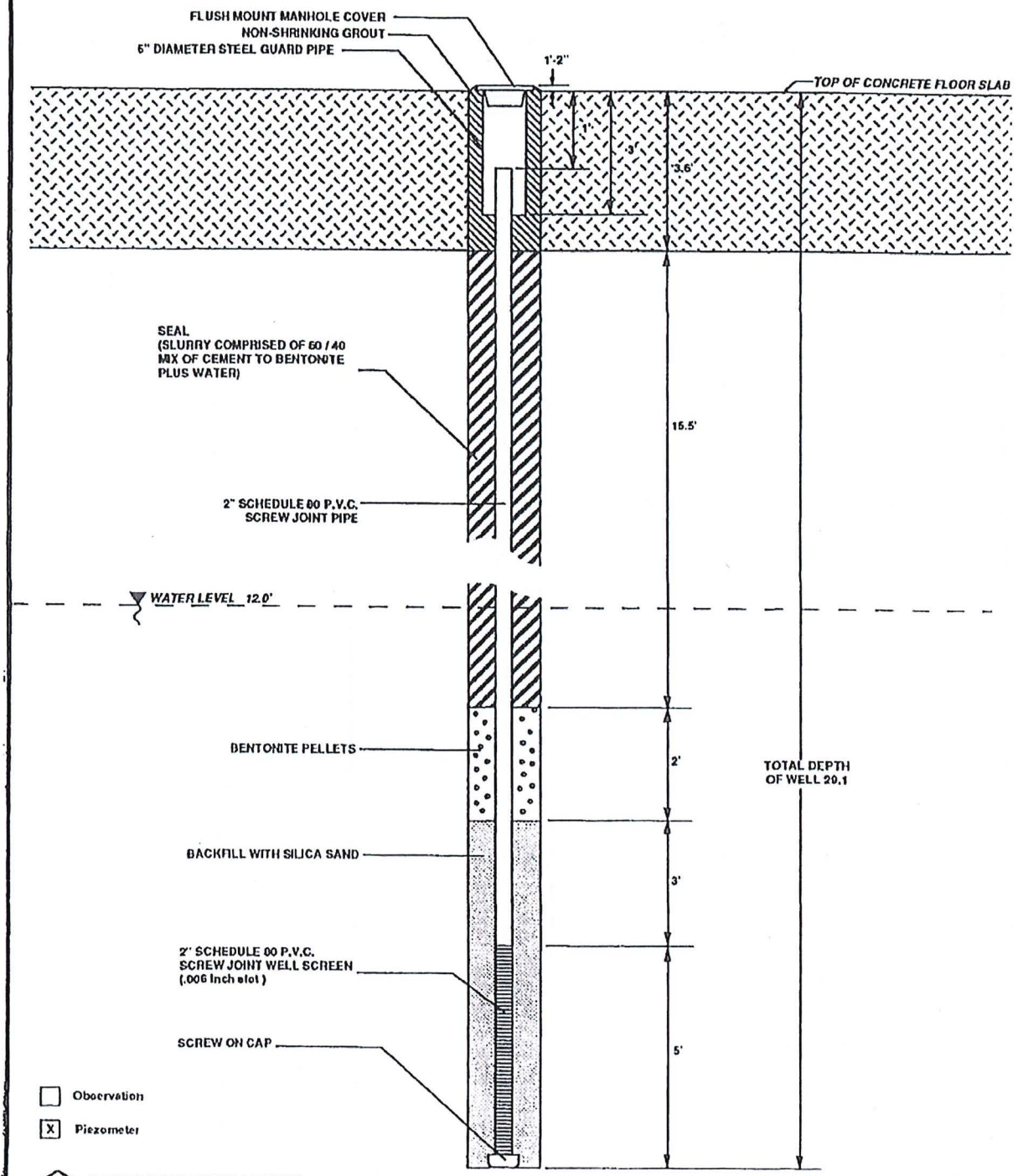


COLEMAN ENGINEERING COMPANY
207 EAST BROWN STREET
IRON MOUNTAIN, MICHIGAN 49801

WEPCO - POINT BEACH
JOB NO. G-91217
DATE: 9/26/91

GROUNDWATER QUALITY MONITORING WELL B-3
CONSTRUCTION DETAIL

NOT TO SCALE

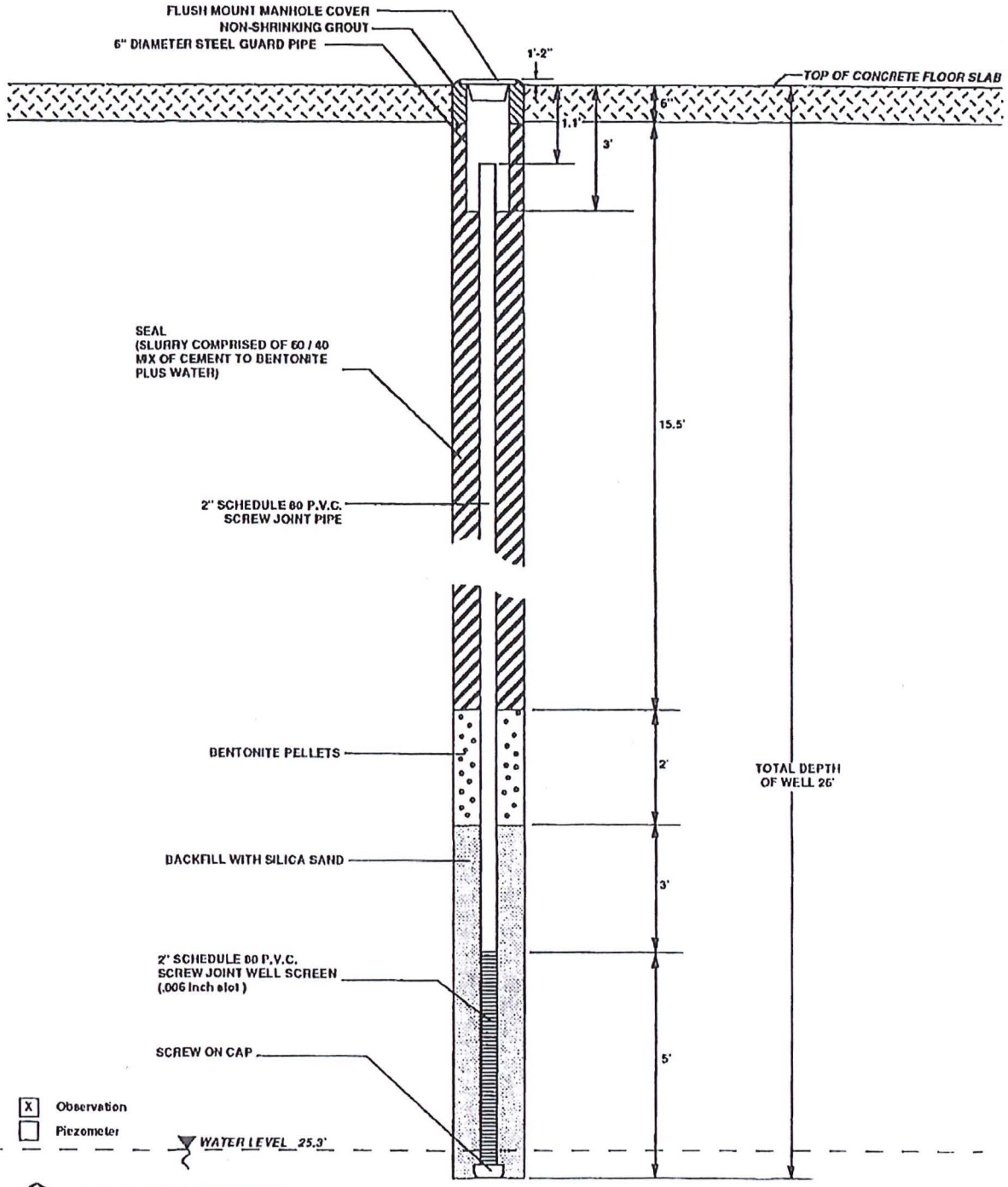


COLEMAN ENGINEERING COMPANY
207 EAST BROWN STREET
IRON MOUNTAIN, MICHIGAN 49801

WEPCO - POINT BEACH
JOB NO. G-91217
DATE: 10/9/91

GROUNDWATER QUALITY MONITORING WELL B-4
CONSTRUCTION DETAIL

NOT TO SCALE



COLEMAN ENGINEERING COMPANY
207 EAST BROWN STREET
IRON MOUNTAIN, MICHIGAN 49801

WEPCO - POINT BEACH
JOB NO. G-91217
DATE: 10/7/91

Appendix E June 13, 2008 Report of Hydrogeologic Services

STS | AECOM

Results of Hydrogeological Services

FPL Energy Point Beach, LLC

STS Project No. 200802277

Prepared by:
Robert J. Mottl
Senior Project Geologist
STS
920-406-3147

STS | AECOM

STS
1035 Kepler Drive, Green Bay, Wisconsin 54311
T 920.468.1978 F 920.468.3312

June 12, 2008

Mr. Lynn Rogers
FPL Energy Point Beach, LLC
6610 Nuclear Road
Two Rivers, Wisconsin 54241

RE: Results of Hydrogeological Services, FPL Energy Point Beach, LLC, Two Rivers, Wisconsin -- STS Project No. 200802277

Dear Mr. Rogers:

This report documents the results of hydrogeological services at the Point Beach Nuclear Plant in Two Rivers, Wisconsin. The services were completed in substantial accordance with STS' October 2, 2007, proposal and FPL Energy Point Beach, LLC. Contract No. 00022998.

Thank you for allowing STS to assist you with this project. Please contact Mr. Bob Mottl or Mr. Jim Kauer at (800) 949-1978 with questions or comments regarding this report.

Respectfully,

Robert J. Mottl

Robert J. Mottl, P.G.
Senior Project Geologist

James W. Kauer

James W. Kauer, P.G., P.H.
Associate Geologist

"I, James W. Kauer, certify that I am a hydrogeologist as that term is defined in s. NR 712.03 (1), Wis. Adm. Code, and that, to the best of my knowledge, all of the information contained in this document is correct and the document was prepared in compliance with all applicable requirements in chs. NR 700 to 726, Wis. Adm. Code."

James W. Kauer

James W. Kauer, P.G.
Associate Geologist

June 2008

RJM/cas

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Figures

Figure 1 – Site Location

Figure 2 – Site Map

Figure 3 – Crosssection

Figure 4 – Groundwater Table Contour Map (5/19/08)

Tables

Table 1 – Monitoring Well Information

Table 2 – Groundwater Linear Velocity Estimates

Appendix A

October 22, 2007 Well Installation Report

Appendix B

Field Hydraulic Conductivity Analysis Calculations & Data (23 pages)

1.0 Introduction

1.1 Purpose and Scope of Services

This report describes the results of the installation of groundwater monitoring wells and the measurement of field parameters associated with groundwater flow at the Point Beach Nuclear Plant (Point Beach) located at 6610 Nuclear Road, Two Rivers, Wisconsin. Point Beach is a nuclear power plant for the generation of electricity.

The work performed by STS is part of an effort to implement a groundwater monitoring program consistent with the groundwater protection initiative (GPI) developed by the Nuclear Energy Institute (NEI). Guidance for implementing the GPI is contained in the document entitled, "Groundwater Protection Guidelines for Nuclear Power Plants, Final Report, November 2007" prepared by the Electric Power Research Institute, Inc. (EPRI). This report is intended to provide information described in Section 4.7 of the EPRI guidance that includes the following items:

4.7 Site-Specific Groundwater Flow Profile

4.7.1 - Well Installation

4.7.2 - Horizontal Distribution and Movement

4.7.3 - Vertical Distribution and Movement

4.7.4 - Flow Regimes, Connectivity, and Hydraulic Conductivity

Installation of six groundwater table monitoring wells occurred in August 2007 and was described in an October 22, 2007 report (copy attached in Appendix A) that addresses section **4.7.1 - Well Installation**. Descriptions of the well installations are also included in Sections 2.0 and 3.0 in this document. The focus of this document is to address section **4.7.2 - Horizontal Distribution and Movement** of groundwater in the shallow (water table) aquifer.

Section **4.7.3 - Vertical Distribution and Movement** is not being addressed in this document. As quoted from 4.7.3 of the EPRI guidance, "If contamination is detected in the shallow aquifer, then install additional monitoring wells to characterize the vertical extent of the plume and more fully characterize the horizontal extent." No contamination above regulatory limits has been reported to STS from Point Beach's initial sampling and analysis of the six groundwater monitoring wells installed in 2007. Accordingly, no additional wells have been installed in deeper portions of the aquifer to assess vertical movement.

The guidance statement in Section 4.**7.4 - Flow Regimes, Connectivity, and Hydraulic Conductivity** states, "If radiological contamination of multiple water-bearing zones is confirmed, conduct aquifer tests in the various strata to determine whether hydraulic connection exists between strata." As no contamination

has been reported to STS, Section 4.7.4 is addressed by inclusion of a discussion of hydraulic conductivity testing recently completed by STS.

1.2 Background

1.2.1 Owner Information

Owner contact information is as follows:

FPL Energy Point Beach, LLC
6610 Nuclear Road
Two Rivers, Wisconsin 54241
Attention: Mr. Lynn Rogers
Phone: (920) 755-7300

1.2.3 Site Location

The Point Beach facility is located on the west shoreline of Lake Michigan east of Two Creeks, Wisconsin. Figure 1 (attached) is a site location map. The facility is located in Section 24, Township 21 North, Range 24 East in Manitowoc County. Figure 2 is a site map.

1.2.4 Regional Geology and Hydrogeology

The Wisconsin Geological and Natural History Survey (WGNHS) document titled "Water Resources of Wisconsin - Lake Michigan Basin Hydrologic Atlas HA-432" by E.L. Skinner and R.G. Borman (1973) reports that shallow soils in the area are primarily comprised of glacial lake deposits consisting of silt, sand, and clay extending to depths ranging from 50 to 100 feet below ground surface (bgs). The lacustrine soils are underlain by approximately 600 feet of undifferentiated Silurian dolomite. Below the Silurian dolomite is Ordovician shale and dolomite followed by Cambrian sandstone. Precambrian granite lies beneath the sandstone. The bedrock units dip to the east and represent the western portion of the Michigan basin, which is centered in the lower peninsula of Michigan.

The hydrogeologic framework of the region is described in the WGNHS document "Hydrogeology and Ground-Water Use and Quality, Brown County, Wisconsin" by J.T. Krohelski. The Quaternary deposits and Silurian formations are identified as the upper aquifer relative to the confining unit of the Ordovician shales. Regional groundwater flow in the area is generally east, toward Lake Michigan. STS experience in the area has shown horizontal groundwater flow toward Lake Michigan and evidence of downward vertical gradients in the Quarternary deposits in the vicinity of Two Creeks.

2.0 Methods

2.1 Soil Borings

Between August 27 and 31, 2007, an STS drill crew was on site and installed six soil borings/groundwater monitoring wells at the locations depicted on Figures 2, 3, and 4. The wells are labeled MW-1, MW-2, MW-3, MW-4, MW-5, and MW-6. During all boring activities, an Environmental Geologist (Mr. Bob Mottl, Wisconsin Professional Geologist No. 225-013 or Mr. Michael Carney, Wisconsin Professional Geologist No. 328-13) was on site to monitor drilling operations.

Soil borings were advanced to depths between 18 and 25 feet bgs. All borings were advanced using hollow-stem auger methods.

During drilling, soil samples were collected using a split-spoon sampling device in accordance with ASTM D1586, "Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils." Soil samples were transferred from the split-spoon to new, pint-size plastic jars and described in the field by STS personnel. Soil samples contained in the pint-size plastic jars were returned to the STS soils laboratory where they were examined and classified according to the Unified Soil Classification System. In accordance with Chapter NR 141, Wisconsin Administrative Code, WDNR Soil Boring Log Information Forms (Form 4400-122) were prepared and were provided in the October 22, 2007 report mentioned above. Soil information from the boring log forms along with well installation and groundwater elevation data described below, were used to construct a soil cross-section, Figure 3.

2.2 Groundwater Monitoring Well Installation and Development

Monitoring wells were constructed in the six borings consisting of 2-inch-diameter, Schedule 40 PVC with flush-threaded joints. The screened portion of each well consisted of a 10 to 15-foot length of 2-inch-diameter, Schedule 40 PVC with 0.006-inch, factory-cut slots. The annulus around the well casing was backfilled with uniformly graded silica sand (Badger 40/60) to a level approximately 1 to 4 feet above the top of the screen. The remainder of the annulus was backfilled with 3/8-inch chipped bentonite, allowing room for a steel, aboveground protector pipe.

Following installation, the monitoring wells were developed by purging the water from each well using a dedicated, disposable bailer. A WDNR Monitoring Well Construction Form (4400-113A) and a Well Development Form (4400-113B) was completed for each well installed and previously provided. STS surveyed the monitoring well locations on September 5, 2007. Wisconsin State Plane Coordinates (NAD 1927, Central) and USGS mean sea level elevations were determined for each well location and were provided on the WDNR forms as well as included on Table 1 in the attachments.

2.3 Water Elevations and Hydraulic Conductivity Testing

On May 19, 2008, an STS Geologist measured static groundwater depths in the 6 groundwater monitoring wells using an electronic water level indicator tape. To measure the water levels, the protector pipe cover was removed from each well and the water level indicator lowered until the electronic signal indicating water level was activated. The water level relative to the top of the PVC casing elevation was recorded in a field notebook. The groundwater elevations were used to prepare the groundwater table contour map (Figure 4).

On May 19, 20, and 21, 2008, STS performed rising head hydraulic conductivity tests on Monitoring Wells MW-1 through MW-6. The field data and hydraulic conductivity test results are included in the Attachment Section. Drawdown data were analyzed using the Bouwer and Rice Method (Bouwer, 1989)[1] for a partially penetrating monitoring well in an unconfined aquifer. Where the water level is below the top of the well screen during the test, Bouwer (1989) developed the equivalent radius (r_{eq}), which was used for hydraulic conductivity calculations instead of the unmodified casing radius (r_c). The equivalent casing radius is the radius of a circle whose area equals the total free water surface area of the well plus the filter pack (the free water surface area in the filter pack is adjusted for the filter pack porosity).

[1] Bouwer, H., 1989, The Bouwer and Rice Slug Test - An Update: Ground Water, Volume 27, No. 3, Pages 304-309.

3.0 Results

3.1 Soil Observations

Soil from groundwater Monitoring Wells MW-1, MW-2, MW-3, MW-4, and MW-5 consisted of reddish-brown to brown and dark brown silty clays with trace to little amounts of sand, fine gravel, and silt layers to the boring termination depth. In addition to the clay soils in Monitoring Well MW-6, an approximate 10-foot thick sand and gravel layer was encountered in the boring, as depicted on the boring logs in the October 2007 well installation report. Soil and monitoring well information from Borings MW-1, MW-3, and MW-4 were used to prepare the cross section in Figure 3. As depicted, clayey soils were encountered in these borings to the boring termination depths. The ground surface from MW-4 through MW-3 and MW-1 slopes to the east toward Lake Michigan. The depiction of the groundsurface in Figure 3 is estimated from the U.S.G.S. 7.5 minute topographic quadrangle.

On October 4 through 9, 2007, STS also completed eight geotechnical borings at Point Beach for an unrelated future construction project. The geotechnical borings were completed in the area of an existing concrete pad that is proposed to become a water storage vessel. The geotechnical site location is near the north end of the plant. The nearest of the environmental wells is MW-5, which is approximately 500 feet to the northeast of the area of the geotechnical borings.

Soils observed in the geotechnical borings were consistent with STS environmental perimeter borings. Natural soils in the geotechnical borings consisted of brown silty and sandy clays at comparable depths of 10 to 20 feet bgs. Fill was observed in the geotechnical borings to depths varying between 1.5 and 10.0 feet bgs.

3.2 Groundwater Horizontal Distribution, Movement, and Hydraulic Conductivity

Groundwater elevations recorded on May 19, 2008 are summarized on Table 1. The depth to groundwater ranged from about 1 to 5 feet below ground surface (BGS). Groundwater elevations ranged from a high of +619.9 MSL in MW-4 to a low of +594.4 MSL in MW-5. The May 19 groundwater elevations were used to prepare a groundwater table contour map (Figure 4). Figure 4 indicates groundwater flow generally to the east. With a distance of approximately 580 feet between Monitoring Wells MW-3 and MW-4 in the center of the site, the horizontal hydraulic gradient between MW-3 and MW-4 was approximately 0.03 feet per foot. With a distance of 1,250 feet between MW-1 and MW-3, the gradient between these wells was approximately 0.009 feet per foot in the southeastern portion of the property.

The calculated hydraulic conductivities ranged from a low of approximately 5.8×10^{-6} cm/s in Well MW-4 to approximately 8.5×10^{-4} cm/s in MW-6. Assuming a soil porosity of 30% and based on the hydraulic gradient of 0.009 to 0.03 feet per foot, we estimate the seepage velocity in the natural silty clay soils to range between <1 foot per year to about 36 feet per year.

4.0 Conclusions

The work performed by STS in Fall 2007 and May 2008 is part of an effort to implement a groundwater monitoring program consistent with the (GPI) developed by the NEI. Guidance for implementing the GPI is contained in the November 2007 EPRI document. This report has provided information described in Section 4.7 of the EPRI guidance that includes the following items:

4.7 Site-Specific Groundwater Flow Profile

4.7.1 - Well Installation

4.7.2 - Horizontal Distribution and Movement

4.7.3 - Vertical Distribution and Movement

4.7.4 - Flow Regimes, Connectivity, and Hydraulic Conductivity

Section 4.7.1 was addressed with the installation of six groundwater table monitoring wells in August 2007 as described in an October 22, 2007 report (copy attached). As documented in this report, between August 27 and 31, 2007, STS completed the installation of six groundwater monitoring wells at the locations shown on Figures 2, 3, and 4. The monitoring wells were installed at depths between 18 and 25 feet bgs. Each monitoring well was developed using a disposable dedicated bailer by STS. The well installation services were provided in substantial accordance with a STS July 2007 proposal.

May 2008 services provided by STS were performed to address primarily section **4.7.2 - Horizontal Distribution and Movement** of groundwater in the shallow aquifer. In May 2008, STS measured water levels and conducted hydraulic conductivity tests in the six groundwater monitoring wells. STS interpreted the observed water elevations which indicated that horizontal groundwater movement was to the east at a rate of between <1 and 36 feet per year.

Section **4.7.3 - Vertical Distribution and Movement** was not addressed in this document. As quoted from 4.7.3 of the EPRI guidance, "If contamination is detected in the shallow aquifer, then install additional monitoring wells to characterize the vertical extent of the plume and more fully characterize the horizontal extent." No contamination above regulatory limits has been reported to STS from Point Beach's initial sampling and analysis of the six groundwater monitoring wells installed in 2007. No additional wells have been installed in deeper portions of the aquifer to assess vertical movement.

The guidance statement in Section 4.**7.4 - Flow Regimes, Connectivity, and Hydraulic Conductivity** states, "If radiological contamination of multiple water-bearing zones is confirmed, conduct aquifer tests in the various strata to determine whether hydraulic connection exists between strata." Because no contamination has been reported to STS, Section 4.7.4 was not addressed other than through a discussion of hydraulic conductivity and horizontal flow regime.

5.0 General Qualifications

The scope of this report is limited to the project and location described herein. The conclusions in this report are based on subsurface conditions as observed in soil borings conducted by STS, the subsurface conditions existing at the time of the study, hydraulic conductivity testing conducted in May 2008, and STS' professional interpretation of this data. Stratification lines on the cross-section represent approximate boundaries between soil types. Variation may exist in both horizontal and vertical directions between borings. Seasonal groundwater fluctuations are likely to occur. This report should be used for the purpose intended. No other warranty is expressed or implied.

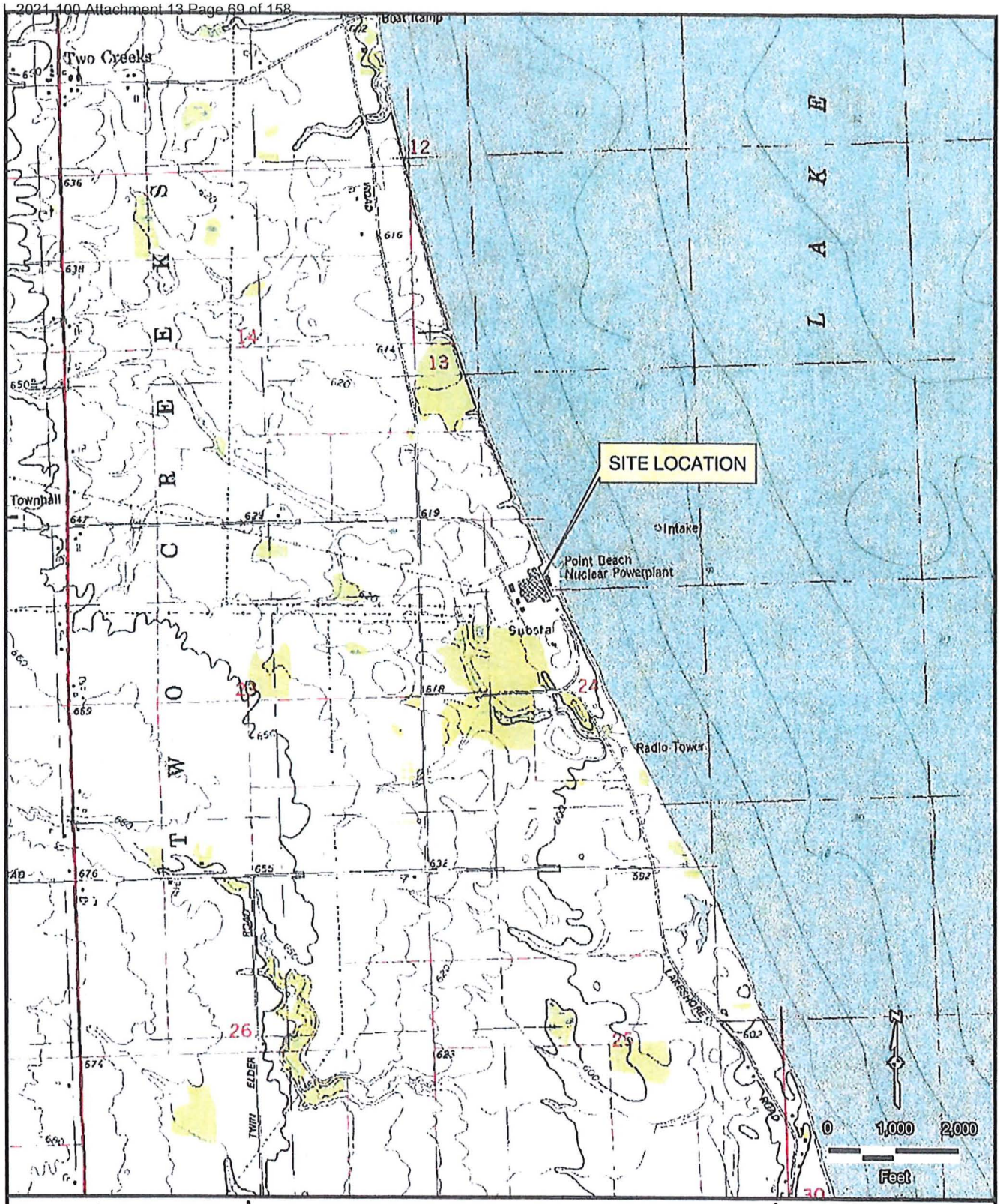
Figures

Figure 1 – Site Location

Figure 2 – Site Map

Figure 3 – Crosssection

Figure 4 – Groundwater Table Contour Map (5/19/08)



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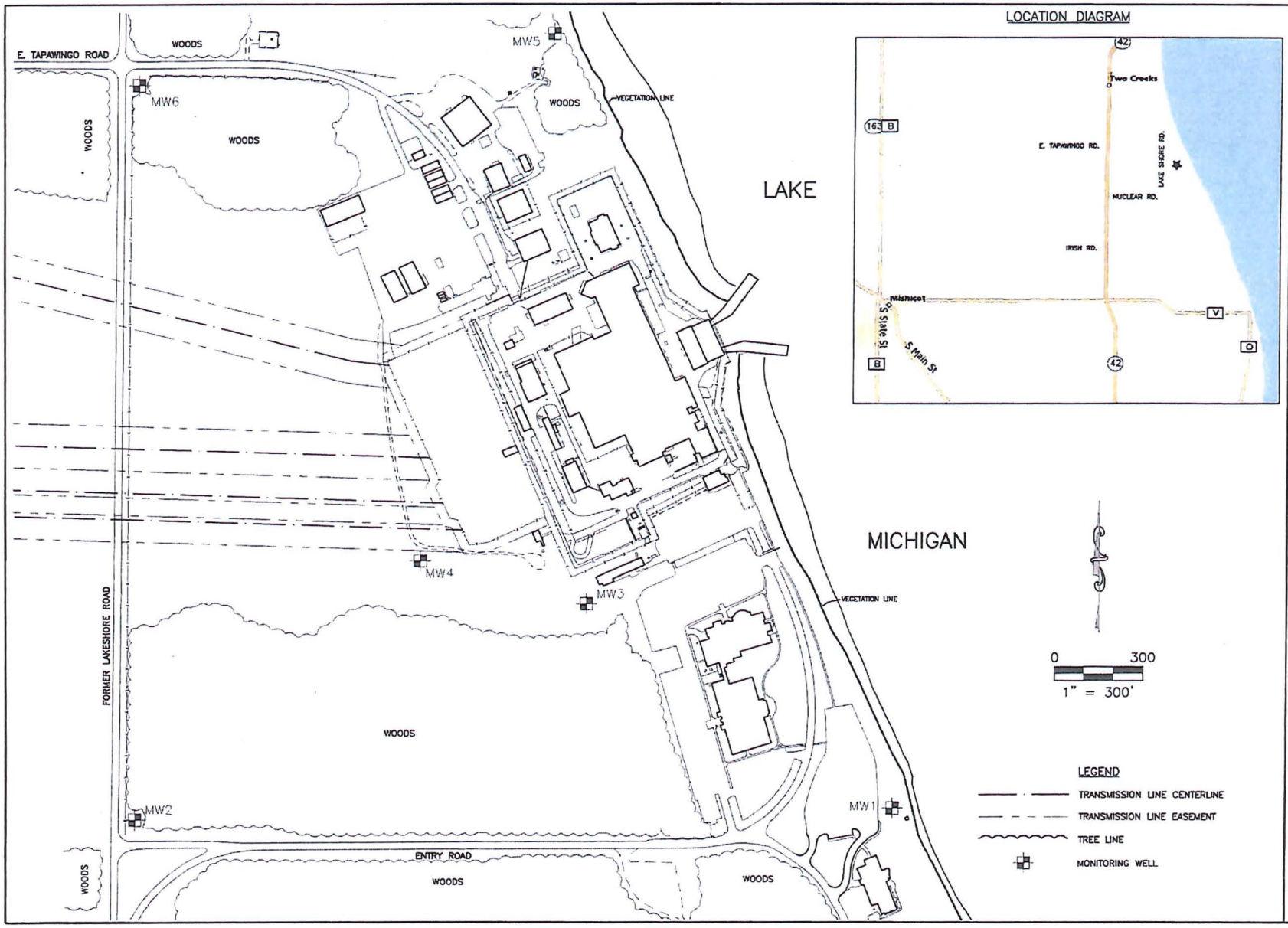
SITE LOCATION DIAGRAM

FPL - POINT BEACH NUCLEAR PLANT
TWO CREEKS, WISCONSIN

Drawn:	JWK	6/2/2008
Checked:	RJM	6/2/2008
Approved:	JWK	6/2/2008
PROJECT NUMBER	200802277	
FIGURE NUMBER	1	



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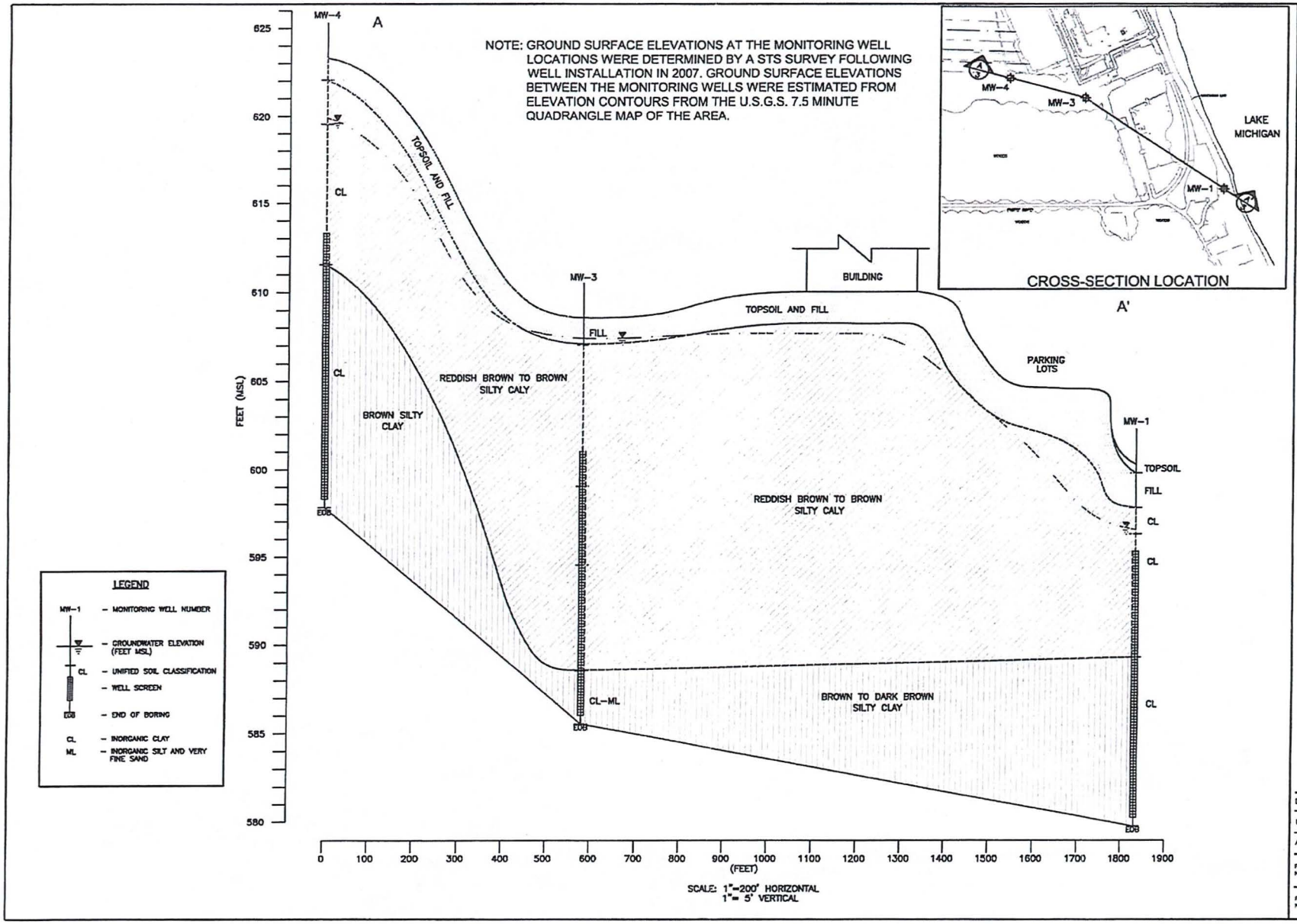
MONITORING WELL LOCATION DIAGRAM

FPL - POINT BEACH NUCLEAR PLANT
TWO CREEKS, WISCONSIN

Drawn:	JRL	06/02/2008
Checked:	RJM	06/02/2008
Approved:	JMK	06/02/2008
PROJECT NUMBER	200802277	
FIGURE NUMBER	2	

X:\PROJECTS\200802277\Dwg\200802277-MONITORING_WELL-Fig2.dwg; 6/2/2008 11:23:28 AM; LEMMENS, JERRY R.; STS_BLACK_010102.ctb



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CROSS-SECTION

FPL - POINT BEACH NUCLEAR PLANT
TWO CREEKS, WISCONSIN

Drawn:	JRL	06/02/2008
Checked:	RJM	06/02/2008
Approved:	JMK	06/02/2008
PROJECT NUMBER	200802277	
FIGURE NUMBER	3	

X:\PROJECTS\200802277\DWG\200802277_fig3_sec.dwg; 6/2/2008 3:31:24 PM; LEUMEVS, JERRY R.; STS.ctb

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GROUNDWATER TABLE CONTOUR MAP
MAY 19, 2008
FPL ENERGY - POINT BEACH NUCLEAR PLANT
TWO RIVERS, WISCONSIN

Drawn:	JWK	5/23/2008
Checked:	MJM	5/23/2008
Approved:	JWK	6/2/2008
PROJECT NUMBER	200802277	
FIGURE NUMBER	4	

Tables

Table 1 – Monitoring Well Information

Table 2 – Groundwater Linear Velocity Estimates

Table 1
Monitoring Well Information
Point Beach Nuclear Plant
Two Creeks, Wisconsin

Monitoring Well	Unique Well No.	Location NORTHING (Wisconsin State Plane)	Location EASTING (Wisconsin State Plane)	Ground Elevation (feet MSL)	TPVC Elevation (feet MSL)	Top of Well Screen Elevation (feet MSL)	Bottom of Well Screen Elevation (feet MSL)	Hydraulic Conductivity 'K' (cm/sec)	Date	Depth to Water from TPVC (feet)	Groundwater Elevation (feet MSL)
MW-1	VT6361	368321	266491	600.17	602.21	595.17	580.17	1.4E-05 to 2.2E-04	5/19/2008	5.77	596.44
MW-2	VT6371	368285	263918	613.81	615.84	605.81	590.81	7.8E-06 to 2.2E-05	5/19/2008	3.93	611.91
MW-3	VT641	369014	265448	608.51	610.54	601.51	586.51	2.8E-05 to 1.4E-04	5/19/2008	3.17	607.37
MW-4	VT640	369161	264886	623.27	625.11	613.27	598.27	5.8E-06 to 3.5E-04	5/19/2008	5.21	619.90
MW-5	VT639	370954	265333	599.31	601.01	594.31	581.31	8.6E-05 to 2.5E-04	5/19/2008	6.60	594.41
MW-6	VT638	370780	263935	619.69	621.67	615.69	600.69	8.5E-04	5/19/2008	7.45	614.22

TPVC = top of PVC casing

MSL = Mean Sea Level

Gradients	
Horizontal Gradient	= Difference in groundwater elevation divided by the distance between the wells
5/19/2008	MW-4 to MW-3 = (619.9 ft-607.37 ft) / 580 ft = 0.027 ft/ft
5/19/2008	MW-3 to MW-1 = (607.37 ft-596.44 ft) / 1250 ft = 0.009 ft/ft

Table 2
Groundwater Linear Velocity Estimate
Point Beach Nuclear Plant
Two Creeks, Wisconsin

	MW-1	MW-3	MW-4
K value ranges (cm/sec)	1.4E-05 to 2.2E-04	2.8E-05 to 1.4E-04	5.8E-06 to 3.5E-04
Gradient value range (ft/ft)	0.009	0.03	

Linear velocity = V = K (Gradient)(1/n)

with n = porosity (est 30%)

$$V_{low} = \frac{5.8E\text{-}06\ cm}{sec} \cdot \frac{0.009\ ft}{ft} \cdot \frac{1}{0.3} \cdot \frac{1\ ft}{30.48\ cm} \cdot \frac{86400\ sec}{day} \cdot \frac{365\ days}{year} = 0.2\ ft/year$$

$$V_{high} = \frac{3.5E\text{-}04\ cm}{sec} \cdot \frac{0.03\ ft}{ft} \cdot \frac{1}{0.3} \cdot \frac{1\ ft}{30.48\ cm} \cdot \frac{86400\ sec}{day} \cdot \frac{365\ days}{year} = 36\ ft/year$$

Calculated by Bob Motti (05/31/08)

Checked by :

Appendix A

October 22, 2007 Well Installation Report

STS CONSULTANTS

STS CONSULTANTS, LTD.

Report of Well Installation Services

Point Beach Nuclear Plant
Two Rivers, Wisconsin

STS Project No. 200704405

Point Beach Nuclear Plant
6610 Nuclear Road
Two Rivers, Wisconsin 54241

THE INFRASTRUCTURE IMPERATIVE

STS CONSULTANTS
1035 Kepler Drive
Green Bay, Wisconsin 54311
920-468-1978 Phone
920-468-3312 Fax

October 22, 2007

Mr. Lynn Rogers
Point Beach Nuclear Plant
6610 Nuclear Road
Two Rivers, Wisconsin 54241

Dr. Kjell Johansen
Point Beach Nuclear Plant
6610 Nuclear Road
Two Rivers, Wisconsin 54241

Re: Report of Well Installation Services, Pont Beach Nuclear Plant, Two Rivers, Wisconsin -- STS Project No. 200704405

Dear Mr. Rogers and Mr. Johansen:

This report documents the installation and surveying of six groundwater monitoring wells at the Point Beach Nuclear Plant in Two Rivers, Wisconsin. The services were completed in substantial accordance with STS' July 24, 2007, proposal and Point Beach Contract No. 0019592.

Thank you for allowing STS to assist you with this project. Please contact Mr. Bob Mottl or Mr. Jim Kauer at (800) 949-1978 with questions or comments regarding this report.

Sincerely,

STS

Robert J. Mottl

Robert J. Mottl, P.G.
Senior Project Geologist

James W Kauer, PH

James W. Kauer, P.G., P.H.
Associate Geologist

RJM/tjs

"I, Robert J. Mottl, certify that I am a registered professional geologist in the State of Wisconsin, registered in accordance with the requirements of ch. A-E 10, Wis. Adm. Code; that this document has been prepared in accordance with the Rules of Professional Conduct in ch. A-E 8, Wis. Adm. Code; and that, to the best of my knowledge, all information contained in this document is correct and the document was prepared in compliance with all applicable requirements in chs. NR 500 to 538, Wis. Adm. Code."

Robert J. Mottl

Robert J. Mottl, P.G. October 2007
Senior Project Geologist

Table of Contents

1.0 INTRODUCTION AND BACKGROUND 1
1.1 Owner Information 1
1.2 Consultant Information 1
1.3 Site Location 1
1.4 Regional Geology and Hydrogeology 1
2.0 METHODS 3
2.1 Soil Borings 3
2.2 Groundwater Monitoring Well Installation and Development 3
3.0 RESULTS 4
3.1 Soil Observations 4
4.0 CONCLUSIONS 5
5.0 GENERAL QUALIFICATIONS 6
6.0 FIGURE AND TABLE 7

Appendix

WDNR Soil Boring Log Information Forms (6)
WDNR Monitoring Well Construction Forms (6)
WDNR Monitoring Well Development Forms (6)

STS CONSULTANTS

Point Beach Nuclear Plant
STS Project No. 200704405
October 22, 2007

1.0 INTRODUCTION AND BACKGROUND

This report describes well installation activities related to implementation of a groundwater monitoring program at the Point Beach Nuclear Plant (Point Beach) located at 6610 Nuclear Road, Two Rivers, Wisconsin. Point Beach is a nuclear power plant for the generation of electricity.

1.1 Owner Information

Owner contact information is as follows:

Point Beach Nuclear Plant
6610 Nuclear Road
Two Rivers, Wisconsin 54241
Attention: Mr. Lynn Rogers
Phone: (920) 755-7300

Point Beach Nuclear Plant
6610 Nuclear Road
Two Rivers, Wisconsin 54241
Attention: Dr. Kjell Johansen
Phone: (920) 755-7300

1.2 Consultant Information

Groundwater monitoring well construction services were provided by STS. Contact information for STS is:

STS
1035 Kepler Drive
Green Bay, Wisconsin 54311
Attention: Mr. Bob Mottl and Mr. James Kauer
Phone: (920) 468-1978

1.3 Site Location

The Point Beach facility is located on the west shoreline of Lake Michigan east of Two Creeks, Wisconsin. Figure 1 (in Section 6.0) is a site location map. The facility is located in Section 24, Township 21 North, Range 24 East in Manitowoc County.

1.4 Regional Geology and Hydrogeology

The Wisconsin Geological and Natural History Survey (WGNHS) document titled "Water Resources of Wisconsin - Lake Michigan Basin Hydrologic Atlas HA-432" by E.L. Skinner and R.G. Borman (1973) reports that shallow soils in the area are primarily comprised of glacial lake

deposits consisting of silt, sand, and clay extending to depths ranging from 50 to 100 feet below ground surface (bgs). The lacustrine soils are underlain by approximately 600 feet of undifferentiated Silurian dolomite. Below the Silurian dolomite is Ordovician shale and dolomite followed by Cambrian sandstone. Precambrian granite lies beneath the sandstone. The bedrock units dip to the east and represent the western portion of the Michigan basin, which is centered in the lower peninsula of Michigan.

The hydrogeologic framework of the region is described in the WGNHS document "Hydrogeology and Ground-Water Use and Quality, Brown County, Wisconsin" by J.T. Krohelski. The Quaternary deposits and Silurian formations are identified as the upper aquifer relative to the confining unit of the Ordovician shales. Regional groundwater flow in the area is generally east, toward Lake Michigan.

2.0 METHODS

2.1 Soil Borings

Between August 27 and 31, 2007, an STS drill crew was on site and installed six soil borings/groundwater monitoring wells at the locations depicted on Figures 1 and 2. During all boring activities, an Environmental Geologist (Mr. Bob Mottl, Wisconsin Professional Geologist No. 225-013 or Mr. Michael Carney, Wisconsin Professional Geologist No. 328-13) was on site to monitor drilling operations.

Soil borings were advanced to depths between 18 and 25 feet bgs. All borings were advanced using hollow-stem auger.

During drilling, soil samples were collected using a split-spoon sampling device in accordance with ASTM D1586, "Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils." Soil samples were transferred from the split-spoon to new, pint-size plastic jars and described in the field by STS personnel. Soil samples contained in the pint-size plastic jars were returned to the STS soils laboratory where they were examined and classified according to the Unified Soil Classification System. In accordance with Chapter NR 141, Wisconsin Administrative Code, WDNR Soil Boring Log Information Forms (Form 4400-122) were prepared and are provided in the Appendix A.

2.2 Groundwater Monitoring Well Installation and Development

Monitoring wells were constructed in the six borings consisting of 2-inch-diameter, Schedule 40 PVC with flush-threaded joints. The screened portion of each well consisted of a 10 to 15-foot length of 2-inch-diameter, Schedule 40 PVC with 0.006-inch, factory-cut slots. The annulus around the well casing was backfilled with uniformly graded silica sand (Badger 40/60) to a level approximately 1 to 4 feet above the top of the screen. The remainder of the annulus was backfilled with 3/8-inch chipped bentonite, allowing room for a steel aboveground protector pipe.

Following installation, the monitoring wells were developed by purging the water from each well using dedicated, disposable bailers. A WDNR Monitoring Well Construction Form (4400-113A) and a Well Development Form (4400-113B) was completed for each well installed (Appendix A). STS surveyed the monitoring well locations on September 5, 2007. Wisconsin State Plane Coordinates (NAD 1927, Central) and USGS mean sea level elevations were determined for each well location and are provided on the WDNR forms as well as Table 1 in Section 6.0.

3.0 RESULTS

3.1 Soil Observations

Soil from groundwater Monitoring Wells MW-1, MW-2, MW-3, MW-4, and MW-5 consisted of reddish-brown to brown and dark brown silty clays with trace to little amounts of sand, fine gravel, and silt layers to the boring termination depth. In addition to the clay soils in Monitoring Well MW-6, an approximate 10-foot thick sand and gravel layer was encountered in the boring, as depicted on the boring logs in the Appendix.

On October 4 through 9, 2007, STS also completed eight geotechnical borings at Point Beach for an unrelated future construction project. The geotechnical borings were completed in the area of an existing concrete pad that is proposed to become a water storage vessel. The geotechnical site location is near the north end of the plant. The nearest of the environmental wells is MW-5 at the northeast corner of the site, approximately 500 feet to the northeast of the area of the geotechnical borings.

Soils observed in the geotechnical borings were consistent with STS environmental perimeter borings. Natural soils in the geotechnical borings consisted of brown silty and sandy clays at comparable depths of 10 to 20 feet bgs. Fill was observed in the geotechnical borings to depths varying between 1.5 and 10.0 feet bgs.

4.0 CONCLUSIONS

As documented in this report, between August 27 and 31, 2007, STS completed the installation of six groundwater monitoring wells at the locations indicated on Figures 1 and 2. The monitoring wells were installed at depths between 18 and 25 feet bgs. Each monitoring well was developed using a disposable dedicated bailer by STS. Following well installation, the wells were surveyed and monitoring well construction and survey information is included in the attachments. The services were provided in substantial accordance with the STS July 2007 proposal and the contract from Point Beach.

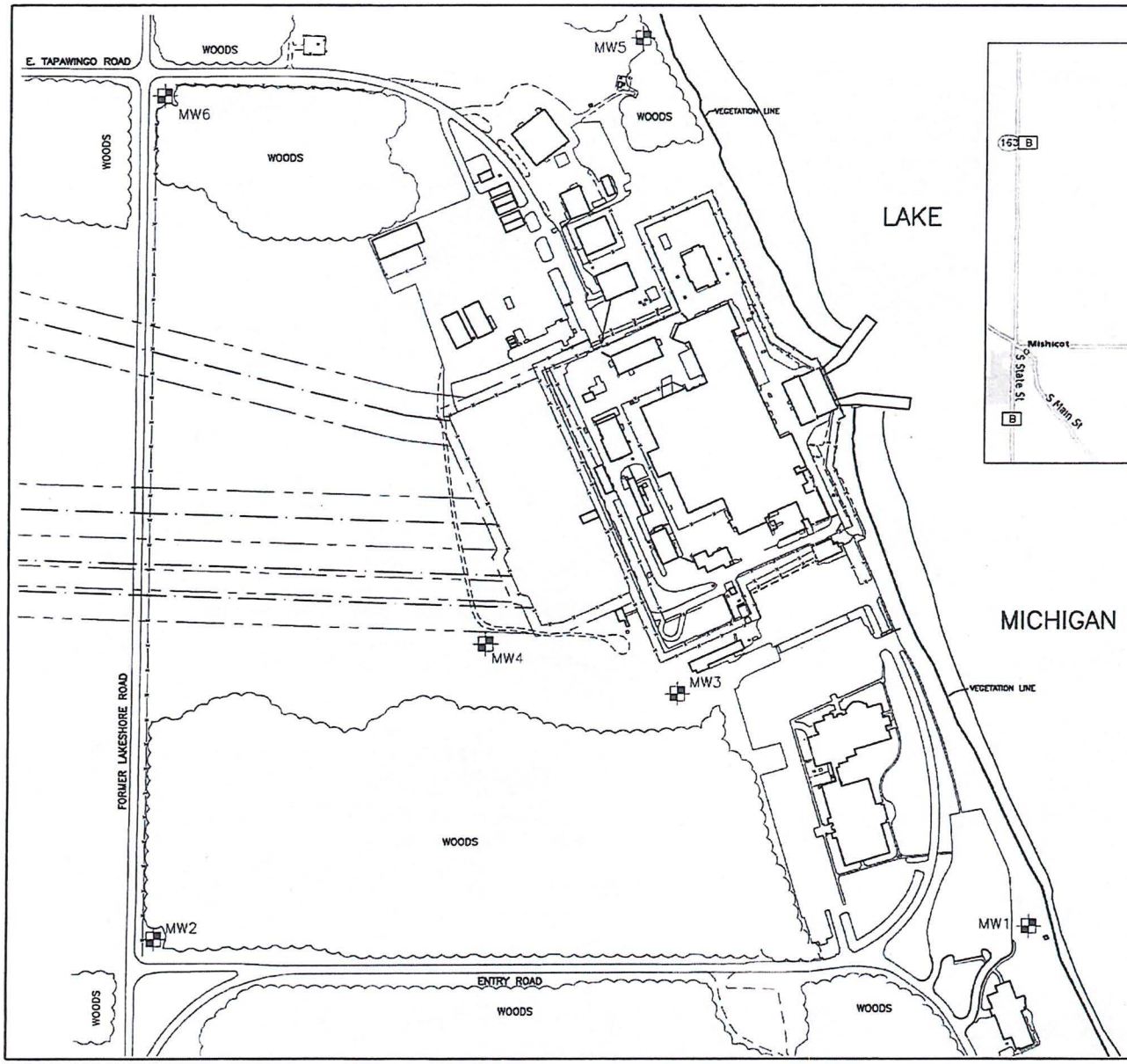
The well installations, as planned, meet the intent of Guidance Statement 5.7.1a contained in Appendix B of the March 2007 EPRI draft document regarding well design. The guidance identifies ASTM D5092-04E1, ASTM D5978-96 (2005), the US EPA handbook, and the local state regulations as recognized standards for well construction. The wells were designed to comply with Chapter NR 141, Wisconsin Administrative Code, which specifies methods for drilling, construction, and development of groundwater monitoring wells in Wisconsin. The Code is generally consistent with the ASTM standards and US EPA handbook.

5.0 GENERAL QUALIFICATIONS

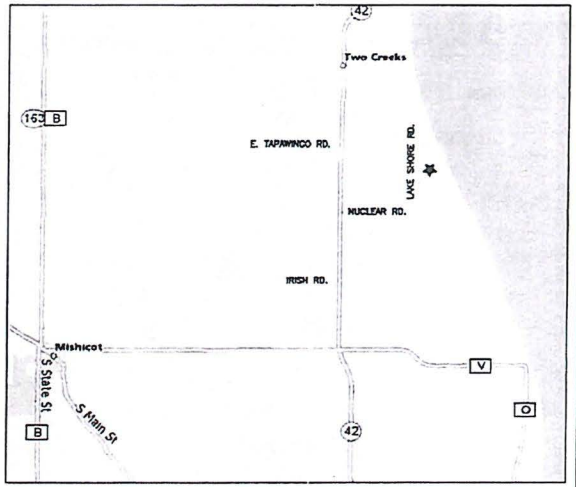
The scope of this report is limited to the project and location described herein. The conclusions in this report are based on subsurface conditions as observed in soil borings conducted by STS, the subsurface conditions existing at the time of the study, laboratory test results conducted in the STS soils lab, and STS' professional interpretation of this data. Stratification lines on boring logs represent approximate boundaries between soil types. Variation may exist in both horizontal and vertical directions between borings. Disturbance of the subsurface during drilling and well construction may cause additional time to be required for conditions to stabilize. Seasonal groundwater fluctuations are likely to occur. This report should be used for the purpose intended. No other warranty is expressed or implied. Because the split-spoon blow counts were recorded as the borings were advanced with hollow stem augers, the blow count information may be used as a general reference of soil density but should not be used for foundation design.

6.0 FIGURE AND TABLE

- Figure 1 - Monitoring Well Location Diagram
- Figure 2 - Aerial Photograph
- Table 1 - Monitoring Well Installation Details



LOCATION DIAGRAM



LEGEND

- TRANSMISSION LINE CENTERLINE
- TRANSMISSION LINE EASEMENT
- TREE LINE
- MONITORING WELL

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MONITORING WELL LOCATION DIAGRAM
POINT BEACH NUCLEAR PLANT
TWO CREEKS, WISCONSIN

Drawn:	RAD	09/06/2007
Checked:	MJO	09/06/2007
Approved:	MJO	09/06/2007
PROJECT NUMBER	200704405	
FIGURE NUMBER	1	

X:\PROJECTS\200704405\DWG\200704405-MONITORING_WELL.dwg; 9/6/2007 4:26:03 PM; DESROCHERS, REBECCA

LEGEND

MONITORING WELL

STS Consultants, Ltd.
1035 Kepler Drive
Green Bay, WI 54311-6279
Tel: (920) 468-1978
www.stsconsultants.com

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AERIAL PHOTOGRAPH
POINT BEACH NUCLEAR PLANT
TWO CREEKS, WISCONSIN

ISSUED
Rev Date
Description

Drawn
Design
Checked
Approved

PROJECT NUMBER
200704405

REFERENCE NUMBER(S)

Figure
2

Table 1
Monitoring Well Installations Details
Point Beach Nuclear Plant
Two Creeks, Wisconsin
STS Project No. 200704405

Monitoring Well	Unique Well No.	Location (Wisconsin State Plane) NORTHING	EASTING	Ground Elevation (feet MSL)	TPVC Elevation (feet MSL)	Top of Well Screen Elevation (feet MSL)	Bottom of Well Screen Elevation (feet MSL)
MW-1	VT6361	368321	266491	600.17	602.21	595.17	580.17
MW-2	VT6371	368285	263918	613.81	615.84	605.81	590.81
MW-3	VT641	369014	265448	608.51	610.54	601.51	586.51
MW-4	VT640	369161	264886	623.27	625.11	613.27	598.27
MW-5	VT639	370954	265333	599.31	601.01	594.31	581.31
MW-6	VT638	370780	263935	619.69	621.67	615.69	600.69

TPVC = top of PVC casing

MSL = Mean Sea Level

STS CONSULTANTS

Point Beach Nuclear Plant
STS Project No. 200704405

Appendix

WDNR Soil Boring Log Information Forms (6)

WDNR Monitoring Well Construction Forms (6)

WDNR Monitoring Well Development Forms (6)

State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION

Form 4400-122 Rev. 7-98

Route To: Watershed/Wastewater ☐ Waste Management ☐ Remediation/Redevelopment ☐ Other ☒

Page 1 of 1

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Point Beach Nuclear Plant		MW-1

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
STS - J. Wagner STS Project No. 200704405	8/27/2007	8/27/2007	hollow stem auger

WI Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
	VT-636	MW-1	Feet MSL	600.2 Feet MSL	8.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 368,321 N, 266,491 E S/C/N
1/4 of 1/4 of Section 24, T 21 N, R 24 E
Lat ___ ° ___ ' ___ "
Long ___ ° ___ ' ___ "
Local Grid Location ☐ N ☐ E Feet ☐ S Feet ☐ W

Facility ID	County	County Code	Civil Town/City/ or Village
	Manitowoc	36	Two Creeks

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 21	8		Topsoil										
			2	Fill: Sand and gravel										
2 SS	24 20	7		Reddish-brown silty clay (CL) - trace fine gravel - very stiff (10R 4/3)	CL									
			4	Brown silty sandy clay (CL) - little to some fine sand and gravel - wet at 6 feet - stiff (2.5YR 5/3)										
3 SS	24 22	5												
4 SS	24 19	5	6		CL									
5 SS	24 22	5	8											
6 SS	24 22	12	10											
				Dark brown silty sandy clay (CL) - little sand and fine gravel - wet - medium firm (7.5YR 5/1)										
7 SS	24 22	7	12											
8 SS	24 20	7	14											
9 SS	24 6	8	16		CL									
10 SS	30 6	8	18											
			20											
				End of Boring. Boring advanced from 0.0 feet to 20.5 feet with hollow-stem auger. Installed 2-inch diameter Schedule 40 PVC monitoring well at 20.0 feet with 2 foot stickup.										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Robert J. Motta

Firm: STS
1035 Kepler Drive Green Bay, Wisconsin 54311
Tel: 920-468-1978
Fax: 920-468-3312

This form is authorized by Chapters 281, 283, 289, 291, 292, 293, 295, and 299, Wis. Stats. Completion of this form is mandatory. Failure to file this form may result in forfeiture of between $10 and $25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be be used for any other purpose. NOTE: See instructions for more information, including where the completed form should be sent.

State of Wisconsin
Department of Natural Resources

Route To: Watershed/Wastewater ☐ Waste Management ☐ Remediation/Redevelopment ☐ Other ☐

MONITORING WELL CONSTRUCTION
Form 4400-113A Rev. 7-98

Facility/Project Name: Point Beach Nuclear Plant	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: MW-1
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. ___° ___' ___" Long. ___° ___' ___" or	Wis. Unique Well No. / DNR Well Number: VT-636
Facility ID	St. Plane 368,321 ft. N, 266,491 ft. E. S/C/N	Date Well Installed: 08/27/2007
Type of Well: Well Code 11/mw	Section Location of Waste/Source: ___ 1/4 of ___ 1/4 of Sec. 24, T. 21 N, R. 24 ☒ E ☐ W	Well Installed By: (Person's Name and Firm) John Wagner
Distance from Waste/Source ft. / Enf. Stds. Apply ☐	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number: ____ STS

A. Protective pipe, top elevation 602.36 ft. MSL

B. Well casing, top elevation 602.21 ft. MSL

C. Land surface elevation 600.2 ft. MSL

D. Surface seal, bottom ____ ft. MSL or ____ ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☐ MH ☐ CL ☒ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☐ 5 0
Hollow Stem Auger ☒ 4 1
____ Other ☐ __

15. Drilling fluid used: Water ☐ 0 2 Air ☐ 0 1
Drilling Mud ☐ 0 3 None ☒ 9 9

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required):
____

E. Bentonite seal, top 599.2 ft. MSL or 1.0 ft.

F. Fine sand, top 595.9 ft. MSL or 4.3 ft.

G. Filter pack, top 595.9 ft. MSL or 4.3 ft.

H. Screen joint, top 595.2 ft. MSL or 5.0 ft.

I. Well bottom 580.2 ft. MSL or 20.0 ft.

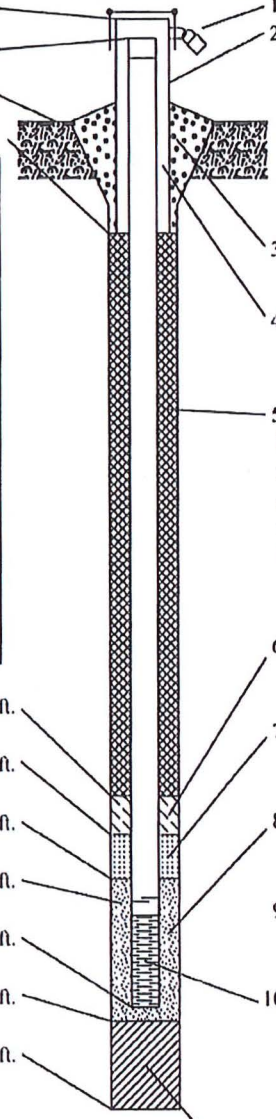
J. Filter pack, bottom 579.7 ft. MSL or 20.5 ft.

K. Borehole, bottom 579.7 ft. MSL or 20.5 ft.

L. Borehole, diameter 8.0 in.

M. O.D. well casing 2.25 in.

N. I.D. well casing 2.00 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
a. Inside diameter: 4.0 in.
b. Length: 7.0 ft.
c. Material: Steel ☒ 0 4
____ Other ☐ __
d. Additional protection? ☒ Yes ☐ No
If yes, describe: steel bumper posts
3. Surface seal: Bentonite ☐ 3 0
Concrete ☒ 0 1
____ Other ☐ __
4. Material between well casing and protective pipe:
Bentonite ☒ 3 0
____ Other ☐ __
5. Annular space seal: a. Granular/Chipped Bentonite ☒ 3 3
b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐ 3 5
c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐ 3 1
d. ____ % Bentonite . . . Bentonite-cement grout ☐ 5 0
e. ____ Ft^3 volume added for any of the above
f. How installed: Tremie ☐ 0 1
Tremie pumped ☐ 0 2
Gravity ☒ 0 8
6. Bentonite seal: a. Bentonite granules ☒ 3 3
b. ☐ 1/4 in. ☐ 3/8 in. ☐ 1/2 in. Bentonite chips ☐ 3 2
c. ____ Other ☐ __
7. Fine sand material: Manufacturer, product name & mesh size
a. Badger 45-55 __
b. Volume added ____ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
a. Badger 45-55 __
b. Volume added 5 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ 2 3
Flush threaded PVC schedule 80 ☐ 2 4
____ Other ☐ __
10. Screen material: PVC __
a. Screen Type: Factory cut ☒ 1 1
Continuous slot ☐ 0 1
____ Other ☐ __
b. Manufacturer Buffalo
c. Slot size: 0.006 in.
d. Slotted length: 15.0 ft.
11. Backfill material (below filter pack): None ☒ 1 4
____ Other ☐ __

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Robert Mottl

Firm: STS
1035 Kepler Drive Green Bay, Wisconsin 54311
Tel: 920-468-1978
Fax: 920-468-3312

Please complete both Forms 4400-113A and 4400-113B and return them to the appropriate DNR office and bureau. Completion of these reports is required by chs. 160, 281, 283, 289, 291, 292, 293, 295, and 299, Wis. Stats., and ch. NR 141, Wis. Adm. Code. In accordance with chs. 281, 289, 291, 292, 293, 295, and 299, Wis. Stats., failure to file these forms may result in a forfeiture of between $10 and $25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on these forms is not intended to be used for any other purpose. NOTE: See the instructions for more information, including where the completed forms should be sent.

State of Wisconsin
Department of Natural Resources

MONITORING WELL DEVELOPMENT

Form 4400-113B Rev. 7-98

Route To: Watershed/Wastewater ☐ Waste Management ☐ Remediation/Redevelopment ☒ Other ☐

Facility/Project Name	County	Well Name
Point Beach Nuclear Plant	Manitowoc	MW-1

Facility License, Permit or Monitoring Number	County Code	Wis. Unique Well Number	DNR Well Number
	36		VT-636

1. Can this well be purged dry? ☒ Yes ☐ No

2. Well development method:
   - surged with bailer and bailed ☒ 41
   - surged with bailer and pumped ☐ 61
   - surged with block and bailed ☐ 42
   - surged with block and pumped ☐ 62
   - surged with block, bailed, and pumped ☐ 70
   - compressed air ☐ 20
   - bailed only ☐ 10
   - pumped only ☐ 51
   - pumped slowly ☐ 50
   - other _____ ☐ __

3. Time spent developing well 30.0 min.

4. Depth of well (from top of well casing) 22.0 ft.

5. Inside diameter of well 2.00 in.

6. Volume of water in filter pack and well casing 15.0 gal.

7. Volume of water removed from well 25.0 gal.

8. Volume of water added (if any) gal.

9. Source of water added _____

10. Analysis performed on water added? ☐ Yes ☒ No
(If yes, attach results)

		Before Development	After Development
11. Depth to Water (from top of well casing)	a.	5.75 ft.	20.00 ft.
Date	b.	8/28/2007	8/28/2007
Time	c.	07:45 ☒ a.m. ☐ p.m.	08:15 ☒ a.m. ☐ p.m.
12. Sediment in well bottom		inches	inches
13. Water clarity		Clear ☐ 10 Turbid ☒ 15 (Describe)	Clear ☐ 20 Turbid ☒ 25 (Describe)

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids	mg/l	mg/l
15. COD	mg/l	mg/l

16. Well developed by: Person's Name and Firm
Robert Mottl
STS

17. Additional comments on development:

Facility Address or Owner/Responsible Party Address

Name: Lynn Rogers
Firm: Point Beach Nuclear Plant
Street: Nuclear Road
City/State/Zip: Two Rivers, Wisconsin

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature: Robert J. Mottl
Print Name: Robert J. Mottl
Firm: STS

NOTE: See instructions for more information including a list of county codes and well type codes.

State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION

Form 4400-122 Rev. 7-98

Route To: Watershed/Wastewater ☐ Waste Management ☐ Remediation/Redevelopment ☐ Other ☒

Page 1 of 1

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Point Beach Nuclear Plant		MW-2

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
STS - J. Wagner STS Project No. 200704405	8/28/2007	8/28/2007	hollow stem auger

WI Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
	VT-637	MW-2	Feet MSL	613.8 Feet MSL	8.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 368,285 N, 263,918 E S/C/N
1/4 of 1/4 of Section 24, T 21 N, R 24 E
Lat ___ ° ___ ' ___ "
Long ___ ° ___ ' ___ "
Local Grid Location ☐ N ☐ E Feet ☐ S Feet ☐ W

Facility ID	County	County Code	Civil Town/City/ or Village
	Manitowoc	36	Two Creeks

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 2	5		Topsoil and gravel										
2 SS	24 22	12	2.5	Reddish-brown silty clay (CL) - trace to little fine to medium gravel - moist - very stiff (10R 4/3)										
3 SS	24 22	11	5.0											
4 SS	24 21	19	7.5		CL									
5 SS	24 21	37												
6 SS	24 24	12	10.0											
7 SS	24 24	6	12.5	Brown silty sandy clay (CL) - little to some fine to medium sand - changing from stiff to medium firm from 12 to 22 feet (2.5YR 5/3) - gravel at 18 to 20 feet										
8 SS	24 14	9	15.0											
9 SS	24 24	6	17.5		CL									
10 SS	24 19	18												
11 SS	24 19	19	20.0											
12 SS	24 24	18	22.5	Brown very silty clay (CL-ML) - trace sand - wet - soft (7.5 YR 6/2)	CL-ML									
			25.0	End of Boring. Boring advanced from 0.0 feet to 23.0 feet with 4 1/4-inch ID hollow-stem auger and to 25.0 feet with split-spoon. Installed 2-inch diameter Schedule 40 PVC monitoring well at 23.0 feet with 2 foot stickup.										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Robert J Mott

Firm: STS
1035 Kepler Drive Green Bay, Wisconsin 54311
Tel: 920-468-1978
Fax: 920-468-3312

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State of Wisconsin
Department of Natural Resources

Route To: Watershed/Wastewater ☐ Waste Management ☐ Remediation/Redevelopment ☐ Other ☐

MONITORING WELL CONSTRUCTION
Form 4400-113A Rev. 7-98

Facility/Project Name: Point Beach Nuclear Plant	Local Grid Location of Well: ____ ft. ☐N. ☐S. ____ ft. ☐E. ☐W.	Well Name: MW-2
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. ° ' " Long. ° ' " or	Wis. Unique Well No. / DNR Well Number: VT-637
Facility ID	St. Plane 368,285 ft. N, 263,918 ft. E. S/C/N	Date Well Installed: 08/28/2007
Type of Well: Observation Well	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. 24, T. 21 N, R. 24 ☒E ☐W	Well Installed By: (Person's Name and Firm) John Wagner, STS
Distance from Waste/Source ft. / Enf. Stds. Apply ☐	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known / Gov. Lot Number	

A. Protective pipe, top elevation 615.99 ft. MSL

B. Well casing, top elevation 615.84 ft. MSL

C. Land surface elevation 613.8 ft. MSL

D. Surface seal, bottom ____ ft. MSL or ____ ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☐ MH ☐ CL ☒ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☐ 5 0
Hollow Stem Auger ☒ 4 1
____ Other ☐ __

15. Drilling fluid used: Water ☐ 0 2 Air ☐ 0 1
Drilling Mud ☐ 0 3 None ☒ 9 9

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required):

E. Bentonite seal, top 612.8 ft. MSL or 1.0 ft.

F. Fine sand, top 607.8 ft. MSL or 6.0 ft.

G. Filter pack, top 607.8 ft. MSL or 6.0 ft.

H. Screen joint, top 605.8 ft. MSL or 8.0 ft.

I. Well bottom 590.8 ft. MSL or 23.0 ft.

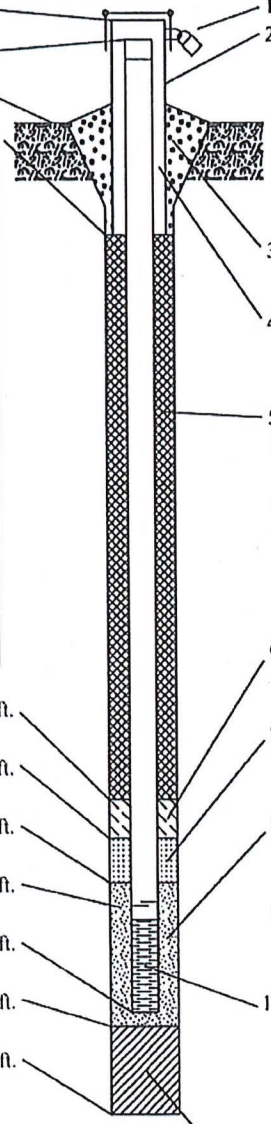
J. Filter pack, bottom 588.8 ft. MSL or 25.0 ft.

K. Borehole, bottom 588.8 ft. MSL or 25.0 ft.

L. Borehole, diameter 8.0 in.

M. O.D. well casing 2.25 in.

N. I.D. well casing 2.00 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
a. Inside diameter: 4.0 in.
b. Length: 7.0 ft.
c. Material: Steel ☒ 0 4
____ Other ☐ __
d. Additional protection? ☒ Yes ☐ No
If yes, describe: steel bumper posts
3. Surface seal: Bentonite ☐ 3 0
Concrete ☒ 0 1
____ Other ☐ __
4. Material between well casing and protective pipe:
Bentonite ☒ 3 0
____ Other ☐ __
5. Annular space seal: a. Granular/Chipped Bentonite ☒ 3 3
b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐ 3 5
c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐ 3 1
d. ____ % Bentonite . . . Bentonite-cement grout ☐ 5 0
e. ____ Ft^3 volume added for any of the above
f. How installed: Tremie ☐ 0 1
Tremie pumped ☐ 0 2
Gravity ☒ 0 8
6. Bentonite seal: a. Bentonite granules ☒ 3 3
b. ☐ 1/4 in. ☐ 3/8 in. ☐ 1/2 in. Bentonite chips ☐ 3 2
c. ____ Other ☐ __
7. Fine sand material: Manufacturer, product name & mesh size
a. Badger 45-55 __
b. Volume added ____ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
a. Badger 45-55 __
b. Volume added 5 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ 2 3
Flush threaded PVC schedule 80 ☐ 2 4
____ Other ☐ __
10. Screen material: PVC __
a. Screen Type: Factory cut ☒ 1 1
Continuous slot ☐ 0 1
____ Other ☐ __
b. Manufacturer Buffalo
c. Slot size: 0.006 in.
d. Slotted length: 15.0 ft.
11. Backfill material (below filter pack): None ☒ 1 4
____ Other ☐ __

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Robert J. Mott	Firm: STS, 1035 Kepler Drive Green Bay, Wisconsin 54311 — Tel: 920-468-1978, Fax: 920-468-3312

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State of Wisconsin
Department of Natural Resources

MONITORING WELL DEVELOPMENT

Form 4400-113B Rev. 7-98

Route To: Watershed/Wastewater ☐ Waste Management ☐ Remediation/Redevelopment ☒ Other ☐

Facility/Project Name	County	Well Name
Point Beach Nuclear Plant	Manitowoc	MW-2

Facility License, Permit or Monitoring Number	County Code	Wis. Unique Well Number	DNR Well Number
	36		VT-637

1. Can this well be purged dry? ☒ Yes ☐ No

2. Well development method:
   - surged with bailer and bailed ☒ 41
   - surged with bailer and pumped ☐ 61
   - surged with block and bailed ☐ 42
   - surged with block and pumped ☐ 62
   - surged with block, bailed, and pumped ☐ 70
   - compressed air ☐ 20
   - bailed only ☐ 10
   - pumped only ☐ 51
   - pumped slowly ☐ 50
   - other _____ ☐ __

3. Time spent developing well 30.0 min.

4. Depth of well (from top of well casing) 25.0 ft.

5. Inside diameter of well 2.00 in.

6. Volume of water in filter pack and well casing 10.0 gal.

7. Volume of water removed from well 20.0 gal.

8. Volume of water added (if any) gal.

9. Source of water added _____

10. Analysis performed on water added? ☐ Yes ☒ No
(If yes, attach results)

		Before Development	After Development
11. Depth to Water (from top of well casing)	a.	6.80 ft.	20.50 ft.
Date	b.	8/29/2007	8/29/2007
Time	c.	08:30 ☒ a.m. ☐ p.m.	12:00 ☒ a.m. ☐ p.m.
12. Sediment in well bottom		inches	inches
13. Water clarity		Clear ☐ 10 Turbid ☒ 15 (Describe)	Clear ☒ 20 Turbid ☐ 25 (Describe)

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids	mg/l	mg/l
15. COD	mg/l	mg/l

16. Well developed by: Person's Name and Firm
Robert Mottl
STS

17. Additional comments on development:

Facility Address or Owner/Responsible Party Address

Name: Lynn Rogers
Firm: Point Beach Nuclear Plant
Street: Nuclear Road
City/State/Zip: Two Rivers, Wisconsin

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature: Robert J. Mottl
Print Name: Robert J. Mottl
Firm: STS

NOTE: See instructions for more information including a list of county codes and well type codes.

State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION

Form 4400-122 Rev. 7-98

Route To: Watershed/Wastewater ☐ Waste Management ☐ Remediation/Redevelopment ☐ Other ☒

Page 1 of 1

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Point Beach Nuclear Plant		MW-3

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
STS - J. Wagner STS Project No. 200704405	8/31/2007	8/31/2007	hollow stem auger

WI Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
	VT-641	MW-3	Feet MSL	608.5 Feet MSL	8.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 369,014 N, 265,448 E S/C/N
1/4 of 1/4 of Section 24, T 21 N, R 24 E
Lat ___ ° ___ ' ___ "
Long ___ ° ___ ' ___ "
Local Grid Location ☐ N ☐ E Feet ☐ S Feet ☐ W

Facility ID	County	County Code	Civil Town/City/ or Village
	Manitowoc	36	Two Creeks

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 17	3		Possible Fill: Disturbed reddish-brown silty clay (CL)	CL									
2 SS	24 19	7	2	Reddish-brown silty clay (CL) - trace fine gravel - very stiff (5YR 4/4)	CL									
3 SS	24 22	11	4											
4 SS	24 24	13	6											
5 SS	24 24	14	8											
6 SS	24 24	12	10	Brown silty clay (CL) - trace fine sand - trace fine sand - trace fine gravel - very stiff (2.5 YR 5/3)	CL									
7 SS	24 19	10	12											
8 SS	24 20	13	14	Dark reddish-brown silty clay (CL) - trace medium gravel - stiff - moist (2.5YR 4/4)	CL									
9 SS	20 24	16	16											
10 SS	24 22	11	18											
11 SS	24	9	20	Brown to dark brown clayey silt (CL-ML) - soft - trace sand - moist (10YR 4/3)	CL-ML									
			22	End of Boring. Boring advanced from 0.0 feet to 23.0 feet with 4 1/4-inch ID hollow-stem auger. Installed 2-inch diameter Schedule 40 PVC monitoring well at 22.0 feet with 2 foot stickup.										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature Robert J. Mottl

Firm STS
1035 Kepler Drive Green Bay, Wisconsin 54311
Tel: 920-468-1978
Fax: 920-468-3312

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State of Wisconsin
Department of Natural Resources

Route To: Watershed/Wastewater ☐ Waste Management ☐ Remediation/Redevelopment ☐ Other ☐

MONITORING WELL CONSTRUCTION
Form 4400-113A Rev. 7-98

Facility/Project Name: Point Beach Nuclear Plant	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: MW-3
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. ___ ° ___ ' ___ " Long. ___ ° ___ ' ___ " or	Wis. Unique Well No. / DNR Well Number: VT-641
Facility ID	St. Plane 369,014 ft. N, 265,448 ft. E. S/C/N	Date Well Installed: 08/31/2007
Type of Well: Observation Well	Section Location of Waste/Source: ___ 1/4 of ___ 1/4 of Sec. 24, T. 21 N, R. 24 ☒ E ☐ W	Well Installed By: (Person's Name and Firm) John Wagner
Distance from Waste/Source ___ ft. / Enf. Stds. Apply ☐	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number: ___ / STS

A. Protective pipe, top elevation 610.73 ft. MSL

B. Well casing, top elevation 610.54 ft. MSL

C. Land surface elevation 608.5 ft. MSL

D. Surface seal, bottom ___ ft. MSL or ___ ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☐ MH ☐ CL ☒ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☐ 5 0
Hollow Stem Auger ☒ 4 1
___ Other ☐ __

15. Drilling fluid used: Water ☐ 0 2 Air ☐ 0 1
Drilling Mud ☐ 0 3 None ☒ 9 9

16. Drilling additives used? ☐ Yes ☒ No

Describe ___

17. Source of water (attach analysis, if required):
___

E. Bentonite seal, top 607.5 ft. MSL or 1.0 ft.

F. Fine sand, top 604.3 ft. MSL or 4.2 ft.

G. Filter pack, top 604.3 ft. MSL or 4.2 ft.

H. Screen joint, top 601.5 ft. MSL or 7.0 ft.

I. Well bottom 586.5 ft. MSL or 22.0 ft.

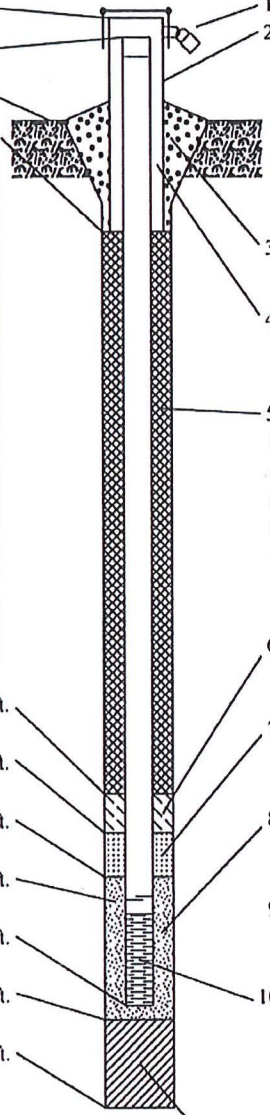
J. Filter pack, bottom 585.5 ft. MSL or 23.0 ft.

K. Borehole, bottom 585.5 ft. MSL or 23.0 ft.

L. Borehole, diameter 8.0 in.

M. O.D. well casing 2.25 in.

N. I.D. well casing 2.00 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
a. Inside diameter: 4.0 in.
b. Length: 5.0 ft.
c. Material: Steel ☒ 0 4
___ Other ☐ __
d. Additional protection? ☒ Yes ☐ No
If yes, describe: steel bumper posts
3. Surface seal: Bentonite ☐ 3 0
Concrete ☒ 0 1
___ Other ☐ __
4. Material between well casing and protective pipe:
Bentonite ☒ 3 0
___ Other ☐ __
5. Annular space seal: a. Granular/Chipped Bentonite ☒ 3 3
b. ___ Lbs/gal mud weight . . . Bentonite-sand slurry ☐ 3 5
c. ___ Lbs/gal mud weight . . . Bentonite slurry ☐ 3 1
d. ___ % Bentonite . . . Bentonite-cement grout ☐ 5 0
e. ___ Ft^3 volume added for any of the above
f. How installed: Tremie ☐ 0 1
Tremie pumped ☐ 0 2
Gravity ☒ 0 8
6. Bentonite seal: a. Bentonite granules ☒ 3 3
b. ☐ 1/4 in. ☐ 3/8 in. ☐ 1/2 in. Bentonite chips ☐ 3 2
c. ___ Other ☐ __
7. Fine sand material: Manufacturer, product name & mesh size
a. Badger 45-55 __
b. Volume added ___ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
a. Badger 45-55 __
b. Volume added 5 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ 2 3
Flush threaded PVC schedule 80 ☐ 2 4
___ Other ☐ __
10. Screen material: PVC __
a. Screen Type: Factory cut ☒ 1 1
Continuous slot ☐ 0 1
___ Other ☐ __
b. Manufacturer Buffalo
c. Slot size: 0.006 in.
d. Slotted length: 15.0 ft.
11. Backfill material (below filter pack): None ☒ 1 4
___ Other ☐ __

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Robert J. Motta
Firm: STS
1035 Kepler Drive Green Bay, Wisconsin 54311
Tel: 920-468-1978
Fax: 920-468-3312

Please complete both Forms 4400-113A and 4400-113B and return them to the appropriate DNR office and bureau. Completion of these reports is required by chs. 160, 281, 283, 289, 291, 292, 293, 295, and 299, Wis. Stats., and ch. NR 141, Wis. Adm. Code. In accordance with chs. 281, 289, 291, 292, 293, 295, and 299, Wis. Stats., failure to file these forms may result in a forfeiture of between $10 and $25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on these forms is not intended to be used for any other purpose. NOTE: See the instructions for more information, including where the completed forms should be sent.

State of Wisconsin
Department of Natural Resources

MONITORING WELL DEVELOPMENT

Form 4400-113B Rev. 7-98

Route To: Watershed/Wastewater ☐ Waste Management ☐ Remediation/Redevelopment ☒ Other ☐

Facility/Project Name	County	Well Name
Point Beach Nuclear Plant	Manitowoc	MW-3

Facility License, Permit or Monitoring Number	County Code	Wis. Unique Well Number	DNR Well Number
	36		VT-641

1. Can this well be purged dry? ☒ Yes ☐ No

2. Well development method:
   - surged with bailer and bailed ☒ 41
   - surged with bailer and pumped ☐ 61
   - surged with block and bailed ☐ 42
   - surged with block and pumped ☐ 62
   - surged with block, bailed, and pumped ☐ 70
   - compressed air ☐ 20
   - bailed only ☐ 10
   - pumped only ☐ 51
   - pumped slowly ☐ 50
   - other _____ ☐ __

3. Time spent developing well 30.0 min.

4. Depth of well (from top of well casing) 22.0 ft.

5. Inside diameter of well 2.00 in.

6. Volume of water in filter pack and well casing 10.0 gal.

7. Volume of water removed from well 10.0 gal.

8. Volume of water added (if any) gal.

9. Source of water added _____

10. Analysis performed on water added? ☐ Yes ☒ No
(If yes, attach results)

		Before Development	After Development
11. Depth to Water (from top of well casing)	a.	8.50 ft.	20.50 ft.
Date	b.	9/4/2007	9/4/2007
Time	c.	09:00 ☒ a.m. ☐ p.m.	09:30 ☒ a.m. ☐ p.m.
12. Sediment in well bottom		inches	inches
13. Water clarity		Clear ☐ 10 Turbid ☒ 15 (Describe)	Clear ☒ 20 Turbid ☐ 25 (Describe)

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids	mg/l	mg/l
15. COD	mg/l	mg/l

16. Well developed by: Person's Name and Firm
John Wagner
STS

17. Additional comments on development:

Facility Address or Owner/Responsible Party Address

Name: Lynn Rogers

Firm: Point Beach Nuclear Plant

Street: Nuclear Road

City/State/Zip: Two Rivers, Wisconsin

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature: Robert J. Mottl

Print Name: Robert J. Mottl

Firm: STS

NOTE: See instructions for more information including a list of county codes and well type codes.

State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION

Form 4400-122 Rev. 7-98

Route To: Watershed/Wastewater ☐ Waste Management ☐ Remediation/Redevelopment ☐ Other ☒

Page 1 of 1

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Point Beach Nuclear Plant		MW-4

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
STS - J. Wagner STS Project No. 200704405	8/30/2007	8/30/2007	hollow stem auger

WI Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
	VT-640	MW-4	Feet MSL	623.3 Feet MSL	8.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 369,161 N, 264,886 E S/C/N
1/4 of 1/4 of Section 24, T 21 N, R 24 E
Lat ___ ° ___ ' ___ "
Long ___ ° ___ ' ___ "
Local Grid Location ☐ N ☐ E Feet ☐ S Feet ☐ W

Facility ID	County	County Code	Civil Town/City/ or Village
	Manitowoc	36	Two Creeks

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 24	10		Possible Fill: Topsoil and gravel										
2 SS	24 24	7	2.5	Possible Fill/Disturbed: Reddish-brown silty clay (CL) - trace sand - trace fiine gravel - stiff (10R 4/3)	CL									
3 SS	24 24	16	5.0	Reddish-brown silty clay (CL) - trace fine sand - trace fine gravel - stiff (10R 4/3)	CL									
4 SS	24 24	14	7.5											
5 SS	24 24	12												
6 SS	24 24	12	10.0											
7 SS	24 24	13	12.5	Brown to dark brown sitly clay (CL) - interbedded fine sand and gravel seams - stiff - wet (2.5 YR 5/3)	CL									
8 SS	24	9	15.0											
9 SS	24 17	9	17.5											
10 SS	24 24	10												
11 SS	24 6	15	20.0											
12 SS	24 24	18	22.5											
13 SS	24 18	26	25.0											
				End of Boring. Boring advanced from 0.0 feet to 25.5 feet with 4 1/4-inch ID hollow-stem auger. Installed 2-inch diameter Schedule 40 PVC monitoring well at 25.0 feet with 2 foot stickup.										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm	
Robert J. Mott	STS 1035 Kepler Drive Green Bay, Wisconsin 54311	Tel: 920-468-1978 Fax: 920-468-3312

This form is authorized by Chapters 281, 283, 289, 291, 292, 293, 295, and 299, Wis. Stats. Completion of this form is mandatory. Failure to file this form may result in forfeiture of between $10 and $25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be be used for any other purpose. NOTE: See instructions for more information, including where the completed form should be sent.

State of Wisconsin
Department of Natural Resources

Route To: Watershed/Wastewater ☐ Waste Management ☐ Remediation/Redevelopment ☐ Other ☐

MONITORING WELL CONSTRUCTION
Form 4400-113A Rev. 7-98

Facility/Project Name: Point Beach Nuclear Plant	Local Grid Location of Well: ____ ft. ☐N. ☐S. ____ ft. ☐E. ☐W.	Well Name: MW-4
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. ___ ° ___ ' ___ " Long. ___ ° ___ ' ___ " or	Wis. Unique Well No. / DNR Well Number: VT-640
Facility ID	St. Plane 369,161 ft. N, 264,886 ft. E. S/C/N	Date Well Installed: 08/30/2007
Type of Well: Well Code 11/mw	Section Location of Waste/Source: ___ 1/4 of ___ 1/4 of Sec. 24, T. 21 N, R. 24 ☒E ☐W	Well Installed By: (Person's Name and Firm) John Wagner, STS
Distance from Waste/Source ___ ft. / Enf. Stds. Apply ☐	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number: ___

A. Protective pipe, top elevation 625.33 ft. MSL

B. Well casing, top elevation 625.11 ft. MSL

C. Land surface elevation 623.3 ft. MSL

D. Surface seal, bottom ___ ft. MSL or ___ ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☐ MH ☐ CL ☒ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☐ 50
Hollow Stem Auger ☒ 41
___ Other ☐ __

15. Drilling fluid used: Water ☐ 02 Air ☐ 01
Drilling Mud ☐ 03 None ☒ 99

16. Drilling additives used? ☐ Yes ☒ No

Describe ___

17. Source of water (attach analysis, if required):

E. Bentonite seal, top 622.3 ft. MSL or 1.0 ft.

F. Fine sand, top 616.3 ft. MSL or 7.0 ft.

G. Filter pack, top 616.3 ft. MSL or 7.0 ft.

H. Screen joint, top 613.3 ft. MSL or 10.0 ft.

I. Well bottom 598.3 ft. MSL or 25.0 ft.

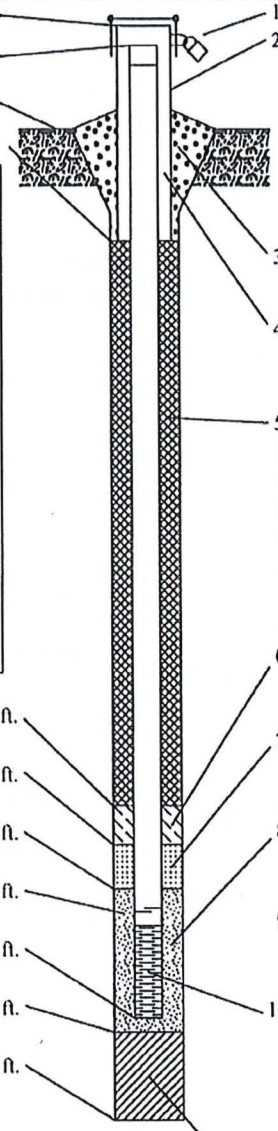
J. Filter pack, bottom 598.3 ft. MSL or 25.0 ft.

K. Borehole, bottom 597.8 ft. MSL or 25.5 ft.

L. Borehole, diameter 8.0 in.

M. O.D. well casing 2.00 in.

N. I.D. well casing 2.00 in.



1. Cap and lock? ☒ Yes ☐ No

2. Protective cover pipe:
a. Inside diameter: 4.0 in.
b. Length: 7.0 ft.
c. Material: Steel ☒ 04
___ Other ☐ __
d. Additional protection? ☒ Yes ☐ No
If yes, describe: steel bumper posts

3. Surface seal: Bentonite ☐ 30
Concrete ☒ 01
___ Other ☐ __

4. Material between well casing and protective pipe:
Bentonite ☒ 30
___ Other ☐ __

5. Annular space seal: a. Granular/Chipped Bentonite ☒ 33
b. ___ Lbs/gal mud weight . . . Bentonite-sand slurry ☐ 35
c. ___ Lbs/gal mud weight . . . Bentonite slurry ☐ 31
d. ___ % Bentonite . . . Bentonite-cement grout ☐ 50
e. ___ Ft^3 volume added for any of the above
f. How installed: Tremie ☐ 01
Tremie pumped ☐ 02
Gravity ☒ 08

6. Bentonite seal: a. Bentonite granules ☒ 33
b. ☐ 1/4 in. ☐ 3/8 in. ☐ 1/2 in. Bentonite chips ☐ 32
c. ___ Other ☐ __

7. Fine sand material: Manufacturer, product name & mesh size
a. Badger 45-55 __
b. Volume added ___ ft^3

8. Filter pack material: Manufacturer, product name & mesh size
a. Badger 45-55 __
b. Volume added 6 ft^3

9. Well casing: Flush threaded PVC schedule 40 ☒ 23
Flush threaded PVC schedule 80 ☐ 24
___ Other ☐ __

10. Screen material: PVC __
a. Screen Type: Factory cut ☒ 11
Continuous slot ☐ 01
___ Other ☐ __
b. Manufacturer Bufffalo
c. Slot size: 0.006 in.
d. Slotted length: 15.0 ft.

11. Backfill material (below filter pack): None ☒ 14
___ Other ☐ __

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Robert J. Matte
Firm: STS, 1035 Kepler Drive Green Bay, Wisconsin 54311
Tel: 920-468-1978
Fax: 920-468-3312

Please complete both Forms 4400-113A and 4400-113B and return them to the appropriate DNR office and bureau. Completion of these reports is required by chs. 160, 281, 283, 289, 291, 292, 293, 295, and 299, Wis. Stats., and ch. NR 141, Wis. Adm. Code. In accordance with chs. 281, 289, 291, 292, 293, 295, and 299, Wis. Stats., failure to file these forms may result in a forfeiture of between $10 and $25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on these forms is not intended to be used for any other purpose. NOTE: See the instructions for more information, including where the completed forms should be sent.

State of Wisconsin
Department of Natural Resources

MONITORING WELL DEVELOPMENT

Form 4400-113B Rev. 7-98

Route To: Watershed/Wastewater ☐ Waste Management ☐ Remediation/Redevelopment ☒ Other ☐

Facility/Project Name	County	Well Name
Point Beach Nuclear Plant	Manitowoc	MW-4

Facility License, Permit or Monitoring Number	County Code	Wis. Unique Well Number	DNR Well Number
	36		VT-640

1. Can this well be purged dry? ☒ Yes ☐ No

2. Well development method:

surged with bailer and bailed	☒	41
surged with bailer and pumped	☐	61
surged with block and bailed	☐	42
surged with block and pumped	☐	62
surged with block, bailed, and pumped	☐	70
compressed air	☐	20
bailed only	☐	10
pumped only	☐	51
pumped slowly	☐	50
other _____	☐	__

3. Time spent developing well 60 min.

4. Depth of well (from top of well casing) 27.0 ft.

5. Inside diameter of well 2.00 in.

6. Volume of water in filter pack and well casing 3.0 gal.

7. Volume of water removed from well 6.0 gal.

8. Volume of water added (if any) gal.

9. Source of water added _____

10. Analysis performed on water added? ☐ Yes ☒ No
(If yes, attach results)

		Before Development	After Development
11. Depth to Water (from top of well casing)	a.	22.50 ft.	27.00 ft.
Date	b.	8/31/2007	8/31/2007
Time	c.	08:00 ☒ a.m. ☐ p.m.	09:00 ☒ a.m. ☐ p.m.
12. Sediment in well bottom		inches	inches
13. Water clarity		Clear ☒ 10 Turbid ☐ 15 (Describe)	Clear ☒ 20 Turbid ☐ 25 (Describe)

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids	mg/l	mg/l
15. COD	mg/l	mg/l

16. Well developed by: Person's Name and Firm
Robert Mottl
STS

17. Additional comments on development:

Facility Address or Owner/Responsible Party Address

Name: Lynn Rogers
Firm: Point Beach Nuclear Plant
Street: Nuclear Road
City/State/Zip: Two Rivers, Wisconsin

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature: Robert J. Mottl
Print Name: Robert J. Mottl
Firm: STS

NOTE: See instructions for more information including a list of county codes and well type codes.

State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION

Form 4400-122 Rev. 7-98

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☒

Page 1 of 1

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Point Beach Nuclear Plant		MW-5

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
STS - J. Wagner STS Project No. 200704405	8/29/2007	8/29/2007	hollow stem auger

WI Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
	VT-639	MW-5	Feet MSL	599.3 Feet MSL	8.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 370,954 N, 265,333 E S/C/N
1/4 of 1/4 of Section 24, T 21 N, R 24 E
Lat ___ ° ___ ' ___ "
Long ___ ° ___ ' ___ "
Local Grid Location ☐ N ☐ E Feet ☐ S Feet ☐ W

Facility ID	County	County Code	Civil Town/City/ or Village
	Manitowoc	36	Two Creeks

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 12	5		Topsoil										
			2	Brown silty clay (CL) - trace fine sand - stiff - moist (2.5YR 5/3)										
2 SS	24 14	7												
			4											
3 SS	24 13	12												
			6											
4 SS	24 19	10			CL									
			8											
5 SS	24 17	6												
			10											
6 SS	24 22	3												
			12											
7 SS	24 24	4												
			14	Grayish-brown very silty clay (CL-ML) - trace to little fine sand - wet - medium firm (10YR 6/3)										
8 SS	24 24	1			CL-ML									
			16											
9 SS	24 24	4												
			18	End of Boring. Boring advanced from 0.0 feet to 18.0 feet with 4 1/4-inch ID hollow-stem auger. Installed 2-inch diameter Schedule 40 PVC monitoring well at 18.0 feet with 2 foot stickup.										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature Robert J. Mattke

Firm STS
1035 Kepler Drive Green Bay, Wisconsin 54311
Tel: 920-468-1978
Fax: 920-468-3312

This form is authorized by Chapters 281, 283, 289, 291, 292, 293, 295, and 299, Wis. Stats. Completion of this form is mandatory. Failure to file this form may result in forfeiture of between $10 and $25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be be used for any other purpose. NOTE: See instructions for more information, including where the completed form should be sent.

State of Wisconsin
Department of Natural Resources

Route To: Watershed/Wastewater ☐ Waste Management ☐ Remediation/Redevelopment ☐ Other ☐

MONITORING WELL CONSTRUCTION
Form 4400-113A Rev. 7-98

Facility/Project Name: Point Beach Nuclear Plant	Local Grid Location of Well: ____ ft. ☐N. ☐S. ____ ft. ☐E. ☐W.	Well Name: MW-5
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. ___ ° ___ ' ___ " Long. ___ ° ___ ' ___ " or	Wis. Unique Well No. / DNR Well Number: VT-639
Facility ID	St. Plane 370,954 ft. N, 265,333 ft. E. S/C/N	Date Well Installed: 08/29/2007
Type of Well: Well Code 11/mw	Section Location of Waste/Source: ___ 1/4 of ___ 1/4 of Sec. 24, T. 21 N, R. 24 ☒E ☐W	Well Installed By: (Person's Name and Firm) John Wagner, STS
Distance from Waste/Source ___ ft. / Enf. Stds. Apply ☐	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number: ___

A. Protective pipe, top elevation 601.17 ft. MSL

B. Well casing, top elevation 601.01 ft. MSL

C. Land surface elevation 599.3 ft. MSL

D. Surface seal, bottom ___ ft. MSL or ___ ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☐ MH ☐ CL ☒ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☐ 5 0
Hollow Stem Auger ☒ 4 1
___ Other ☐ __

15. Drilling fluid used: Water ☐ 0 2 Air ☐ 0 1
Drilling Mud ☐ 0 3 None ☒ 9 9

16. Drilling additives used? ☐ Yes ☒ No

Describe ___

17. Source of water (attach analysis, if required):
___

E. Bentonite seal, top 598.3 ft. MSL or 1.0 ft.

F. Fine sand, top 598.3 ft. MSL or 1.0 ft.

G. Filter pack, top 595.3 ft. MSL or 4.0 ft.

H. Screen joint, top 594.3 ft. MSL or 5.0 ft.

I. Well bottom 581.3 ft. MSL or 18.0 ft.

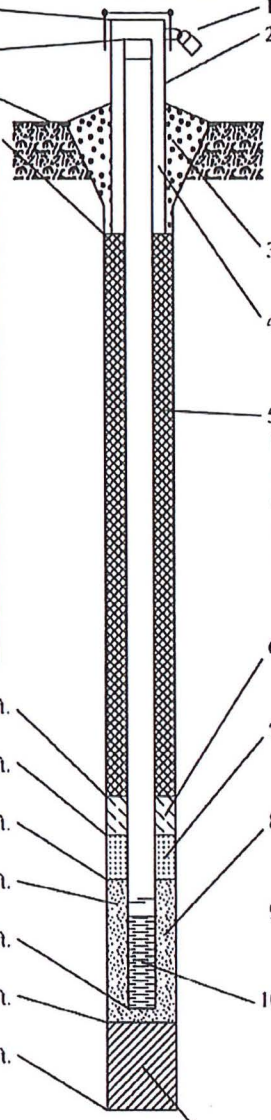
J. Filter pack, bottom 581.3 ft. MSL or 18.0 ft.

K. Borehole, bottom 581.3 ft. MSL or 18.0 ft.

L. Borehole, diameter 8.0 in.

M. O.D. well casing 2.00 in.

N. I.D. well casing 2.00 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
a. Inside diameter: 4.0 in.
b. Length: 7.0 ft.
c. Material: Steel ☒ 0 4
___ Other ☐ __
d. Additional protection? ☒ Yes ☐ No
If yes, describe: steel bumper posts
3. Surface seal: Bentonite ☐ 3 0
Concrete ☒ 0 1
___ Other ☐ __
4. Material between well casing and protective pipe:
Bentonite ☒ 3 0
___ Other ☐ __
5. Annular space seal: a. Granular/Chipped Bentonite ☒ 3 3
b. ___ Lbs/gal mud weight . . . Bentonite-sand slurry ☐ 3 5
c. ___ Lbs/gal mud weight . . . Bentonite slurry ☐ 3 1
d. ___ % Bentonite . . . Bentonite-cement grout ☐ 5 0
e. ___ Ft^3 volume added for any of the above
f. How installed: Tremie ☐ 0 1
Tremie pumped ☐ 0 2
Gravity ☒ 0 8
6. Bentonite seal: a. Bentonite granules ☒ 3 3
b. ☐ 1/4 in. ☐ 3/8 in. ☐ 1/2 in. Bentonite chips ☐ 3 2
c. ___ Other ☐ __
7. Fine sand material: Manufacturer, product name & mesh size
a. Badger 45-55 __
b. Volume added ___ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
a. Badger 45-55 __
b. Volume added 4 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ 2 3
Flush threaded PVC schedule 80 ☐ 2 4
___ Other ☐ __
10. Screen material: PVC __
a. Screen Type: Factory cut ☒ 1 1
Continuous slot ☐ 0 1
___ Other ☐ __
b. Manufacturer Bufffalo
c. Slot size: 0.006 in.
d. Slotted length: 13.0 ft.
11. Backfill material (below filter pack): None ☒ 1 4
___ Other ☐ __

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm	
Robert J. Mo[illegible]	STS 1035 Kepler Drive Green Bay, Wisconsin 54311	Tel: 920-468-1978 Fax: 920-468-3312

Please complete both Forms 4400-113A and 4400-113B and return them to the appropriate DNR office and bureau. Completion of these reports is required by chs. 160, 281, 283, 289, 291, 292, 293, 295, and 299, Wis. Stats., and ch. NR 141, Wis. Adm. Code. In accordance with chs. 281, 289, 291, 292, 293, 295, and 299, Wis. Stats., failure to file these forms may result in a forfeiture of between $10 and $25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on these forms is not intended to be used for any other purpose. NOTE: See the instructions for more information, including where the completed forms should be sent.

State of Wisconsin
Department of Natural Resources

MONITORING WELL DEVELOPMENT

Form 4400-113B Rev. 7-98

Route To: Watershed/Wastewater ☐ Waste Management ☐ Remediation/Redevelopment ☒ Other ☐

Facility/Project Name	County	Well Name
Point Beach Nuclear Plant	Manitowoc	MW-5

Facility License, Permit or Monitoring Number	County Code	Wis. Unique Well Number	DNR Well Number
	36		VT-639

1. Can this well be purged dry? ☒ Yes ☐ No

2. Well development method:

surged with bailer and bailed	☒	41
surged with bailer and pumped	☐	61
surged with block and bailed	☐	42
surged with block and pumped	☐	62
surged with block, bailed, and pumped	☐	70
compressed air	☐	20
bailed only	☐	10
pumped only	☐	51
pumped slowly	☐	50
other _____	☐	__

3. Time spent developing well 30.0 min.

4. Depth of well (from top of well casing) 20.0 ft.

5. Inside diameter of well 2.00 in.

6. Volume of water in filter pack and well casing 4.0 gal.

7. Volume of water removed from well 8.0 gal.

8. Volume of water added (if any) gal.

9. Source of water added _____

10. Analysis performed on water added? ☐ Yes ☒ No
(If yes, attach results)

		Before Development	After Development
11. Depth to Water (from top of well casing)	a.	8.50 ft.	19.50 ft.
Date	b.	8/31/2007	8/31/2007
Time	c.	02:30 ☐ a.m. ☒ p.m.	03:00 ☐ a.m. ☒ p.m.
12. Sediment in well bottom		inches	inches
13. Water clarity		Clear ☒ 10 Turbid ☐ 15 (Describe)	Clear ☒ 20 Turbid ☐ 25 (Describe)

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids	mg/l	mg/l
15. COD	mg/l	mg/l

16. Well developed by: Person's Name and Firm
Robert Mottl
STS

17. Additional comments on development:

Facility Address or Owner/Responsible Party Address

Name: Lynn Rogers
Firm: Point Beach Nuclear Plant
Street: Nuclear Road
City/State/Zip: Two Rivers, Wisconsin

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature: Robert J. Mottl
Print Name: Robert J. Mottl
Firm: STS

NOTE: See instructions for more information including a list of county codes and well type codes.

State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION

Form 4400-122 Rev. 7-98

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☒

Page 1 of 1

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Point Beach Nuclear Plant		MW-6

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
STS - J. Wagner STS Project No. 200704405	8/28/2007	8/28/2007	hollow stem auger

WI Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
	VT-638	MW-6	Feet MSL	619.7 Feet MSL	8.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 370,780 N, 263,935 E S/C/N
1/4 of 1/4 of Section 24, T 21 N, R 24 E
Lat ___ ° ___ ' ___ "
Long ___ ° ___ ' ___ "
Local Grid Location ☐ N ☐ E Feet ☐ S Feet ☐ W

Facility ID	County	County Code	Civil Town/City/ or Village
	Manitowoc	36	Two Creeks

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 20	10		Topsoil										
			2	Possible fill/Disturbed: Brown silty sand and gravel - medium dense - dry										
2 SS	24 13	14												
			4											
3 SS	24 12	12												
			6	Possible Fill: Reddish-brown silty clay (CL) - trace fine gravel - stiff - (10YR 4/3)	CL									
4 SS	24 22	14												
			8	Possible Fill: Brown fine to coarse sand and gravel (SW) - medium dense - wet - no recovery due to blow in so blind-drilled from 15 to 20 feet										
5 SS	24 13	21												
			10											
6 SS	24 13	11												
			12											
7 SS	24 6	9												
			14		SW									
			16											
			18											
			20	Dark brown silty clay (CL) - trace medium gravel - very stiff	CL									
8 SS	24 12	108												
			22											
				End of Boring. Boring advanced from 0.0 feet to 20.0 feet with 4 1/4-inch ID hollow-stem auger and to 22.0 feet with split-spoon. Installed 2-inch diameter Schedule 40 PVC monitoring well at 19.0 feet with 2 foot stickup.										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm	
Robert J. Mott	STS 1035 Kepler Drive Green Bay, Wisconsin 54311	Tel: 920-468-1978 Fax: 920-468-3312

This form is authorized by Chapters 281, 283, 289, 291, 292, 293, 295, and 299, Wis. Stats. Completion of this form is mandatory. Failure to file this form may result in forfeiture of between $10 and $25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be be used for any other purpose. NOTE: See instructions for more information, including where the completed form should be sent.

State of Wisconsin
Department of Natural Resources

Route To: Watershed/Wastewater ☐ Waste Management ☐ Remediation/Redevelopment ☐ Other ☐

MONITORING WELL CONSTRUCTION
Form 4400-113A Rev. 7-98

Facility/Project Name: Point Beach Nuclear Plant	Local Grid Location of Well: ____ft. ☐N. ☐S. ____ft. ☐E. ☐W.	Well Name: MW-6
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. ___° ___' ___" Long. ___° ___' ___" or	Wis. Unique Well No. / DNR Well Number: VT-638
Facility ID	St. Plane 370,780 ft. N, 263,935 ft. E. S/C/N	Date Well Installed: 08/28/2007
Type of Well: Observation Well	Section Location of Waste/Source: ___1/4 of ___ 1/4 of Sec. 24, T. 21 N, R. 24 ☒E ☐W	Well Installed By: (Person's Name and Firm): John Wagner, STS
Distance from Waste/Source ft. / Enf. Stds. Apply ☐	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number:

A. Protective pipe, top elevation 621.85 ft. MSL

B. Well casing, top elevation 621.67 ft. MSL

C. Land surface elevation 619.7 ft. MSL

D. Surface seal, bottom 619.1 ft. MSL or 0.6 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☐ MH ☐ CL ☒ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☐ 5 0
Hollow Stem Auger ☒ 4 1
Other ☐ __

15. Drilling fluid used: Water ☒ 0 2 Air ☐ 0 1
Drilling Mud ☐ 0 3 None ☐ 9 9

16. Drilling additives used? ☐ Yes ☒ No
Describe ____

17. Source of water (attach analysis, if required): ____

E. Bentonite seal, top 619.1 ft. MSL or 0.6 ft.

F. Fine sand, top 615.9 ft. MSL or 3.8 ft.

G. Filter pack, top 615.9 ft. MSL or 3.8 ft.

H. Screen joint, top 615.7 ft. MSL or 4.0 ft.

I. Well bottom 600.7 ft. MSL or 19.0 ft.

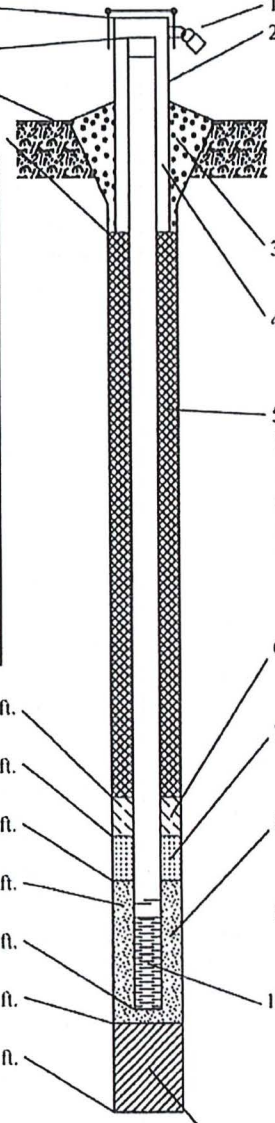
J. Filter pack, bottom 600.7 ft. MSL or 19.0 ft.

K. Borehole, bottom 597.7 ft. MSL or 22.0 ft.

L. Borehole, diameter 8.0 in.

M. O.D. well casing 2.25 in.

N. I.D. well casing 2.00 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
a. Inside diameter: 4.0 in.
b. Length: 7.0 ft.
c. Material: Steel ☒ 0 4 Other ☐ __
d. Additional protection? ☒ Yes ☐ No
If yes, describe: steel bumper posts
3. Surface seal: Bentonite ☐ 3 0 Concrete ☒ 0 1 Other ☐ __
4. Material between well casing and protective pipe: Bentonite ☒ 3 0 Other ☐ __
5. Annular space seal: a. Granular/Chipped Bentonite ☒ 3 3
b. ____Lbs/gal mud weight . . . Bentonite-sand slurry ☐ 3 5
c. ____Lbs/gal mud weight . . . Bentonite slurry ☐ 3 1
d. ____% Bentonite . . . Bentonite-cement grout ☐ 5 0
e. ____ft^3 volume added for any of the above
f. How installed: Tremie ☐ 0 1 Tremie pumped ☐ 0 2 Gravity ☒ 0 8
6. Bentonite seal: a. Bentonite granules ☒ 3 3
b. ☐ 1/4 in. ☐ 3/8 in. ☐ 1/2 in. Bentonite chips ☐ 3 2
c. ____ Other ☐ __
7. Fine sand material: Manufacturer, product name & mesh size
a. Badger 45-55
b. Volume added ____ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
a. Badger 45-55
b. Volume added 5 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ 2 3 Flush threaded PVC schedule 80 ☐ 2 4 Other ☐ __
10. Screen material: PVC
a. Screen Type: Factory cut ☒ 1 1 Continuous slot ☐ 0 1 Other ☐ __
b. Manufacturer Bufffalo
c. Slot size: 0.006 in.
d. Slotted length: 15.0 ft.
11. Backfill material (below filter pack): None ☒ 1 4 Other ☐ __

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Robert J. Mottl	Firm: STS, 1035 Kepler Drive Green Bay, Wisconsin 54311	Tel: 920-468-1978 Fax: 920-468-3312

Please complete both Forms 4400-113A and 4400-113B and return them to the appropriate DNR office and bureau. Completion of these reports is required by chs. 160, 281, 283, 289, 291, 292, 293, 295, and 299, Wis. Stats., and ch. NR 141, Wis. Adm. Code. In accordance with chs. 281, 289, 291, 292, 293, 295, and 299, Wis. Stats., failure to file these forms may result in a forfeiture of between $10 and $25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on these forms is not intended to be used for any other purpose. NOTE: See the instructions for more information, including where the completed forms should be sent.

State of Wisconsin
Department of Natural Resources

MONITORING WELL DEVELOPMENT

Form 4400-113B Rev. 7-98

Route To: Watershed/Wastewater ☐ Waste Management ☐ Remediation/Redevelopment ☒ Other ☐

Facility/Project Name	County	Well Name
Point Beach Nuclear Plant	Manitowoc	MW-6

Facility License, Permit or Monitoring Number	County Code	Wis. Unique Well Number	DNR Well Number
	36		VT-638

1. Can this well be purged dry? ☒ Yes ☐ No

2. Well development method:
   - surged with bailer and bailed ☒ 41
   - surged with bailer and pumped ☐ 61
   - surged with block and bailed ☐ 42
   - surged with block and pumped ☐ 62
   - surged with block, bailed, and pumped ☐ 70
   - compressed air ☐ 20
   - bailed only ☐ 10
   - pumped only ☐ 51
   - pumped slowly ☐ 50
   - other _____ ☐ __

3. Time spent developing well 30.0 min.

4. Depth of well (from top of well casing) 21.0 ft.

5. Inside diameter of well 2.00 in.

6. Volume of water in filter pack and well casing 8.0 gal.

7. Volume of water removed from well 20.0 gal.

8. Volume of water added (if any) <10.0 gal.

9. Source of water added _____

10. Analysis performed on water added? ☐ Yes ☒ No
(If yes, attach results)

		Before Development	After Development
11. Depth to Water (from top of well casing)	a.	8.50 ft.	20.00 ft.
Date	b.	8/29/2007	8/29/2007
Time	c.	12:00 ☒ a.m. ☐ p.m.	12:00 ☒ a.m. ☐ p.m.
12. Sediment in well bottom		inches	inches
13. Water clarity		Clear ☐ 10 Turbid ☒ 15 (Describe)	Clear ☒ 20 Turbid ☐ 25 (Describe)

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids	mg/l	mg/l
15. COD	mg/l	mg/l

16. Well developed by: Person's Name and Firm
Robert Mottl
STS

17. Additional comments on development:
City of Green Bay water was used to flush out hollow-stem auger because of wet sand blow-in into auger. Majority of water recovered. A sample of flush water given to PBNP.

Facility Address or Owner/Responsible Party Address

Name: Lynn Rogers
Firm: Point Beach Nuclear Plant
Street: Nuclear Road
City/State/Zip: Two Rivers, Wisconsin

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature: Robert J. Mottl
Print Name: Robert J. Mottl
Firm: STS

NOTE: See instructions for more information including a list of county codes and well type codes.

Appendix B

Field Hydraulic Conductivity Analysis Calculations & Data (23 pages)

Point Beach Nuclear Power Plant
Field Hydraulic Conductivity Analysis: **Well MW-1 - Line 1**
Bouwer & Rice Method
Partially Penetrating Well in an Unconfined Aquifer

	ft	cm	
r_c	0.085	2.6	Radius of Well Casing
r_w	0.34	10.4	Radius of Borehole/Well
L_w	16.3	496.8	Vertical Distance from Static Water Level to Bottom of Well
L_e	15	457.2	Vertical Length of Saturated Filter Pack
H	20	609.6	Vertical Distance from Static Water Level to Impermeable Boundary
n	0.3	0.3	Filter Pack Porosity
r_{eq}	0.20	6.08	Equivalent Casing Radius
y_o	4.2	128.0	Change in Water Level at Time 0
y_t	2.57	78.3	Change in Water Level at Time t
t	240	240	Time which Corresponds to y_t (sec)
A	2.7	2.7	Well Geometry Parameter (dimensionless)
B	0.5	0.5	Well Geometry Parameter (dimensionless)
Part1	0.284	0.284	Portion of $\ln(R_e/r_w)$ Calculation
Part2	0.088	0.088	Portion of $\ln(R_e/r_w)$ Calculation
$\ln(R_e/r_w)$	2.685	2.685	
	(ft/sec)	(cm/sec)	
K	**7.3E-06**	**2.2E-04**	**Hydraulic Conductivity**

Where:

$$K = r_{eq}^2 * \ln(R_e/r_w)/2L_e * 1/t * \ln(y_o/y_t)$$

$$\ln(R_e/r_w) = \{1.1/\ln(L_w/r_w) + [A+B\ln[(H-L_w)/r_w]]/(L_e/r_w)\}^{-1}$$

$$\ln(R_e/r_w) = \{\text{"Part 1"} + \text{"Part 2"}\}^{-1}$$

Calculated by: Bob Mottl (5/27/08)

Checked by:

Point Beach Nuclear Power Plant
Field Hydraulic Conductivity Analysis: **Well MW-1 - Line 2**
Bouwer & Rice Method
Partially Penetrating Well in an Unconfined Aquifer

	ft	cm	
r_c	0.085	2.6	Radius of Well Casing
r_w	0.34	10.4	Radius of Borehole/Well
L_w	16.3	496.8	Vertical Distance from Static Water Level to Bottom of Well
L_e	15	457.2	Vertical Length of Saturated Filter Pack
H	20	609.6	Vertical Distance from Static Water Level to Impermeable Boundary
n	0.3	0.3	Filter Pack Porosity
r_{eq}	0.20	6.08	Equivalent Casing Radius
y_o	1.9	57.9	Change in Water Level at Time 0
y_t	1.72	52.4	Change in Water Level at Time t
t	750	750	Time which Corresponds to y_t (sec)
A	2.7	2.7	Well Geometry Parameter (dimensionless)
B	0.5	0.5	Well Geometry Parameter (dimensionless)
Part1	0.284	0.284	Portion of $\ln(R_e/r_w)$ Calculation
Part2	0.088	0.088	Portion of $\ln(R_e/r_w)$ Calculation
$\ln(R_e/r_w)$	2.685	2.685	
	(ft/sec)	(cm/sec)	
K	**4.7E-07**	**1.4E-05**	**Hydraulic Conductivity**

Where:

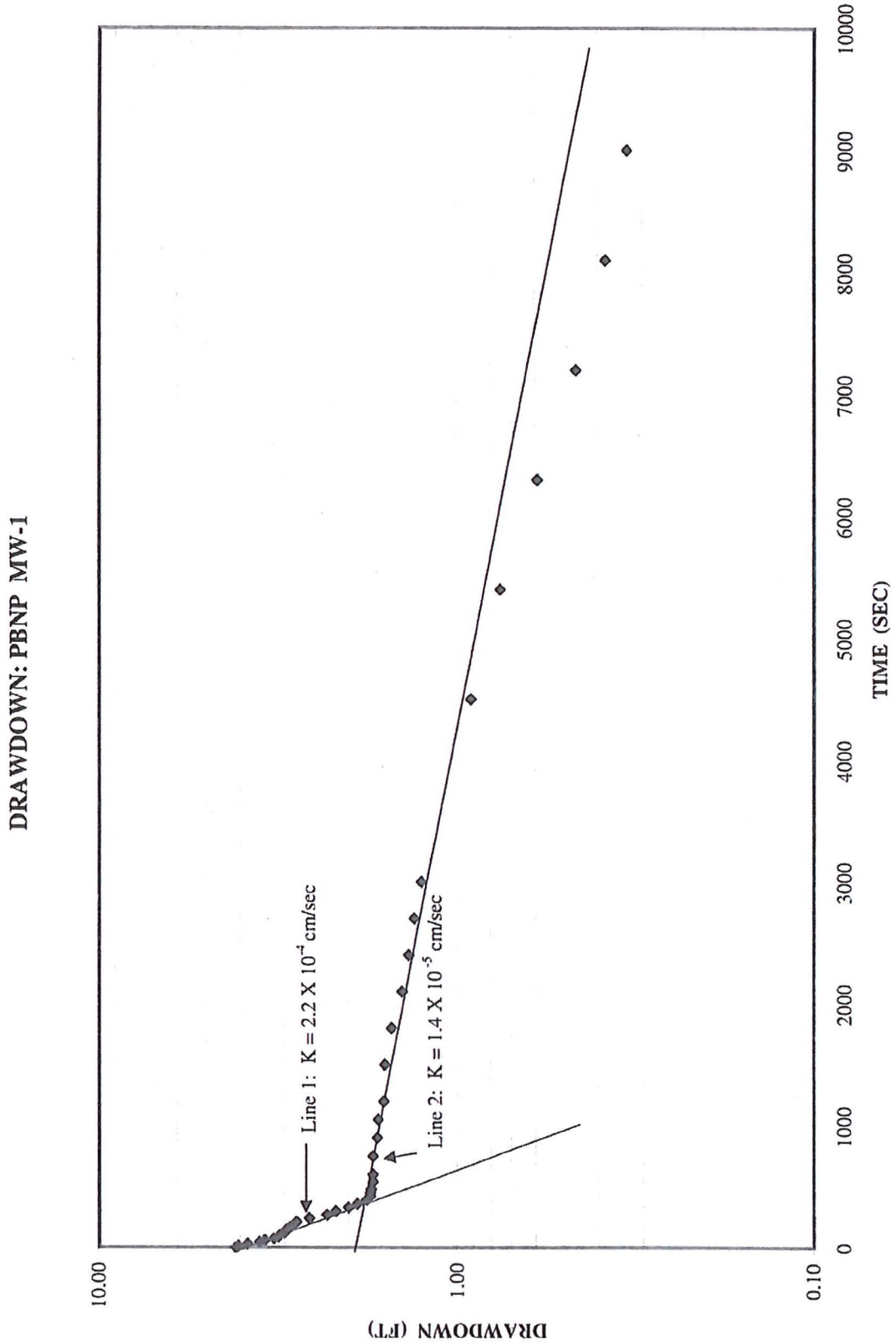
$$K = r_{eq}^2 * \ln(R_e/r_w)/2L_e * 1/t * \ln(y_o/y_t)$$

$$\ln(R_e/r_w) = \{1.1/\ln(L_w/r_w) + [A+B\ln[(H-L_w)/r_w]]/(L_e/r_w)\}^{-1}$$

$$\ln(R_e/r_w) = \{\text{"Part 1"} + \text{"Part 2"}\}^{-1}$$

Calculated by: Bob Mottl (5/27/08)

Checked by:


DRAWDOWN: PBNP MW-1
Line 1: K = 2.2 X 10^-4 cm/sec
Line 2: K = 1.4 X 10^-5 cm/sec
DRAWDOWN (FT)
10.00
1.00
0.10
TIME (SEC)
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000

PBNPP Water Level Measurements MW-1 (5/21/08)

static water table = 5.93

time (decimal minutes)	*time* (seconds)	*water level* (feet)	*drawdown* (feet)
	1	10.05	4.12
0.25	15	9.98	4.05
0.50	30	9.75	3.82
0.75	45	9.47	3.54
1.00	60	9.35	3.42
1.25	75	9.15	3.22
1.50	90	9.06	3.13
1.75	105	9.03	3.10
2.00	120	8.95	3.02
2.25	135	8.91	2.98
2.50	150	8.90	2.97
2.75	165	8.84	2.91
3.00	180	8.79	2.86
3.50	210	8.72	2.79
4.00	240	8.50	2.57
4.50	270	8.23	2.30
5.00	300	8.11	2.18
5.50	330	7.94	2.01
6.00	360	7.83	1.90
6.50	390	7.72	1.79
7.00	420	7.68	1.75
7.50	450	7.68	1.75
8.00	480	7.67	1.74
9.00	540	7.65	1.72
10.00	600	7.65	1.72
12.50	750	7.65	1.72
15.00	900	7.60	1.67
17.50	1050	7.59	1.66
20.00	1200	7.53	1.60
25.00	1500	7.52	1.59
30.00	1800	7.45	1.52
35.00	2100	7.35	1.42
40.00	2400	7.29	1.36
45.00	2700	7.24	1.31
50.00	3000	7.18	1.25

Point Beach Nuclear Power Plant
Field Hydraulic Conductivity Analysis: **Well MW-2 - Line 1**
Bouwer & Rice Method
Partially Penetrating Well in an Unconfined Aquifer

	ft	cm	
r_c	0.085	2.6	Radius of Well Casing
r_w	0.34	10.4	Radius of Borehole/Well
L_w	21.1	643.1	Vertical Distance from Static Water Level to Bottom of Well
L_e	15	457.2	Vertical Length of Saturated Filter Pack
H	23	701.0	Vertical Distance from Static Water Level to Impermeable Boundary
n	0.3	0.3	Filter Pack Porosity
r_{eq}	0.20	6.08	Equivalent Casing Radius
y_o	7.7	234.7	Change in Water Level at Time 0
y_t	6.43	196.0	Change in Water Level at Time t
t	900	900	Time which Corresponds to y_t (sec)
A	3.4	3.4	Well Geometry Parameter (dimensionless)
B	0.5	0.5	Well Geometry Parameter (dimensionless)
Part1	0.266	0.266	Portion of $\ln(R_e/r_w)$ Calculation
Part2	0.097	0.097	Portion of $\ln(R_e/r_w)$ Calculation
$\ln(R_e/r_w)$	2.755	2.755	
	(ft/sec)	(cm/sec)	
K	**7.3E-07**	**2.2E-05**	**Hydraulic Conductivity**

Where:

$$K = r_{eq}^2 * \ln(R_e/r_w)/2L_e * 1/t * \ln(y_o/y_t)$$

$$\ln(R_e/r_w) = \{1.1/\ln(L_w/r_w) + [A+B\ln[(H-L_w)/r_w]]/(L_e/r_w)\}^{-1}$$

$$\ln(R_e/r_w) = \{\text{"Part 1"} + \text{"Part 2"}\}^{-1}$$

Calculated by: Bob Mottl (5/27/08)

Checked by:

Point Beach Nuclear Power Plant
Field Hydraulic Conductivity Analysis: **Well MW-2 - Line 2**
Bouwer & Rice Method
Partially Penetrating Well in an Unconfined Aquifer

	ft	cm	
r_c	0.085	2.6	Radius of Well Casing
r_w	0.34	10.4	Radius of Borehole/Well
L_w	21	640.1	Vertical Distance from Static Water Level to Bottom of Well
L_e	15	457.2	Vertical Length of Saturated Filter Pack
H	23	701.0	Vertical Distance from Static Water Level to Impermeable Boundary
n	0.3	0.3	Filter Pack Porosity
r_{eq}	0.20	6.08	Equivalent Casing Radius
y_o	4.3	131.1	Change in Water Level at Time 0
y_t	2.59	78.9	Change in Water Level at Time t
t	7200	7200	Time which Corresponds to y_t (sec)
A	3.4	3.4	Well Geometry Parameter (dimensionless)
B	0.5	0.5	Well Geometry Parameter (dimensionless)
Part1	0.267	0.267	Portion of $\ln(R_e/r_w)$ Calculation
Part2	0.097	0.097	Portion of $\ln(R_e/r_w)$ Calculation
$\ln(R_e/r_w)$	2.748	2.748	
	(ft/sec)	(cm/sec)	
K	**2.6E-07**	**7.8E-06**	**Hydraulic Conductivity**

Where:

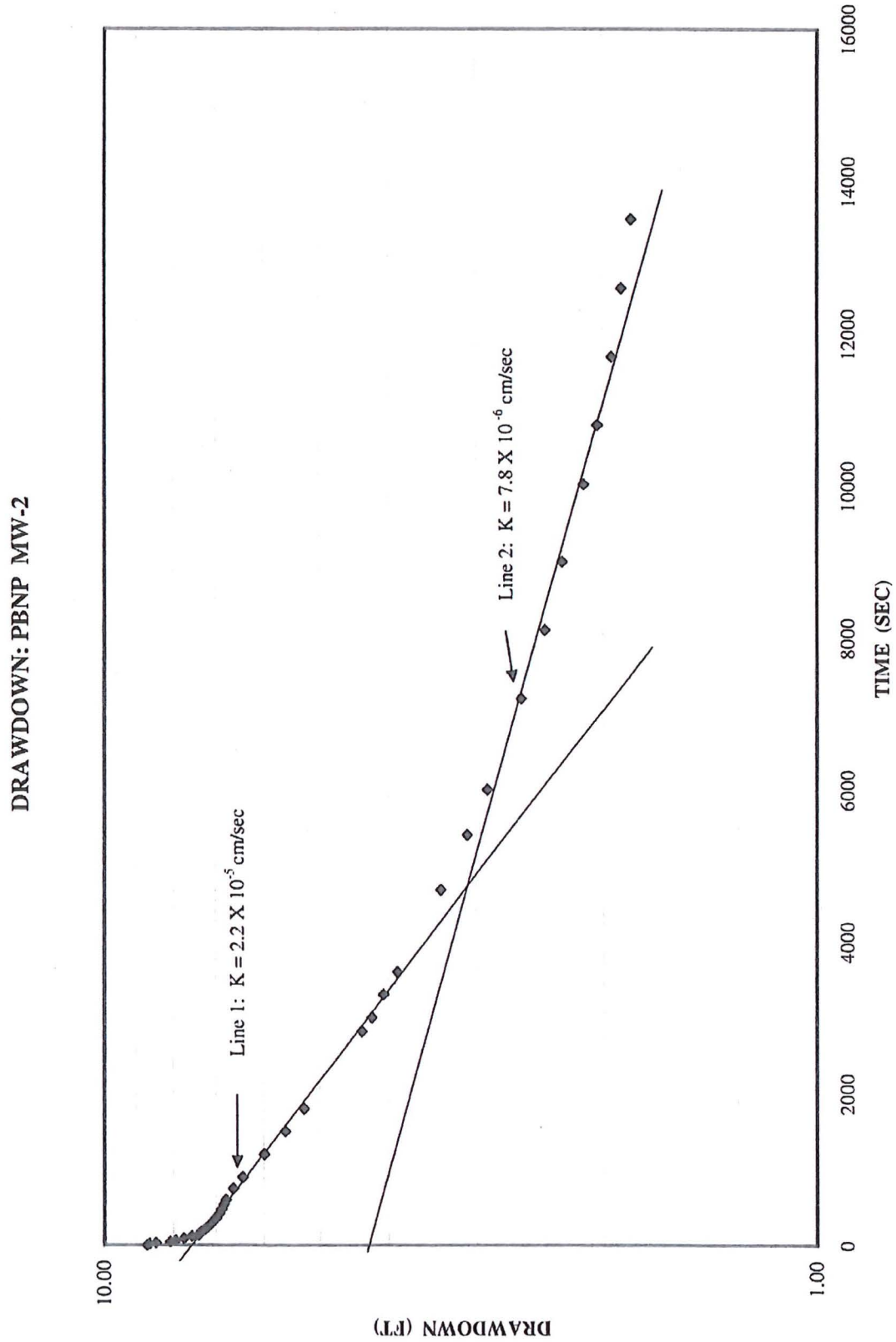
$$K = r_{eq}^2 * \ln(R_e/r_w)/2L_e * 1/t * \ln(y_o/y_t)$$

$$\ln(R_e/r_w) = \{1.1/\ln(L_w/r_w) + [A+B\ln[(H-L_w)/r_w]]/(L_e/r_w)\}^{-1}$$

$$\ln(R_e/r_w) = \{\text{"Part 1"} + \text{"Part 2"}\}^{-1}$$

Calculated by: Bob Mottl (5/27/08)

Checked by:


DRAWDOWN: PBNP MW-2
Line 1: K = 2.2 X 10^-5 cm/sec
Line 2: K = 7.8 X 10^-6 cm/sec
10.00
1.00
DRAWDOWN (FT)
0
2000
4000
6000
8000
10000
12000
14000
16000
TIME (SEC)

PBNPP Water Level Measurements MW-2 (5/20/08)

static water table = 3.96

time (decimal minutes)	*time* (seconds)	*water level* (feet)	*drawdown* (feet)
	1	12.65	8.69
0.25	15	12.58	8.62
0.50	30	12.41	8.45
0.75	45	12.03	8.07
1.00	60	11.90	7.94
1.50	90	11.70	7.74
2.00	120	11.50	7.54
2.50	135	11.35	7.39
3.00	180	11.29	7.33
3.50	210	11.21	7.25
4.00	240	11.15	7.19
5.00	300	11.05	7.09
6.00	360	10.96	7.00
7.00	420	10.89	6.93
8.00	480	10.84	6.88
9.00	540	10.79	6.83
10.00	600	10.75	6.79
12.50	750	10.59	6.63
15.00	900	10.39	6.43
20.00	1200	9.95	5.99
25.00	1500	9.56	5.60
30.00	1800	9.23	5.27
47.00	2820	8.33	4.37
50.00	3000	8.19	4.23
55.00	3300	8.03	4.07
60.00	3600	7.85	3.89
78.00	4680	7.33	3.37
90.00	5400	7.05	3.09
100.00	6000	6.85	2.89
120.00	7200	6.55	2.59
135.00	8100	6.36	2.40
150.00	9000	6.23	2.27
167.00	10020	6.08	2.12
180.00	10800	5.99	2.03
195.00	11700	5.90	1.94
210.00	12600	5.84	1.88
225.00	13500	5.78	1.82
990.00	59400	4.83	0.87 (8:00 am on 5/21/08)

Point Beach Nuclear Power Plant
Field Hydraulic Conductivity Analysis: **Well MW-3 - Line 1**
Bouwer & Rice Method
Partially Penetrating Well in an Unconfined Aquifer

	ft	cm	
r_c	0.085	2.6	Radius of Well Casing
r_w	0.34	10.4	Radius of Borehole/Well
L_w	20.86	635.8	Vertical Distance from Static Water Level to Bottom of Well
L_e	15	457.2	Vertical Length of Saturated Filter Pack
H	23	701.0	Vertical Distance from Static Water Level to Impermeable Boundary
n	0.3	0.3	Filter Pack Porosity
r_{eq}	0.20	6.08	Equivalent Casing Radius
y_o	11	335.3	Change in Water Level at Time 0
y_t	7.88	240.2	Change in Water Level at Time t
t	270	270	Time which Corresponds to y_t (sec)
A	2.7	2.7	Well Geometry Parameter (dimensionless)
B	0.48	0.48	Well Geometry Parameter (dimensionless)
Part1	0.267	0.267	Portion of $\ln(R_e/r_w)$ Calculation
Part2	0.081	0.081	Portion of $\ln(R_e/r_w)$ Calculation
$\ln(R_e/r_w)$	2.870	2.870	
	(ft/sec)	(cm/sec)	
K	**4.7E-06**	**1.4E-04**	**Hydraulic Conductivity**

Where:

$$K = r_{eq}^2 * \ln(R_e/r_w)/2L_e * 1/t * \ln(y_o/y_t)$$

$$\ln(R_e/r_w) = \{1.1/\ln(L_w/r_w) + [A+B\ln[(H-L_w)/r_w]]/(L_e/r_w)\}^{-1}$$

$$\ln(R_e/r_w) = \{\text{"Part 1"} + \text{"Part 2"}\}^{-1}$$

Calculated by: Bob Mottl (5/27/08)

Checked by:

Point Beach Nuclear Power Plant
Field Hydraulic Conductivity Analysis: **Well MW-3 - Line 2**
Bouwer & Rice Method
Partially Penetrating Well in an Unconfined Aquifer

	ft	cm	
r_c	0.085	2.6	Radius of Well Casing
r_w	0.34	10.4	Radius of Borehole/Well
L_w	20.86	635.8	Vertical Distance from Static Water Level to Bottom of Well
L_e	15	457.2	Vertical Length of Saturated Filter Pack
H	23	701.0	Vertical Distance from Static Water Level to Impermeable Boundary
n	0.3	0.3	Filter Pack Porosity
r_{eq}	0.20	6.08	Equivalent Casing Radius
y_o	7.4	225.6	Change in Water Level at Time 0
y_t	5.52	168.2	Change in Water Level at Time t
t	1200	1200	Time which Corresponds to y_t (sec)
A	2.7	2.7	Well Geometry Parameter (dimensionless)
B	0.48	0.48	Well Geometry Parameter (dimensionless)
Part1	0.267	0.267	Portion of $\ln(R_e/r_w)$ Calculation
Part2	0.081	0.081	Portion of $\ln(R_e/r_w)$ Calculation
$\ln(R_e/r_w)$	2.870	2.870	
	(ft/sec)	(cm/sec)	
K	**9.3E-07**	**2.8E-05**	**Hydraulic Conductivity**

Where:

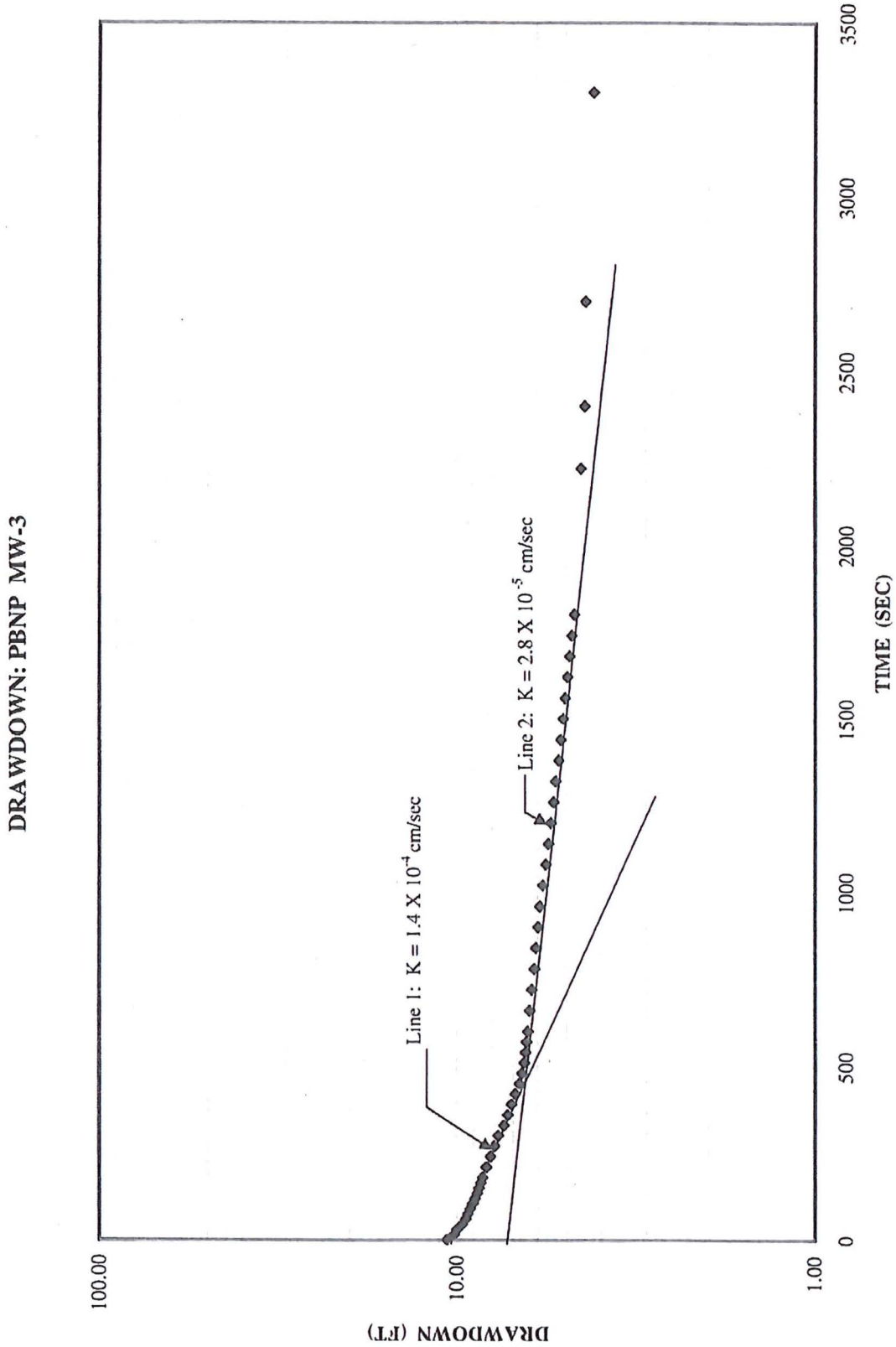
$$K = r_{eq}^2 * \ln(R_e/r_w)/2L_e * 1/t * \ln(y_o/y_t)$$

$$\ln(R_e/r_w) = \{1.1/\ln(L_w/r_w) + [A+B\ln[(H-L_w)/r_w]]/(L_e/r_w)\}^{-1}$$

$$\ln(R_e/r_w) = \{\text{"Part 1"} + \text{"Part 2"}\}^{-1}$$

Calculated by: Bob Mottl (5/27/08)

Checked by:


DRAWDOWN: PBNP MW-3
Line 1: K = 1.4 X 10^-4 cm/sec
Line 2: K = 2.8 X 10^-5 cm/sec
DRAWDOWN (FT)
100.00
10.00
1.00
TIME (SEC)
0
500
1000
1500
2000
2500
3000
3500

PBNPP Water Level Measurements MW-3 (5/20/08)

static water table = 3.26

time (decimal minutes)	*time* (seconds)	*water level* (feet)	*drawdown* (feet)
	1	13.90	10.64
0.25	15	13.45	10.19
0.50	30	13.25	9.99
0.75	45	12.93	9.67
1.00	60	12.71	9.45
1.25	75	12.58	9.32
1.50	90	12.43	9.17
1.75	105	12.29	9.03
2.00	120	12.17	8.91
2.25	135	12.04	8.78
2.50	150	11.95	8.69
2.75	165	11.85	8.59
3.00	180	11.75	8.49
3.50	210	11.55	8.29
4.00	240	11.33	8.07
4.50	270	11.14	7.88
5.00	300	10.95	7.69
5.50	330	10.68	7.42
6.00	360	10.50	7.24
6.50	390	10.33	7.07
7.00	420	10.17	6.91
7.50	450	9.99	6.73
8.00	480	9.88	6.62
8.50	510	9.79	6.53
9.00	540	9.74	6.48
9.50	570	9.69	6.43
10.00	600	9.64	6.38
11.00	660	9.57	6.31
12.00	720	9.48	6.22
13.00	780	9.39	6.13
14.00	840	9.33	6.07
15.00	900	9.24	5.98
16.00	960	9.18	5.92
17.00	1020	9.07	5.81
18.00	1080	8.96	5.70
19.00	1140	8.87	5.61
20.00	1200	8.78	5.52
21.00	1260	8.69	5.43
22.00	1320	8.62	5.36
23.00	1380	8.51	5.25
24.00	1440	8.44	5.18
25.00	1500	8.36	5.10
26.00	1560	8.30	5.04
27.00	1620	8.22	4.96
28.00	1680	8.15	4.89
29.00	1740	8.08	4.82
30.00	1800	8.00	4.74
37.00	2220	7.80	4.54
40.00	2400	7.69	4.43
45.00	2700	7.65	4.39
55.00	3300	7.43	4.17

Appendix F Groundwater Monitoring Data and Plots

TABLE F-1
TRITIUM WELL GW-11 (MW-1)

Collection Date	Tritium (pCi/L)	Error (±) [pCi/L]	MDL (pCi/L)	Collection Date	Tritium (pCi/L)	Error (±) [pCi/L]	MDL (pCi/L)
28-Jan-2008	85	± 95	<174	23-Dec-2011	60	± 79	<144
29-Feb-2008	24	± 89	<178	26-Jan-2012	24	± 74	<146
26-Mar-2008	138	± 93	<180	21-May-2012	37	± 79	<147
30-Apr-2008	45	± 80	<156	20-Jun-2012	149	± 81	<152
29-May-2008	108	± 77	<145	18-Sep-2012	1	± 82	<157
24-Jun-2008	124	± 91	<172	23-Oct-2012	-1	± 78	<158
29-Jul-2008	97	± 82	<147	18-Feb-2013	115	± 77	<143
27-Aug-2008	86	± 80	<152	21-May-2013	128	± 83	<146
30-Sep-2008	67	± 96	<154	1-Aug-2013	82	± 84	<152
22-Oct-2008	106	± 85	<151	23-Oct-2013	87	± 78	<149
19-Nov-2008	-1	± 72	<145	4-Feb-2014	66	± 70	<137
23-Dec-2008	46	± 72	<133	30-Jun-2014	133	± 72	<134
23-Jan-2009	105	± 81	<152	22-Jul-2014	61	± 76	<138
26-Feb-2009	108	± 81	<151	21-Oct-2014	66	± 90	<176
30-Mar-2009	123	± 98	<152	21-Jan-2015	-10	± 96	<196
16-Apr-2009	90	± 83	<157	24-Apr-2015	-72	± 80	<159
26-May-2009	7	± 81	<162	9-Jul-2015	130	± 82	<143
17-Jun-2009	76	± 82	<149	19-Oct-2015	108	± 76	<141
30-Jul-2009	82	± 75	<149				
17-Aug-2009	149	± 80	<145	Min	-72		
16-Sep-2009	50	± 78	<152	Max	181		
5-Nov-2009	41	± 96	<155	Ave	79		
21-Nov-2009	145	± 96	<147				
23-Dec-2009	140	± 103	<161				
22-Jan-2010	59	± 96	<153				
26-Feb-2010	55	± 75	<146				
18-Mar-2010	92	± 96	<152				
23-Apr-2010	60	± 80	<147				
26-May-2010	149	± 79	<143				
25-Jun-2010	82	± 88	<160				
29-Jul-2010	11	± 84	<159				
19-Aug-2010	105	± 82	<154				
24-Sep-2010	101	± 82	<159				
19-Oct-2010	181	± 90	<154				
22-Nov-2010	131	± 82	<144				
20-Dec-2010	46	± 82	<161				
27-Jan-2011	31	± 73	<144				
23-Feb-2011	102	± 79	<152				
27-Mar-2011	168	± 85	<146				
9-Apr-2011	95	± 79	<141				
8-May-2011	105	± 80	<141				
28-Jun-2011	116	± 78	<144				
19-Jul-2011	22	± 77	<144				
24-Aug-2011	18	± 73	<150				
25-Sep-2011	90	± 91	<166				
9-Oct-2011	31	± 79	<147				
25-Nov-2011	101	± 90	<162				

FIGURE F-1
TRITIUM IN GROUNDWATER
GW-11 (MW-1)

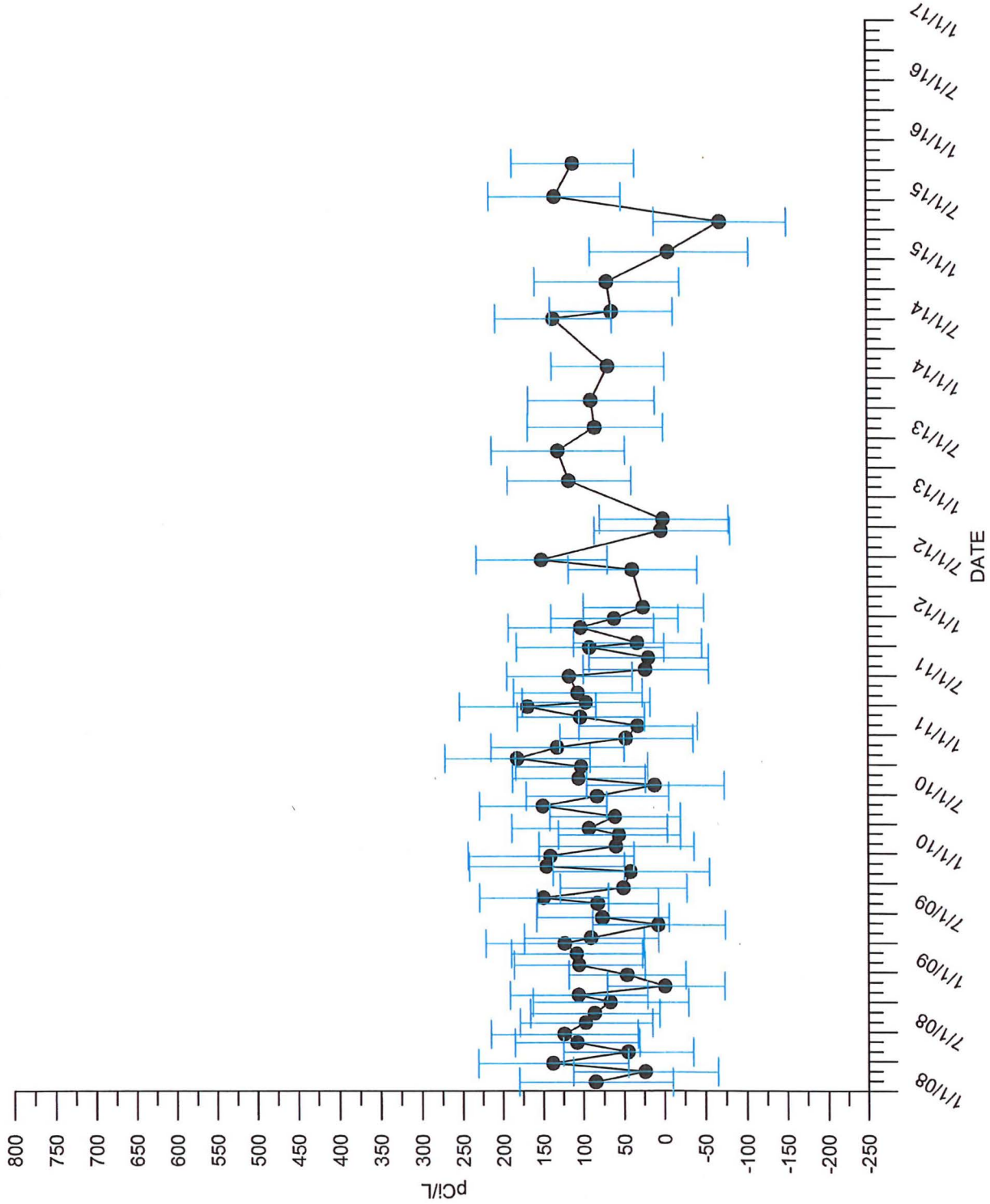


TABLE F-2
TRITIUM WELL GW-12 (MW-2)

Collection Date	Tritium (pCi/L)	Error (±) [pCi/L]	MDL (pCi/L)	Collection Date	Tritium (pCi/L)	Error (±) [pCi/L]	MDL (pCi/L)
28-Jan-2008	-35	± 90	<174	23-Dec-2011	37	± 78	<144
29-Feb-2008	-64	± 85	<178	26-Jan-2012	-42	± 70	<146
26-Mar-2008	2	± 87	<180	21-May-2012	-35	± 75	<147
30-Apr-2008	-51	± 75	<156	20-Jun-2012	-12	± 72	<152
29-May-2008	-19	± 71	<145	18-Sep-2012	-64	± 79	<157
24-Jun-2008	46	± 87	<172	23-Oct-2012	-6	± 78	<158
28-Jul-2008	39	± 79	<147	18-Feb-2013	6	± 71	<143
27-Aug-2008	-24	± 74	<152	21-May-2013	90	± 81	<146
30-Sep-2008	-16	± 93	<154	1-Aug-2013	-22	± 79	<152
22-Oct-2008	-27	± 78	<151	23-Oct-2013	-14	± 73	<149
19-Nov-2008	-14	± 71	<145	8-Apr-2014	-8	± 65	<136
23-Dec-2008	85	± 74	<133	22-Jul-2014	-61	± 69	<138
23-Jan-2009	59	± 78	<152	21-Oct-2014	49	± 89	<176
26-Feb-2009	14	± 76	<151	24-Apr-2015	-168	± 75	<159
30-Mar-2009	60	± 79	<152	9-Jul-2015	54	± 78	<143
16-Apr-2009	-51	± 75	<157	19-Oct-2015	12	± 71	<141
26-May-2009	-74	± 76	<162				
17-Jun-2009	3	± 78	<149	Min	-168		
30-Jul-2009	12	± 71	<149	Max	90		
17-Aug-2009	-25	± 70	<145	Ave	1		
16-Sep-2009	-19	± 74	<152				
5-Nov-2009	43	± 96	<155				
21-Nov-2009	60	± 92	<147				
23-Dec-2009	38	± 99	<161				
22-Jan-2010	-27	± 92	<153				
26-Feb-2010	2	± 73	<146				
18-Mar-2010	15	± 93	<152				
23-Apr-2010	-9	± 77	<147				
26-May-2010	68	± 75	<143				
25-Jun-2010	34	± 86	<160				
29-Jul-2010	-8	± 83	<159				
19-Aug-2010	-4	± 76	<154				
24-Sep-2010	31	± 78	<159				
19-Oct-2010	18	± 82	<154				
22-Nov-2010	-69	± 72	<144				
20-Dec-2010	-88	± 75	<161				
27-Jan-2011	66	± 75	<144				
23-Feb-2011	12	± 74	<152				
27-Mar-2011	39	± 79	<146				
9-Apr-2011	0	± 74	<141				
8-May-2011	2	± 74	<141				
28-Jun-2011	46	± 74	<144				
19-Jul-2011	-26	± 74	<144				
24-Aug-2011	78	± 81	<146				
25-Sep-2011	-23	± 86	<166				
9-Oct-2011	5	± 77	<147				
25-Nov-2011	69	± 89	<162				

FIGURE F-2
TRITIUM IN GROUNDWATER
GW-12 (MW-2)

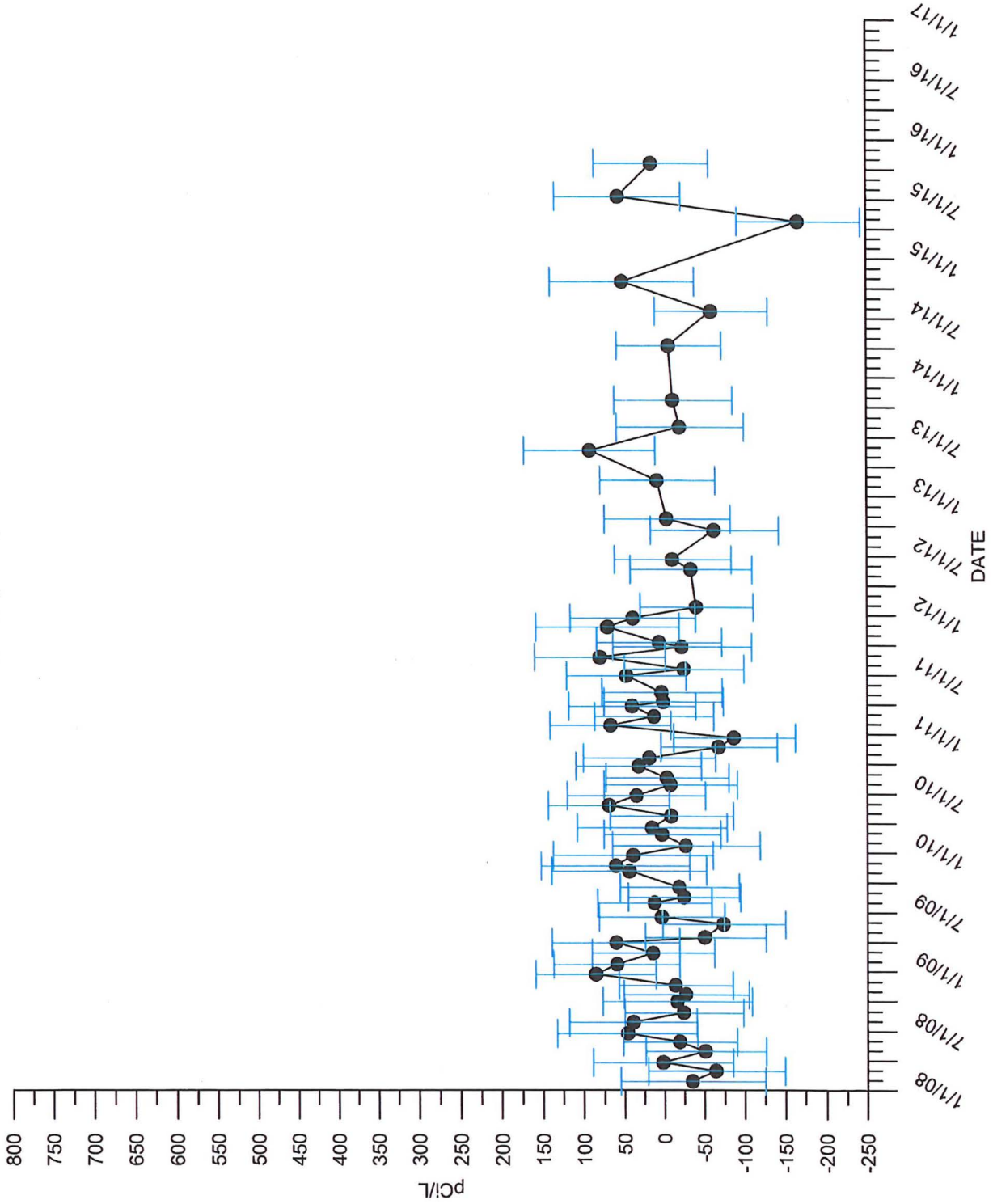


TABLE F-3
TRITIUM WELL GW-13 (MW-6)

Collection Date	Tritium (pCi/L)	Error (±) [pCi/L]	MDL (pCi/L)
28-Jan-2008	110	±96	<174
29-Feb-2008	66	±91	<178
26-Mar-2008	108	±91	<180
30-Apr-2008	-8	±77	<156
29-May-2008	125	±78	<145
24-Jun-2008	102	±90	<172
28-Jul-2008	74	±78	<150
27-Aug-2008	104	±81	<152
30-Sep-2008	16	±94	<154
22-Oct-2008	12	±80	<151
19-Nov-2008	-1	±72	<145
23-Dec-2008	79	±74	<133
23-Jan-2009	36	±77	<152
26-Feb-2009	60	±78	<151
30-Mar-2009	131	±83	<152
16-Apr-2009	103	±83	<157
26-May-2009	66	±84	<162
17-Jun-2009	116	±84	<149
30-Jul-2009	137	±78	<149
17-Aug-2009	82	±76	<145
16-Sep-2009	52	±78	<152
5-Nov-2009	94	±98	<155
21-Nov-2009	93	±93	<147
23-Dec-2009	127	±103	<161
22-Jan-2010	57	±96	<153
26-Feb-2010	43	±75	<146
18-Mar-2010	27	±93	<152
23-Apr-2010	98	±82	<147
26-May-2010	212	±82	<143
25-Jun-2010	80	±88	<160
29-Jul-2010	57	±86	<159
19-Aug-2010	41	±79	<154
24-Sep-2010	103	±82	<159
19-Oct-2010	108	±87	<154
22-Nov-2010	81	±80	<144
20-Dec-2010	88	±84	<161
27-Jan-2011	92	±76	<144
23-Feb-2011	86	±78	<152
27-Mar-2011	114	±82	<146
9-Apr-2011	103	±79	<141
8-May-2011	86	±79	<141
28-Jun-2011	15	±72	<144
19-Jul-2011	22	±77	<144
24-Aug-2011	105	±78	<150
25-Sep-2011	15	±88	<166
9-Oct-2011	-7	±77	<147
25-Nov-2011	69	±89	<162
23-Dec-2011	82	±80	<144
26-Jan-2012	36	±75	<146
21-May-2012	105	±83	<147
20-Jun-2012	43	±76	<152
18-Sep-2012	32	±84	<157
23-Oct-2012	-33	±77	<158
18-Feb-2013	12	±71	<143
21-May-2013	84	±81	<146
1-Aug-2013	106	±85	<152
23-Oct-2013	-5	±73	<149
4-Feb-2014	32	±68	<137
8-Apr-2014	69	±69	<136
22-Jul-2014	81	±77	<138
21-Oct-2014	38	±89	<176
21-Jan-2015	-83	±91	<196
24-Apr-2015	-145	±76	<159
9-Jul-2015	159	±83	<143
19-Oct-2015	134	±77	<141
Min	-145		
Max	212		
Ave	67		

FIGURE F-3
TRITIUM IN GROUNDWATER
GW-13 (MW-6)

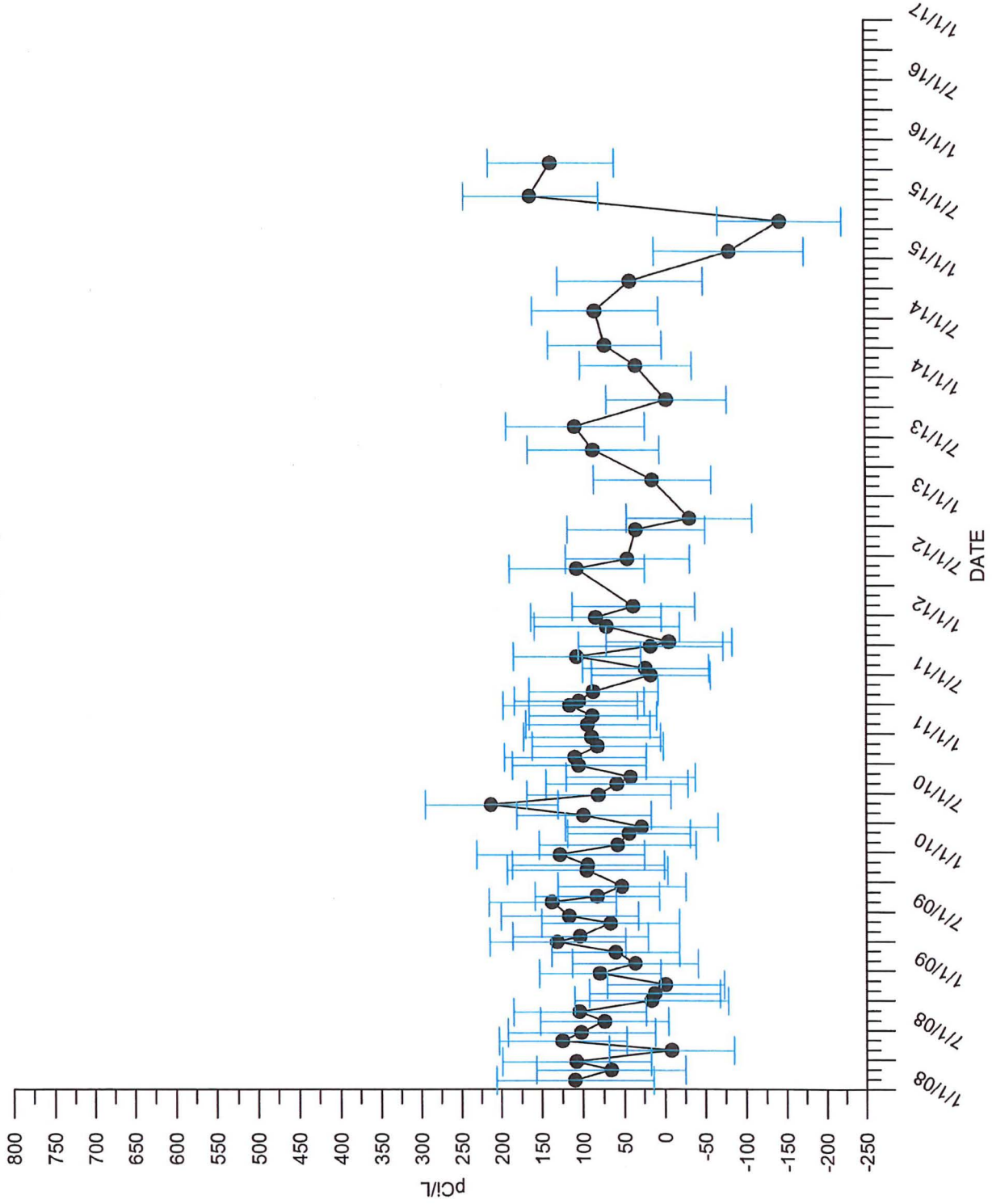


TABLE F-4
TRITIUM WELL GW-14 (MW-5)

Collection Date	Tritium (pCi/L)	Error (±) [pCi/L]	MDL (pCi/L)	Collection Date	Tritium (pCi/L)	Error (±) [pCi/L]	MDL (pCi/L)
29-Jan-2008	96	±96	<174	23-Dec-2011	96	±81	<144
29-Feb-2008	96	±92	<178	26-Jan-2012	71	±76	<146
26-Mar-2008	124	±92	<180	21-May-2012	80	±81	<147
30-Apr-2008	86	±82	<156	20-Jun-2012	134	±81	<152
29-May-2008	189	±81	<145	18-Sep-2012	51	±85	<157
24-Jun-2008	138	±91	<172	23-Oct-2012	26	±80	<158
28-Jul-2008	59	±77	<150	18-Feb-2013	18	±72	<143
27-Aug-2008	96	±81	<152	21-May-2013	151	±84	<146
30-Sep-2008	82	±97	<154	1-Aug-2013	58	±83	<152
22-Oct-2008	52	±82	<151	23-Oct-2013	81	±78	<149
19-Nov-2008	15	±73	<145	4-Feb-2014	96	±72	<137
23-Dec-2008	-1	±70	<133	8-Apr-2014	83	±70	<136
23-Jan-2009	173	±84	<152	22-Jul-2014	112	±79	<138
26-Feb-2009	101	±80	<151	21-Oct-2014	148	±93	<176
30-Mar-2009	150	±84	<152	21-Jan-2015	29	±99	<196
16-Apr-2009	-10	±77	<157	24-Apr-2015	-101	±78	<159
26-May-2009	70	±84	<162	9-Jul-2015	139	±82	<143
17-Jun-2009	50	±81	<149	19-Oct-2015	91	±75	<141
30-Jul-2009	56	±73	<149				
17-Aug-2009	70	±76	<145	Min	-101		
16-Sep-2009	22	±76	<152	Max	198		
5-Nov-2009	174	±101	<155	Ave	86		
21-Nov-2009	114	±94	<147				
23-Dec-2009	144	±103	<161				
22-Jan-2010	19	±94	<153				
26-Feb-2010	141	±80	<146				
18-Mar-2010	17	±93	<152				
23-Apr-2010	142	±85	<147				
26-May-2010	133	±78	<143				
25-Jun-2010	126	±90	<160				
29-Jul-2010	98	±88	<159				
19-Aug-2010	90	±81	<154				
24-Sep-2010	112	±82	<159				
19-Oct-2010	198	±91	<154				
22-Nov-2010	123	±82	<144				
20-Dec-2010	95	±84	<161				
27-Jan-2011	16	±72	<144				
23-Feb-2011	126	±80	<152				
27-Mar-2011	144	±84	<146				
9-Apr-2011	24	±75	<141				
8-May-2011	26	±76	<141				
28-Jun-2011	81	±76	<144				
19-Jul-2011	110	±81	<144				
24-Aug-2011	18	±73	<150				
25-Sep-2011	134	±93	<166				
9-Oct-2011	31	±79	<147				
25-Nov-2011	67	±88	<162				

FIGURE F-4
TRITIUM IN GROUNDWATER
GW-14 (MW-5)

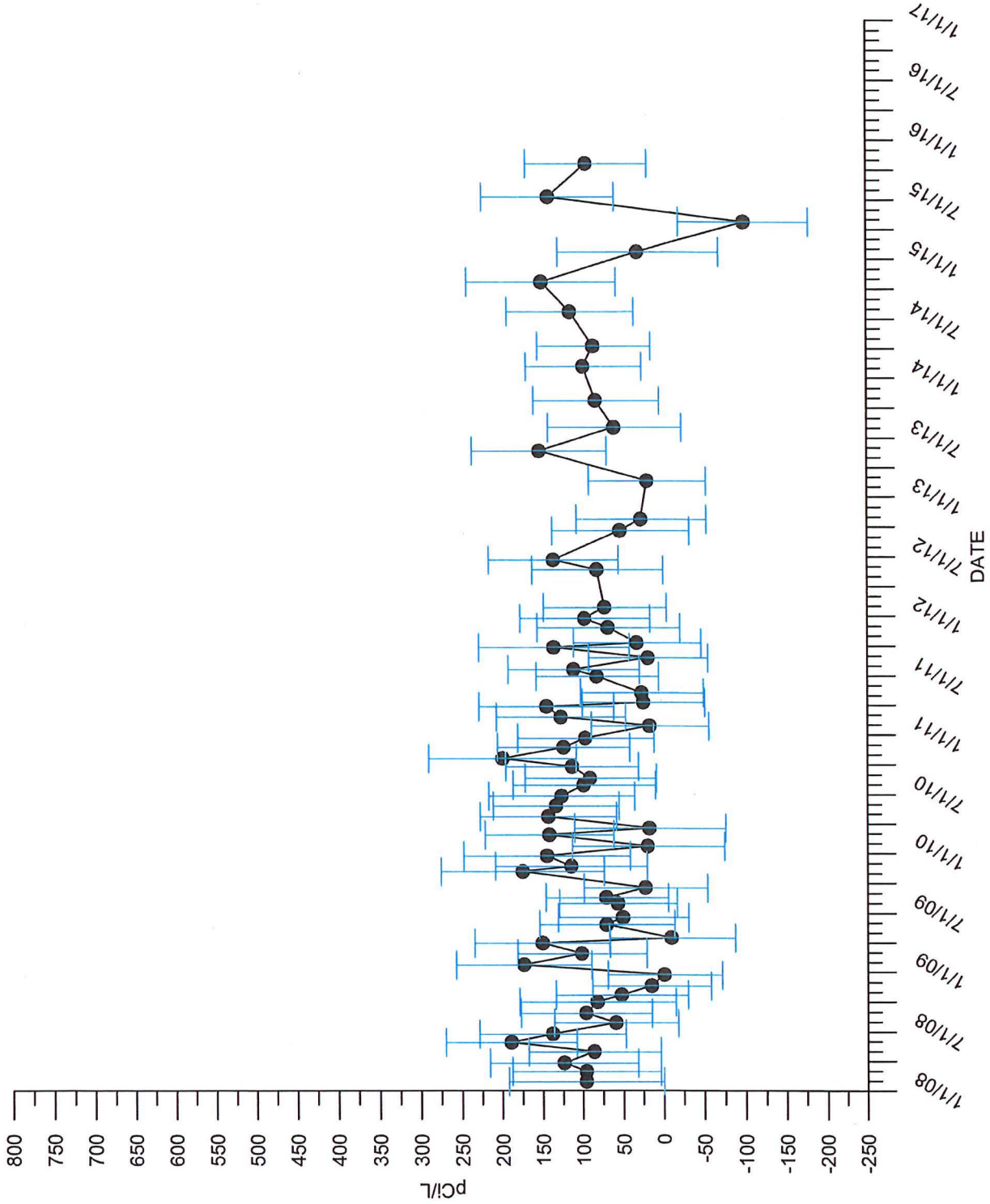


TABLE F-5
TRITIUM WELL GW-15 (MW-4)

Collection Date	Tritium (pCi/L)	Error (±) [pCi/L]	MDL (pCi/L)	Collection Date	Tritium (pCi/L)	Error (±) [pCi/L]	MDL (pCi/L)
28-Jan-2008	456	±109	<174	26-Jan-2012	263	±86	<146
29-Feb-2008	404	±105	<178	21-May-2012	203	±87	<147
26-Mar-2008	450	±105	<180	20-Jun-2012	251	±87	<152
30-Apr-2008	466	±98	<156	18-Sep-2012	244	±94	<157
29-May-2008	450	±93	<145	23-Oct-2012	236	±90	<158
24-Jun-2008	533	±107	<172	18-Feb-2013	278	±84	<143
28-Jul-2008	433	±94	<150	21-May-2013	296	±90	<146
27-Aug-2008	507	±100	<152	1-Aug-2013	252	±92	<152
30-Sep-2008	434	±111	<154	23-Oct-2013	255	±87	<149
22-Oct-2008	542	±104	<151	4-Feb-2014	253	±80	<137
19-Nov-2008	344	±88	<145	8-Apr-2014	250	±79	<136
23-Dec-2008	396	±88	<133	22-Jul-2014	191	±82	<138
23-Jan-2009	423	±96	<152	21-Oct-2014	229	±96	<176
26-Feb-2009	566	±102	<151	21-Jan-2015	131	±105	<196
30-Mar-2009	615	±105	<152	24-Apr-2015	-18	±83	<159
16-Apr-2009	446	±100	<157	9-Jul-2015	284	±89	<143
26-May-2009	379	±99	<162	19-Oct-2015	187	±80	<141
17-Jun-2009	387	±96	<149				
30-Jul-2009	423	±91	<149	Min	-18		
17-Aug-2009	495	±96	<145	Max	615		
16-Sep-2009	452	±97	<152	Ave	358		
5-Nov-2009	410	±109	<155				
21-Nov-2009	503	±110	<147				
23-Dec-2009	452	±114	<161				
28-Jan-2010	422	±96	<152				
26-Feb-2010	386	±92	<146				
18-Mar-2010	374	±108	<152				
23-Apr-2010	359	±95	<147				
26-May-2010	486	±95	<143				
25-Jun-2010	379	±102	<160				
29-Jul-2010	363	±100	<159				
19-Aug-2010	393	±96	<154				
24-Sep-2010	464	±99	<159				
19-Oct-2010	441	±102	<154				
22-Nov-2010	337	±92	<144				
20-Dec-2010	378	±97	<161				
23-Feb-2011	424	±95	<152				
27-Mar-2011	394	±95	<146				
9-Apr-2011	313	±89	<141				
8-May-2011	263	±87	<141				
28-Jun-2011	282	±86	<144				
19-Jul-2011	274	±89	<144				
24-Aug-2011	230	±84	<150				
25-Sep-2011	367	±103	<166				
9-Oct-2011	209	±87	<147				
25-Nov-2011	311	±99	<162				
23-Dec-2011	298	±90	<144				

FIGURE F-5
TRITIUM IN GROUNDWATER
GW-15 (MW-4)

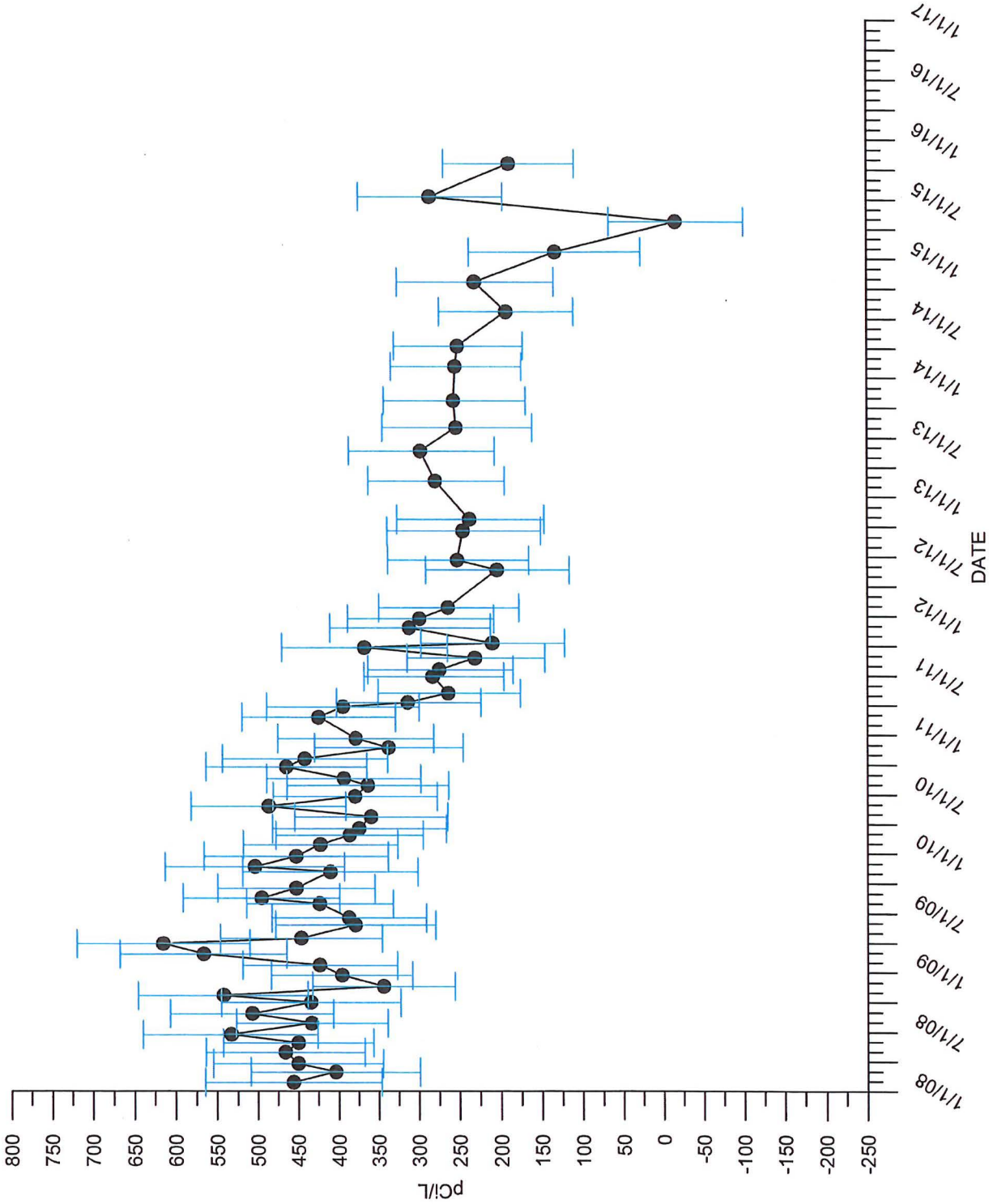


TABLE F-6
TRITIUM WELL GW-16 (MW-3)

Collection Date	Tritium (pCi/L)	Error (±) [pCi/L]	MDL (pCi/L)	Collection Date	Tritium (pCi/L)	Error (±) [pCi/L]	MDL (pCi/L)
29-Feb-2008	204	±97	<178	30-Jun-2014	206	±76	<134
26-Mar-2008	232	±97	<180	22-Jul-2014	234	±85	<138
30-Apr-2008	182	±86	<156	21-Oct-2014	195	±95	<176
29-May-2008	262	±85	<145	21-Jan-2015	147	±106	<196
24-Jun-2008	334	±99	<172	24-Apr-2015	186	±81	<152
28-Jul-2008	198	±84	<150	9-Jul-2015	199	±85	<143
27-Aug-2008	150	±83	<152	19-Oct-2015	179	±80	<141
30-Sep-2008	202	±102	<154				
22-Oct-2008	151	±87	<151	Min	66		
19-Nov-2008	66	±75	<145	Max	382		
23-Dec-2008	213	±80	<133	Ave	215		
23-Jan-2009	131	±82	<152				
30-Mar-2009	382	±95	<152				
16-Apr-2009	244	±91	<157				
26-May-2009	138	±88	<162				
17-Jun-2009	175	±87	<149				
30-Jul-2009	215	±82	<149				
17-Aug-2009	216	±83	<145				
16-Sep-2009	230	±87	<152				
5-Nov-2009	272	±104	<155				
21-Nov-2009	296	±102	<147				
23-Dec-2009	325	±110	<161				
23-Apr-2010	298	±92	<147				
26-May-2010	301	±87	<143				
25-Jun-2010	237	±96	<160				
29-Jul-2010	212	±94	<159				
19-Aug-2010	235	±89	<154				
24-Sep-2010	319	±93	<159				
19-Oct-2010	260	±94	<154				
22-Nov-2010	240	±88	<144				
20-Dec-2010	207	±89	<161				
9-Apr-2011	244	±86	<141				
28-Jun-2011	198	±82	<144				
19-Jul-2011	221	±87	<144				
24-Aug-2011	179	±82	<150				
25-Sep-2011	161	±94	<166				
9-Oct-2011	193	±87	<147				
25-Nov-2011	148	±92	<162				
23-Dec-2011	225	±87	<144				
26-Jan-2012	126	±79	<146				
21-May-2012	152	±85	<147				
20-Jun-2012	207	±84	<152				
18-Sep-2012	208	±92	<157				
23-Oct-2012	253	±91	<158				
21-May-2013	232	±87	<146				
1-Aug-2013	210	±90	<152				
23-Oct-2013	169	±83	<149				

FIGURE F-6
TRITIUM IN GROUNDWATER
GW-16 (MW-3)

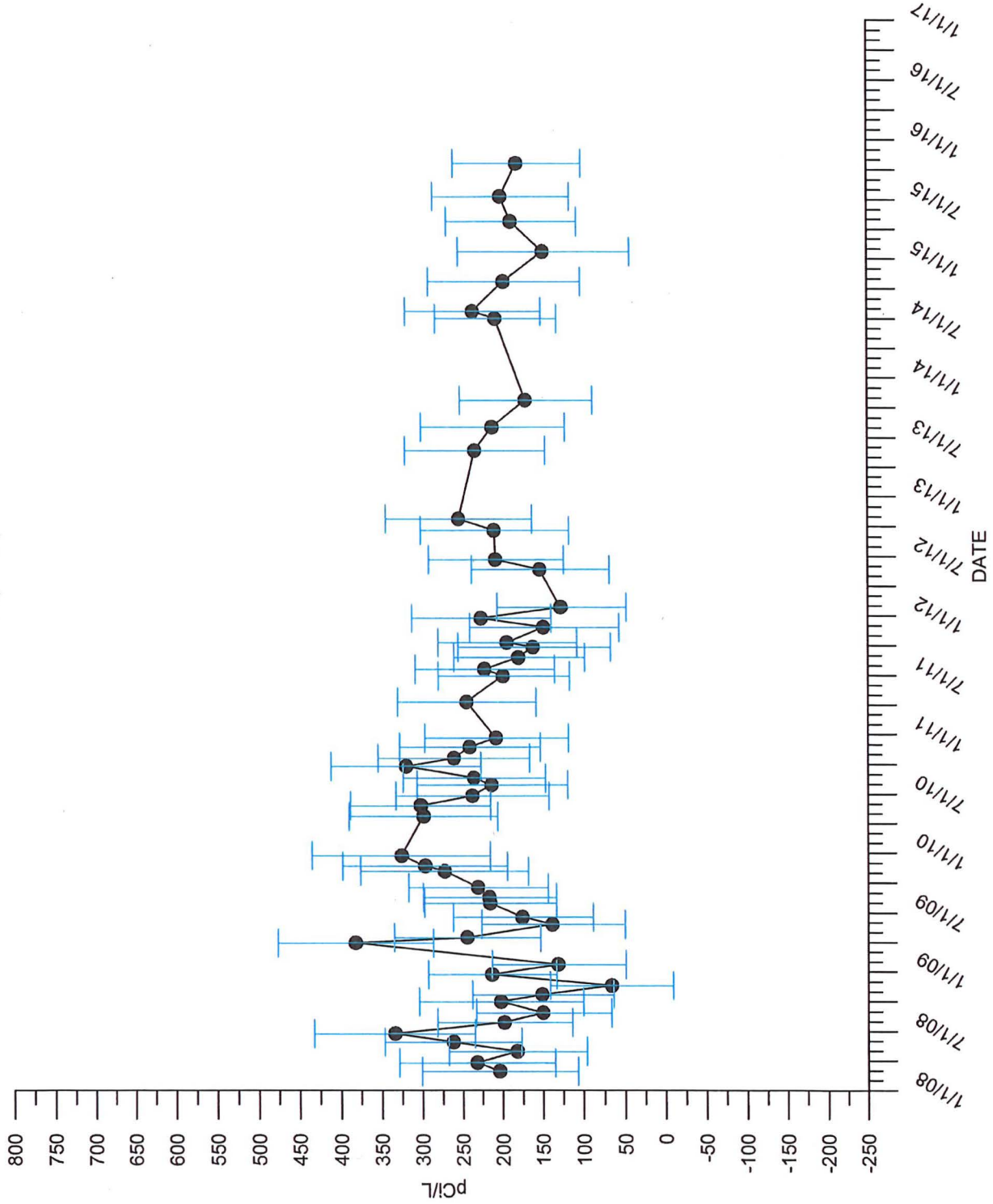


TABLE F-7
TRITIUM EIC SUPPLY WELL GW-04

Collection Date	Tritium (pCi/L)	Error (±) [pCi/L]	MDL (pCi/L)	Collection Date	Tritium (pCi/L)	Error (±) [pCi/L]	MDL (pCi/L)
31-Jan-2008	35	±93	<174	31-May-2012	70	±84	<155
28-Feb-2008	-17	±74	<152	27-Jun-2012	5	±71	<148
27-Mar-2008	-25	±89	<171	24-Jul-2012	-26	±76	<156
23-Apr-2008	-83	±90	<178	29-Aug-2012	-47	±89	<150
30-May-2008	-12	±71	<145	19-Sep-2012	8	±81	<153
25-Jun-2008	30	±86	<172	31-Oct-2012	9	±80	<152
31-Jul-2008	-13	±74	<150	27-Nov-2012	69	±79	<144
3-Sep-2008	-30	±71	<147	19-Dec-2012	-105	±71	<145
24-Sep-2008	-32	±96	<161	31-Jan-2013	-68	±67	<143
30-Oct-2008	81	±80	<153	28-Feb-2013	30	±77	<144
26-Nov-2008	85	±77	<147	28-Mar-2013	-9	±73	<148
30-Dec-2008	121	±106	<168	24-Apr-2013	77	±100	<183
28-Jan-2009	-50	±72	<152	22-May-2013	53	±79	<146
25-Feb-2009	-11	±77	<148	26-Jun-2013	-76	±78	<156
26-Mar-2009	104	±89	<158	1-Aug-2013	-97	±80	<161
29-Apr-2009	47	±81	<158	28-Aug-2013	31	±75	<149
28-May-2009	-9	±83	<158	26-Sep-2013	-4	±75	<143
30-Jul-2009	-23	±69	<149	31-Oct-2013	-58	±76	<150
26-Aug-2009	-26	±72	<147	19-Nov-2013	-46	±76	<150
30-Sep-2009	6	±77	<154	18-Dec-2013	-23	±71	<145
28-Oct-2009	19	±90	<148	22-Jan-2014	-19	±79	<151
25-Nov-2009	45	±81	<149	26-Feb-2014	16	±74	<139
26-Feb-2010	-8	±72	<146	27-Mar-2014	-30	±73	<143
24-Mar-2010	2	±73	<148	30-Apr-2014	17	±71	<145
28-Apr-2010	-25	±72	<149	29-May-2014	45	±73	<143
26-May-2010	82	±75	<143	26-Jun-2014	68	±78	<142
30-Jun-2010	-61	±78	<164	24-Jul-2014	55	±76	<138
29-Jul-2010	28	±85	<159	28-Aug-2014	48	±84	<155
25-Aug-2010	37	±86	<160	1-Oct-2014	-5	±77	<156
29-Sep-2010	8	±85	<160	26-Oct-2014	-39	±85	<175
28-Oct-2010	20	±82	<154	25-Nov-2014	-54	±94	<186
1-Dec-2010	68	±73	<139	30-Dec-2014	99	±93	<169
28-Dec-2010	-5	±71	<144	22-Jan-2015	-78	±90	<192
27-Jan-2011	-33	±66	<138	22-Jan-2015	-39	±72	<142
2-Mar-2011	62	±76	<152	25-Mar-2015	19	±72	<147
30-Mar-2011	47	±79	<146	29-Apr-2015	13	±74	<147
26-Apr-2011	35	±84	<166	20-May-2015	-3	±74	<150
23-May-2011	18	±75	<140	24-Jun-2015	2	±71	<143
29-Jun-2011	-43	±76	<149	23-Jul-2015	48	±77	<143
28-Jul-2011	-5	±84	<171	27-Aug-2015	-24	±70	<145
30-Aug-2011	-27	±90	<150	30-Sep-2015	-101	±67	<147
28-Sep-2011	19	±72	<144	28-Oct-2015	14	±71	<141
27-Oct-2011	33	±76	<142	25-Nov-2015	-25	±70	<144
1-Dec-2011	51	±88	<162	30-Dec-2015	51	±74	<144
28-Dec-2011	23	±77	<144				
26-Jan-2012	-20	±75	<145	Min	-105		
1-Mar-2012	13	±73	<146	Max	121		
28-Mar-2012	-7	±80	<152	Ave	4		
25-Apr-2012	-28	±74	<153				

FIGURE F-7
TRITIUM IN GROUNDWATER
GW-04 (EIC)

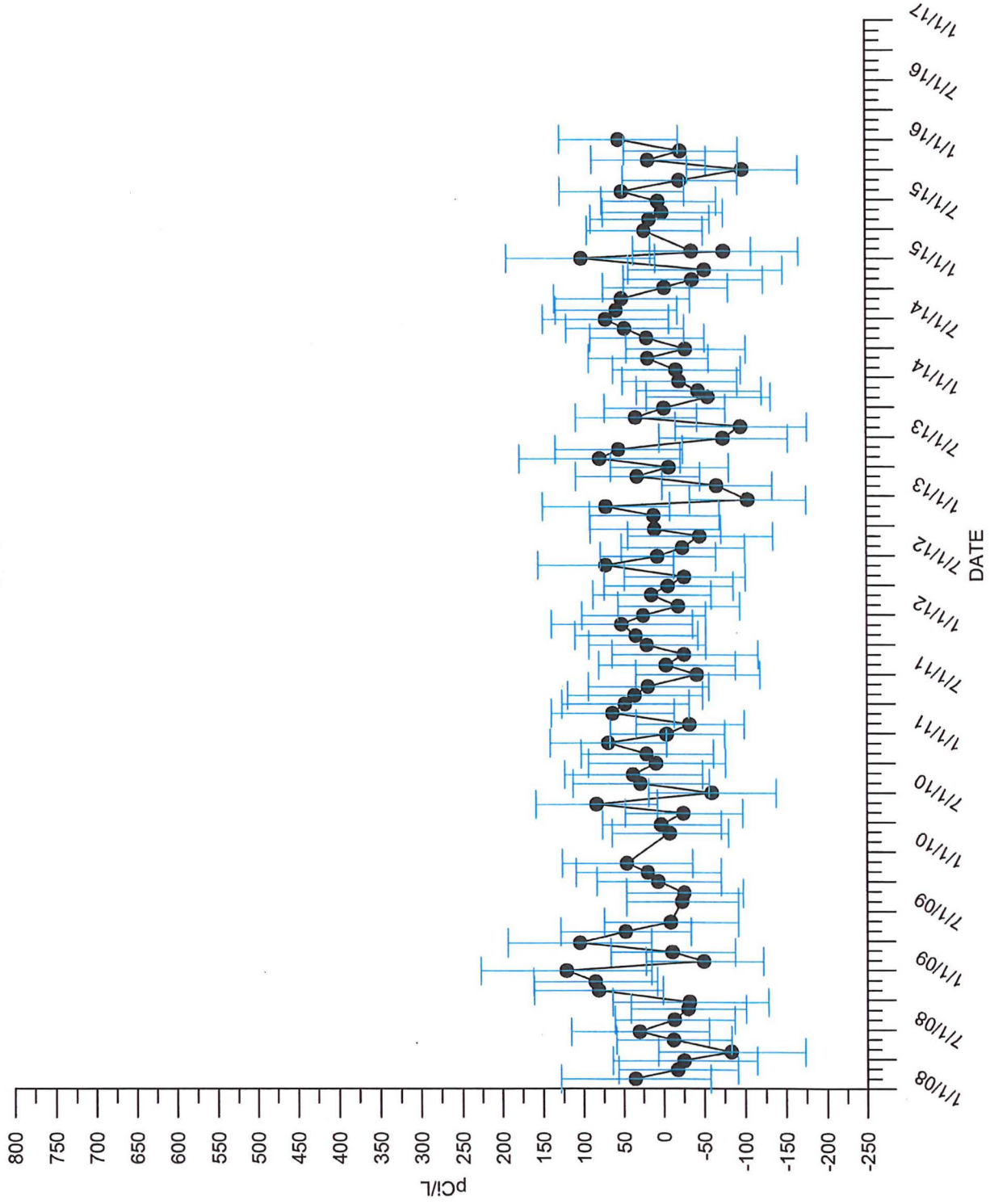


TABLE F-8
TRITIUM WH 6 SUPPLY WELL GW-05

Collection Date	Tritium (pCi/L)	Error (±) [pCi/L]	MDL (pCi/L)
17-Jan-2008	96	±100	<183
1-Apr-2008	63	±82	<151
17-Jul-2008	62	±77	<140
15-Oct-2008	-36	±83	<139
19-Jan-2009	-24	±74	<143
16-Apr-2009	42	±80	<157
2-Jul-2009	-40	±70	<147
15-Jul-2009	-17	±69	<149
17-Oct-2009	-45	±81	<159
13-Jan-2010	-23	±75	<154
15-Apr-2010	-40	±86	<178
15-Jul-2010	11	±55	<105
14-Oct-2010	30	±81	<160
12-Jan-2011	-28	±82	<138
19-Apr-2011	-18	±74	<142
14-Jul-2011	5	±73	<148
13-Oct-2011	2	±76	<145
12-Jan-2012	37	±90	<146
12-Apr-2012	24	±76	<143
12-Jul-2012	11	±78	<147
16-Oct-2012	1	±80	<151
16-Jan-2013	-10	±72	<138
9-Apr-2013	22	±86	<182
10-Jul-2013	1	±75	<150
15-Oct-2013	22	±74	<147
9-Jan-2014	14	±94	<153
16-Apr-2014	-36	±74	<144
10-Jul-2014	-17	±70	<143
15-Oct-2014	-21	±82	<158
15-Jan-2015	36	±102	<165
15-Apr-2015	-47	±76	<158
9-Jul-2015	-44	±91	<154
7-Oct-2015	19	±75	<149
Min	-47		
Max	96		
Ave	2		

FIGURE F-8
TRITIUM IN GROUNDWATER
GW-05 (WH 6)

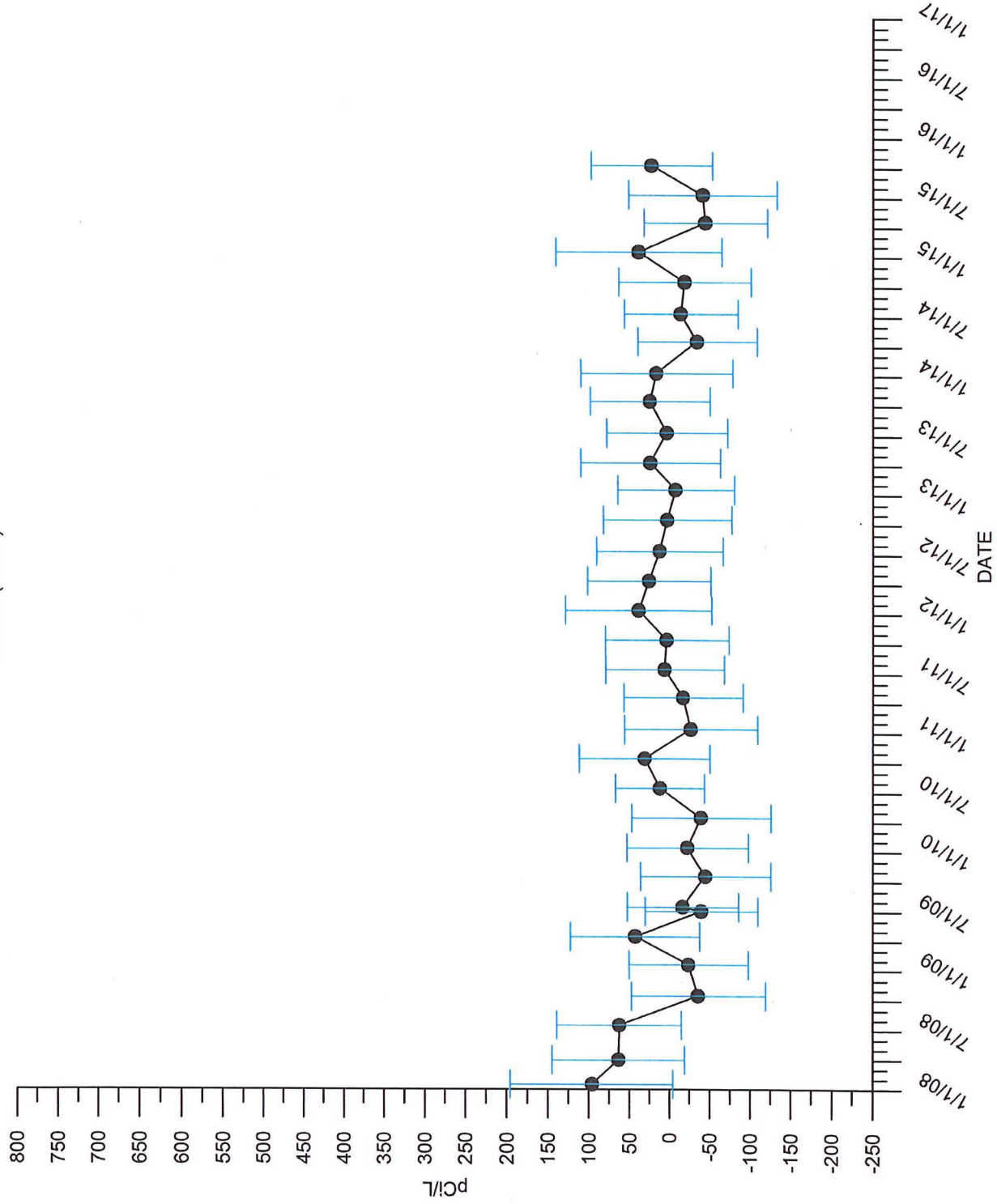


TABLE F-9
TRITIUM SBCC SUPPLY WELL GW-06

Collection Date	Tritium (pCi/L)	Error (±) [pCi/L]	MDL (pCi/L)
17-Jan-2008	26	±97	<183
1-Apr-2008	107	±84	<151
17-Jul-2008	30	±75	<140
15-Oct-2008	-72	±81	<139
19-Jan-2009	-39	±73	<143
16-Apr-2009	35	±80	<157
15-Jul-2009	-9	±69	<149
17-Oct-2009	-56	±81	<159
13-Jan-2010	-36	±75	<154
15-Apr-2010	-73	±85	<178
15-Jul-2010	2	±55	<105
15-Oct-2010	34	±81	<160
12-Jan-2011	-14	±83	<138
19-Apr-2011	-4	±75	<142
14-Jul-2011	41	±75	<148
13-Oct-2011	-63	±73	<145
12-Jan-2012	27	±90	<146
12-Apr-2012	22	±76	<143
12-Jul-2012	32	±79	<147
16-Oct-2012	-32	±78	<151
16-Jan-2013	52	±75	<138
9-Apr-2013	-50	±83	<182
10-Jul-2013	-1	±74	<150
15-Oct-2013	14	±74	<147
9-Jan-2014	30	±94	<153
16-Apr-2014	-6	±75	<144
10-Jul-2014	-21	±70	<143
15-Oct-2014	-28	±81	<158
15-Jan-2015	39	±102	<165
15-Apr-2015	-76	±74	<158
9-Jul-2015	-48	±91	<154
7-Oct-2015	-8	±73	<149
Min	-76		
Max	107		
Ave	-4		

FIGURE F-9
TRITIUM IN GROUNDWATER
GW-06 (SBCC)

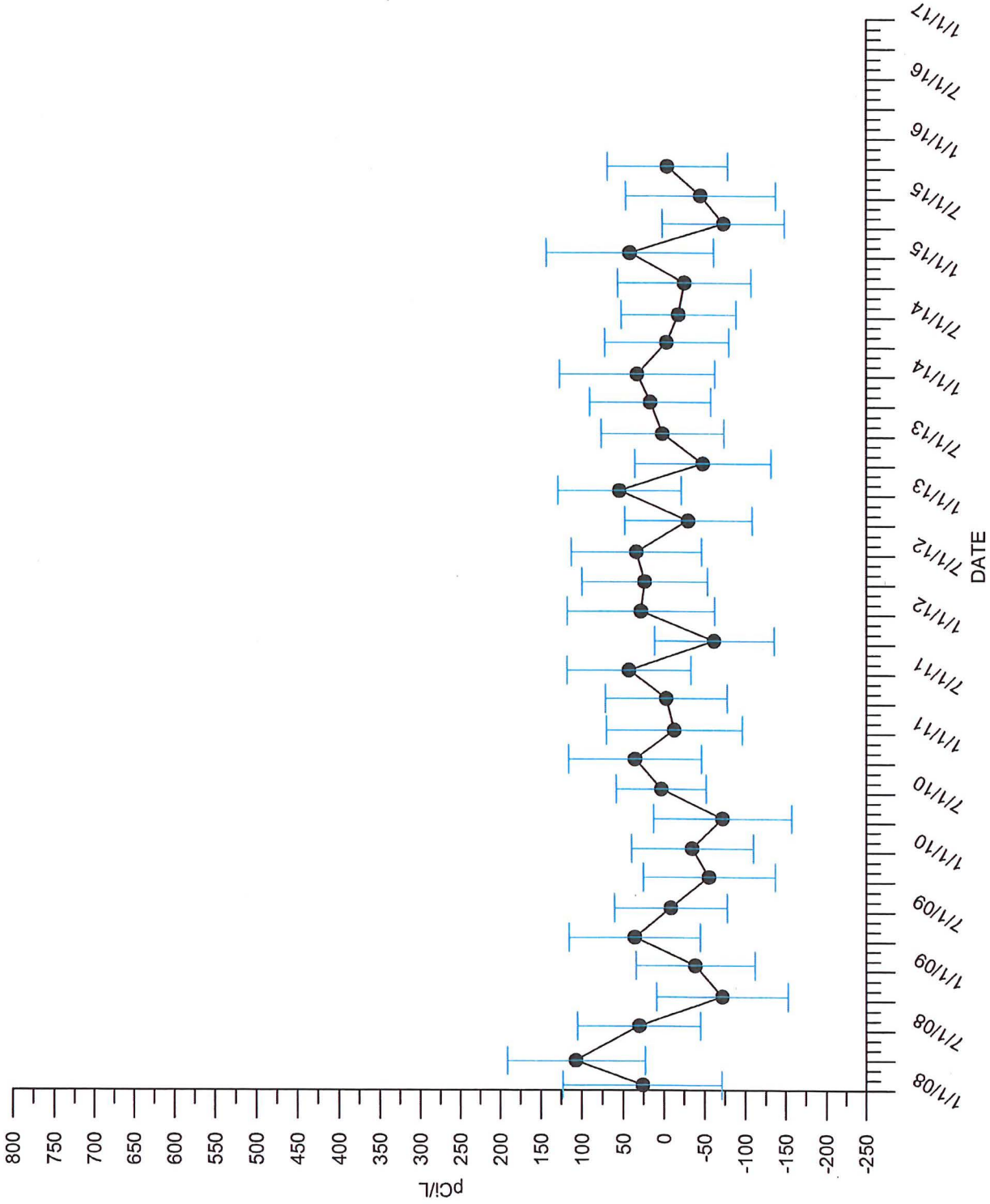


TABLE F-10
TRITIUM FACADE WELL GW-09A

Collection Date	Tritium (pCi/L)	Error (±) [pCi/L]	MDL (pCi/L)	Collection Date	Tritium (pCi/L)	Error (±) [pCi/L]	MDL (pCi/L)
13-Dec-2007	1331	±128	<154	11-Apr-2013	255	±90	<149
20-Apr-2008	1169	±122	<151	1-Jun-2013	278	±87	<148
11-Jul-2008	1066	±118	<147	21-Jun-2013	189	±93	<161
26-Oct-2008	929	±117	<154	3-Jul-2013	223	±88	<148
14-Apr-2009	780	±114	<159	1-Aug-2013	214	±89	<150
1-Jun-2009	705	±113	<154	26-Sep-2013	99	±98	<155
17-Jun-2009	633	±106	<150	31-Oct-2013	257	±91	<148
8-Jul-2009	466	±99	<147	22-Nov-2013	240	±84	<145
11-Aug-2009	548	±114	<151	17-Dec-2013	169	±78	<142
17-Sep-2009	535	±100	<152	15-Mar-2014	325	±91	<143
21-Oct-2009	468	±110	<150	6-Apr-2014	28	±72	<146
26-Nov-2009	678	±122	<158	25-Jun-2014	258	±84	<144
14-Dec-2009	474	±112	<152	16-Jul-2014	301	±83	<136
27-Jan-2010	393	±106	<147	19-Aug-2014	322	±96	<151
3-Feb-2010	462	±99	<147	17-Nov-2014	375	±106	<170
21-Mar-2010	404	±106	<145	27-Feb-2015	307	±91	<151
11-Apr-2010	359	±104	<144	12-Apr-2015	287	±107	<183
17-May-2010	333	±88	<143	8-Aug-2015	253	±87	<150
8-Jul-2010	356	±99	<156	15-Oct-2015	346	±88	<141
7-Sep-2010	442	±98	<159				
16-Sep-2010	318	±93	<159	Min	28		
28-Nov-2010	402	±90	<141	Max	1342		
19-Dec-2010	274	±85	<144	Ave	387		
7-Feb-2011	372	±93	<141				
28-Mar-2011	248	±87	<142				
16-Apr-2011	373	±92	<142				
20-May-2011	227	±93	<138				
29-Jun-2011	228	±87	<144				
26-Jul-2011	246	±99	<146				
23-Aug-2011	172	±94	<142				
9-Oct-2011	262	±97	<140				
24-Nov-2011	178	±85	<144				
27-Jan-2012	154	±79	<142				
7-Mar-2012	282	±89	<142				
30-Mar-2012	257	±98	<143				
4-May-2012	212	±91	<154				
1-Jun-2012	158	±85	<147				
11-Jul-2012	404	±94	<142				
1-Sep-2012	1342	±135	<157				
29-Sep-2012	191	±103	<184				
11-Nov-2012	263	±88	<152				
18-Nov-2012	150	±86	<151				
29-Dec-2012	255	±85	<138				
29-Jan-2013	288	±90	<146				
28-Feb-2013	308	±91	<146				
27-Mar-2013	324	±93	<149				

TABLE F-11
TRITIUM FACADE WELL GW-09B

Collection Date	Tritium (pCi/L)	Error (±) [pCi/L]	MDL (pCi/L)	Collection Date	Tritium (pCi/L)	Error (±) [pCi/L]	MDL (pCi/L)
20-Apr-2008	210	±87	<154	11-Apr-2013	204	±88	<149
20-Apr-2008	62	±78	<151	1-Jun-2013	102	±78	<148
11-Jul-2008	83	±81	<147	21-Jun-2013	93	±89	<161
26-Oct-2008	102	±82	<154	3-Jul-2013	125	±84	<148
14-Apr-2009	165	±87	<159	1-Aug-2013	130	±85	<150
1-Jun-2009	232	±93	<154	26-Sep-2013	168	±101	<155
17-Jun-2009	58	±82	<150	31-Oct-2013	122	±84	<148
8-Jul-2009	32	±79	<147	22-Nov-2013	230	±84	<145
11-Aug-2009	94	±96	<151	17-Dec-2013	143	±76	<142
17-Sep-2009	-50	±72	<152	15-Mar-2014	143	±83	<143
21-Oct-2009	182	±97	<146	6-Apr-2014	131	±77	<146
26-Nov-2009	201	±105	<158	25-Jun-2014	328	±88	<144
14-Dec-2009	83	±96	<152	16-Jul-2014	224	±80	<136
27-Jan-2010	111	±94	<147	19-Aug-2014	82	±84	<151
3-Feb-2010	193	±87	<147	17-Nov-2014	219	±96	<170
21-Mar-2010	144	±95	<145	27-Feb-2015	147	±83	<151
11-Apr-2010	90	±92	<144	12-Apr-2015	91	±100	<183
17-May-2010	118	±78	<143	8-Aug-2015	50	±77	<150
8-Jul-2010	133	±89	<156	15-Oct-2015	51	±73	<141
7-Sep-2010	94	±81	<159				
16-Sep-2010	136	±84	<159	Min	-50		
28-Nov-2010	132	±77	<141	Max	354		
19-Dec-2010	116	±77	<144	Ave	134		
7-Feb-2011	224	±86	<141				
28-Mar-2011	48	±77	<142				
16-Apr-2011	164	±83	<142				
20-May-2011	136	±89	<138				
29-Jun-2011	114	±82	<144				
26-Jul-2011	66	±91	<146				
23-Aug-2011	87	±90	<142				
9-Oct-2011	13	±78	<147				
24-Nov-2011	98	±83	<148				
27-Jan-2012	54	±74	<142				
7-Mar-2012	63	±78	<142				
30-Mar-2012	100	±91	<143				
4-May-2012	48	±83	<154				
1-Jun-2012	41	±79	<147				
11-Jul-2012	354	±92	<142				
1-Sep-2012	345	±99	<157				
29-Sep-2012	166	±103	<184				
11-Nov-2012	57	±78	<152				
18-Nov-2012	158	±87	<151				
29-Dec-2012	160	±81	<138				
29-Jan-2013	308	±91	<146				
28-Feb-2013	259	±89	<146				
27-Mar-2013	128	±85	<149				

FIGURE F-10
TRITIUM IN GROUNDWATER
GW-09 (A&B)

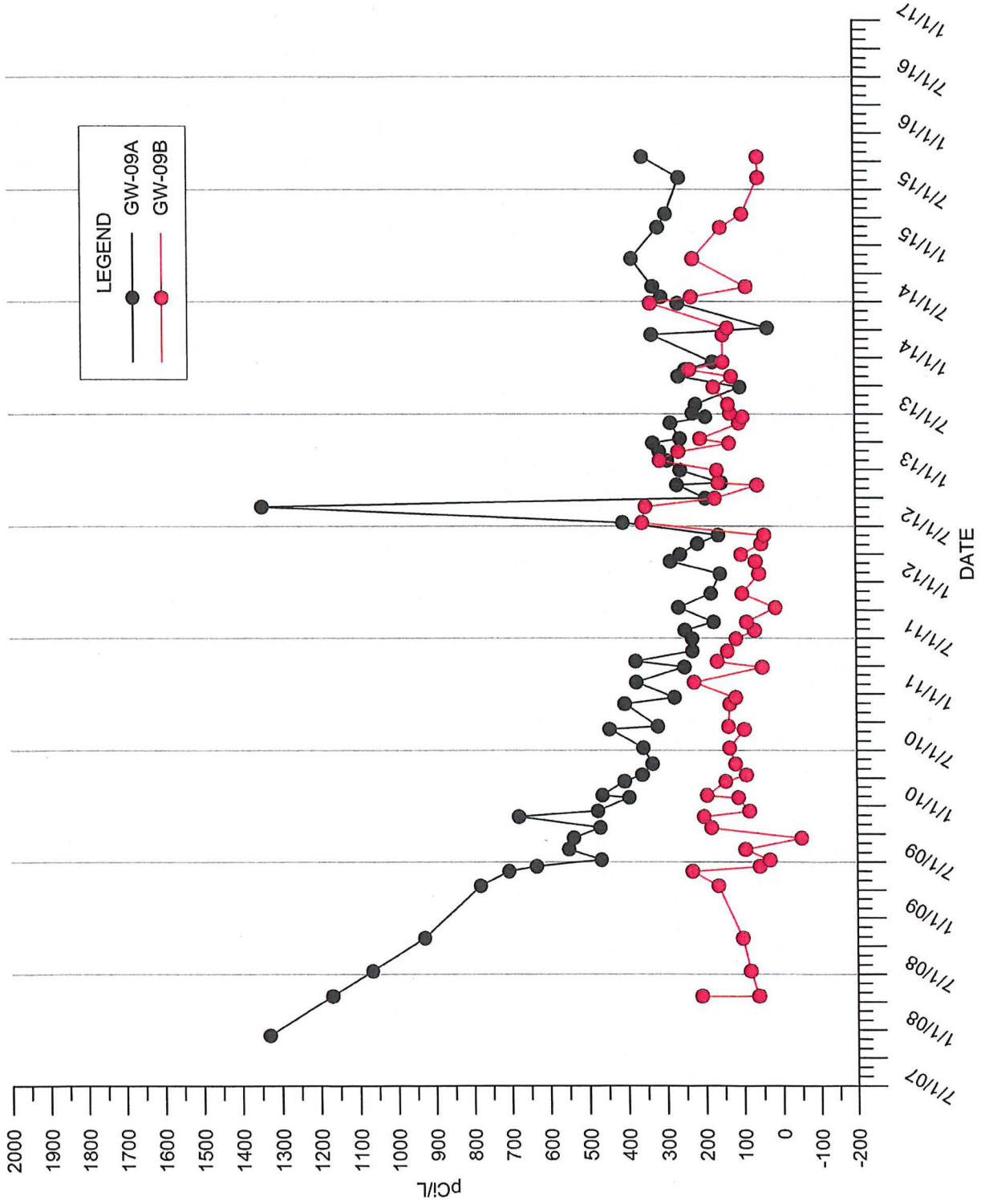


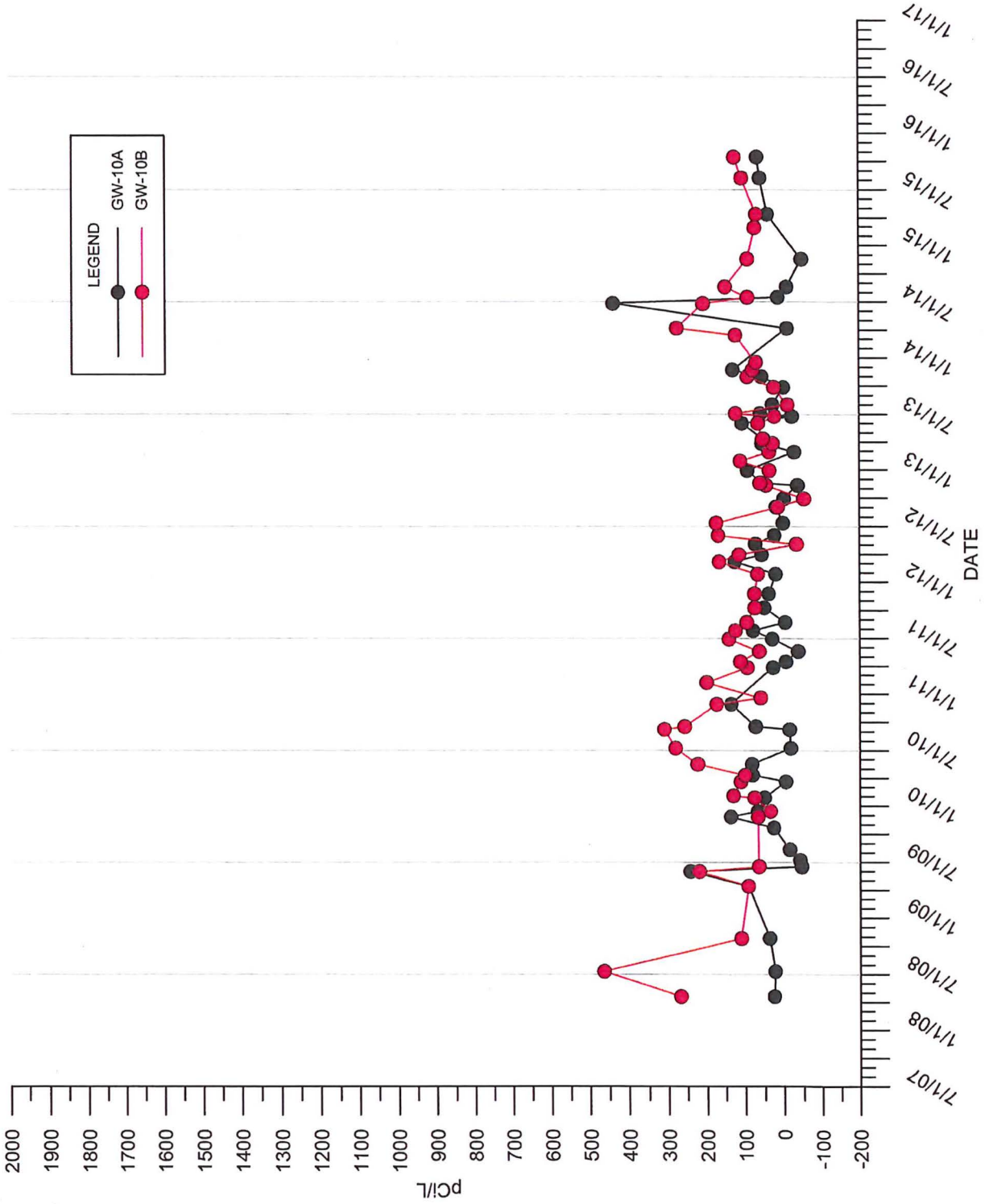
TABLE F-12
TRITIUM FACADE WELL GW-10A

Collection Date	Tritium (pCi/L)	Error (±) [pCi/L]	MDL (pCi/L)	Collection Date	Tritium (pCi/L)	Error (±) [pCi/L]	MDL (pCi/L)
20-Apr-2008	25	±76	<151	31-Oct-2013	51	±81	<148
11-Jul-2008	23	±78	<147	22-Nov-2013	126	±79	<145
26-Oct-2008	37	±78	<154	6-Apr-2014	-14	±69	<146
14-Apr-2009	91	±84	<159	25-Jun-2014	431	±92	<144
1-Jun-2009	241	±93	<154	16-Jul-2014	8	±68	<136
17-Jun-2009	-46	±76	<150	19-Aug-2014	-14	±78	<151
8-Jul-2009	-42	±75	<147	17-Nov-2014	-51	±78	<170
11-Aug-2009	-16	±91	<151	12-Apr-2015	35	±98	<183
21-Oct-2009	25	±90	<146	8-Aug-2015	54	±77	<150
26-Nov-2009	136	±102	<158	15-Oct-2015	61	±74	<141
14-Dec-2009	66	±95	<152				
27-Jan-2010	49	±91	<147	Min	-51		
21-Mar-2010	-6	±88	<145	Max	431		
11-Apr-2010	79	±91	<144	Ave	42		
17-May-2010	81	±75	<143				
8-Jul-2010	-19	±81	<156				
7-Sep-2010	-16	±75	<159				
16-Sep-2010	70	±80	<159				
28-Nov-2010	134	±77	<141				
28-Mar-2011	26	±76	<142				
16-Apr-2011	-8	±74	<142				
20-May-2011	-38	±82	<138				
29-Jun-2011	28	±77	<144				
26-Jul-2011	77	±92	<146				
23-Aug-2011	-6	±86	<142				
9-Oct-2011	48	±80	<147				
24-Nov-2011	36	±78	<144				
27-Jan-2012	18	±72	<142				
7-Mar-2012	123	±81	<142				
30-Mar-2012	54	±89	<143				
4-May-2012	69	±84	<154				
1-Jun-2012	21	±78	<147				
11-Jul-2012	-2	±75	<142				
1-Sep-2012	16	±83	<157				
29-Sep-2012	-4	±96	<184				
11-Nov-2012	-40	±73	<152				
18-Nov-2012	51	±82	<151				
29-Dec-2012	89	±77	<138				
28-Feb-2013	-31	±75	<146				
27-Mar-2013	52	±81	<149				
11-Apr-2013	48	±81	<149				
1-Jun-2013	102	±78	<148				
24-Jun-2013	-26	±84	<161				
3-Jul-2013	56	±80	<148				
1-Aug-2013	24	±80	<150				
26-Sep-2013	-4	±94	<155				

TABLE F-13
TRITIUM FACADE WELL GW-10B

Collection Date	Tritium (pCi/L)	Error (±) [pCi/L]	MDL (pCi/L)	Collection Date	Tritium (pCi/L)	Error (±) [pCi/L]	MDL (pCi/L)
20-Apr-2008	268	±88	<151	26-Sep-2013	20	±95	<155
11-Jul-2008	464	±97	<147	31-Oct-2013	89	±83	<148
26-Oct-2008	110	±82	<154	22-Nov-2013	76	±76	<145
14-Apr-2009	91	±84	<159	17-Dec-2013	66	±72	<142
1-Jun-2009	219	±92	<154	15-Mar-2014	119	±81	<143
17-Jun-2009	64	±82	<150	6-Apr-2014	270	±84	<146
26-Nov-2009	66	±99	<158	25-Jun-2014	202	±82	<144
14-Dec-2009	34	±94	<152	16-Jul-2014	87	±72	<136
27-Jan-2010	75	±92	<147	19-Aug-2014	145	±87	<151
3-Feb-2010	129	±84	<147	17-Nov-2014	87	±88	<170
21-Mar-2010	110	±93	<145	27-Feb-2015	68	±79	<151
11-Apr-2010	99	±92	<144	12-Apr-2015	64	±99	<183
17-May-2010	222	±83	<143	8-Aug-2015	101	±80	<150
8-Jul-2010	279	±96	<156	15-Oct-2015	120	±77	<141
7-Sep-2010	307	±92	<159				
16-Sep-2010	255	±90	<159	Min	-54		
28-Nov-2010	172	±79	<141	Max	464		
19-Dec-2010	58	±74	<144	Ave	110		
7-Feb-2011	199	±85	<141				
28-Mar-2011	92	±80	<142				
16-Apr-2011	110	±80	<142				
20-May-2011	61	±86	<138				
29-Jun-2011	139	±83	<144				
26-Jul-2011	122	±94	<146				
23-Aug-2011	93	±91	<142				
9-Oct-2011	72	±81	<147				
24-Nov-2011	72	±80	<144				
27-Jan-2012	64	±74	<142				
7-Mar-2012	164	±83	<142				
30-Mar-2012	112	±92	<143				
4-May-2012	-36	±79	<154				
1-Jun-2012	166	±86	<147				
11-Jul-2012	171	±84	<142				
1-Sep-2012	12	±83	<157				
29-Sep-2012	-54	±95	<184				
11-Nov-2012	42	±78	<152				
18-Nov-2012	57	±82	<151				
29-Dec-2012	33	±74	<138				
29-Jan-2013	108	±82	<146				
28-Feb-2013	33	±78	<146				
27-Mar-2013	24	±80	<149				
11-Apr-2013	50	±81	<149				
1-Jun-2013	62	±76	<148				
24-Jun-2013	19	±86	<161				
3-Jul-2013	119	±84	<148				
1-Aug-2013	-14	±78	<150				

FIGURE F-11
TRITIUM IN GROUNDWATER
GW-10 (A&B)



Figures

Figure 1 – Site Location

Figure 2 – 2015 Aerial Photograph

Figure 3 – Significant Features

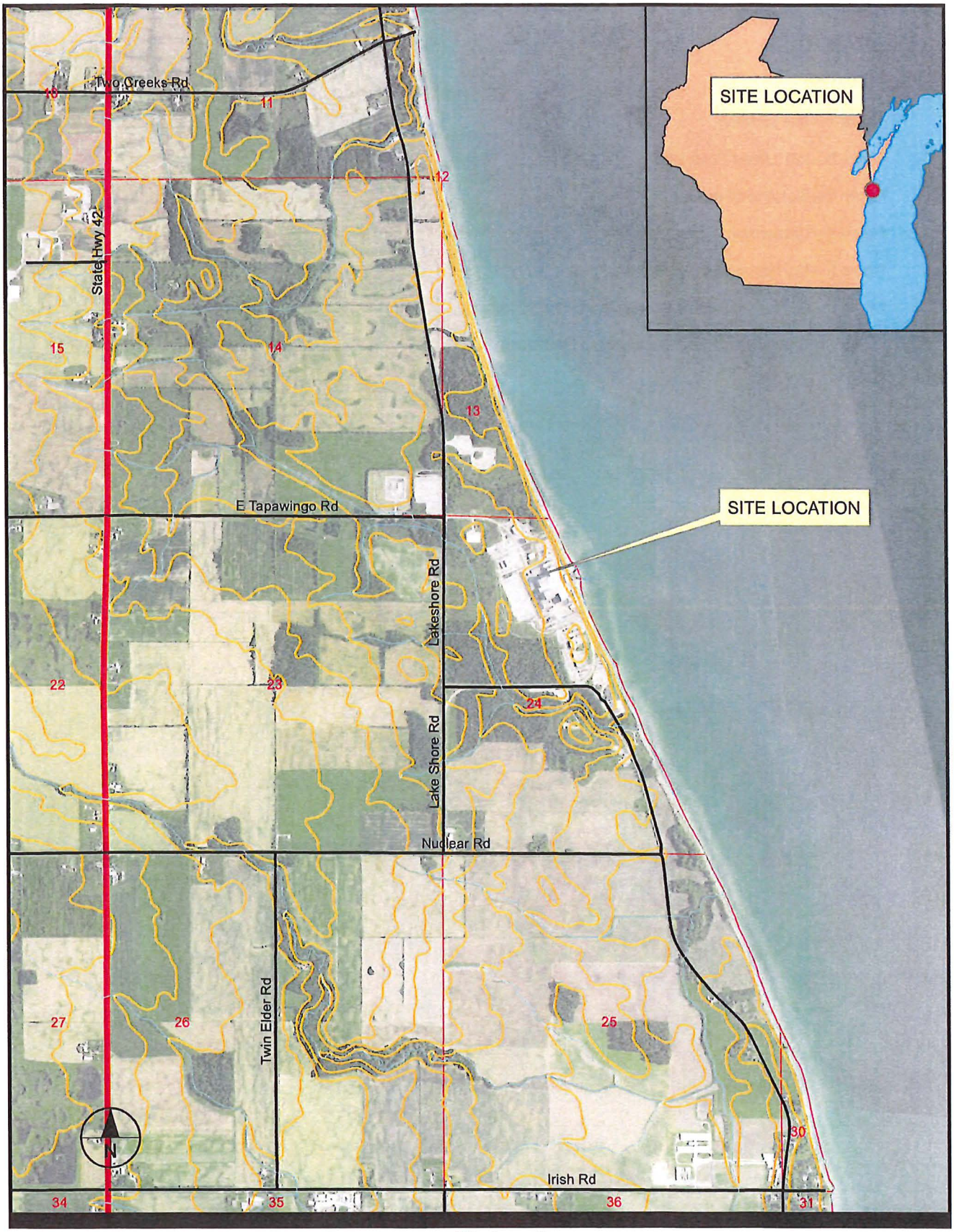
Figure 4 – Crossection

Figure 5 – Monitoring Well Hydrographs

Figure 6 – Groundwater Table Contour Map (12/23/2008)

Figure 7 – Groundwater Table Contour Map (1/15/2016)

Project Management Initials: JWK Designer: JWK ANSI A 8.5" x 11"



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NEXTERA ENERGY RESOURCES, LLC
SITE CONCEPTUAL MODEL
POINT BEACH NUCLEAR PLANT
Project No.: 60519993 Date: 2016-12-09

Site Location
Point Beach Nuclear Plant
NextEra Energy Resources, LLC
Two Rivers, Wisconsin

AECOM

Figure: 1

Project Management Initials: JWK Designer: JWK ANSI B 11" x 17"

NEXTERA ENERGY RESOURCES, LLC
SITE CONCEPTUAL MODEL
POINT BEACH NUCLEAR PLANT
Project No.: 60519993 Date: 2016-12-12

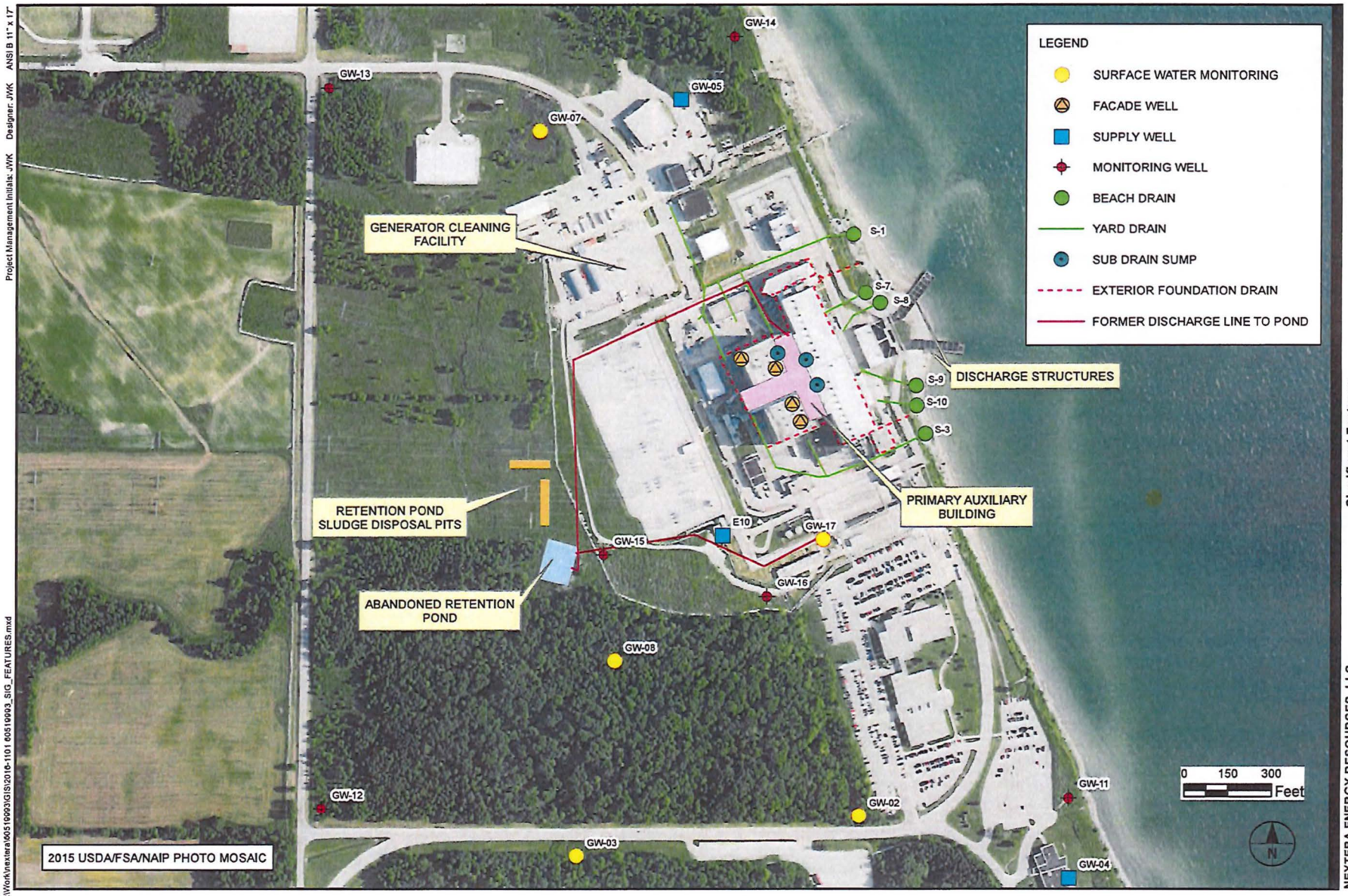
Property Extent and Site Topography
Point Beach Nuclear Plant
Nextera Energy Resources, LLC
Two Rivers, Wisconsin

AECOM

Figure: 2

Figure: 3

AECOM



Significant Features
Site Conceptual Model
Point Beach Nuclear Plant
Two Rivers, Wisconsin

NEXTERA ENERGY RESOURCES, LLC
SITE CONCEPTUAL MODEL
POINT BEACH NUCLEAR PLANT
Project No.: 60159993 Date: 2016-12-12

Project Management Initials: JWK Designer: JWK ANSI B 11" x 17"

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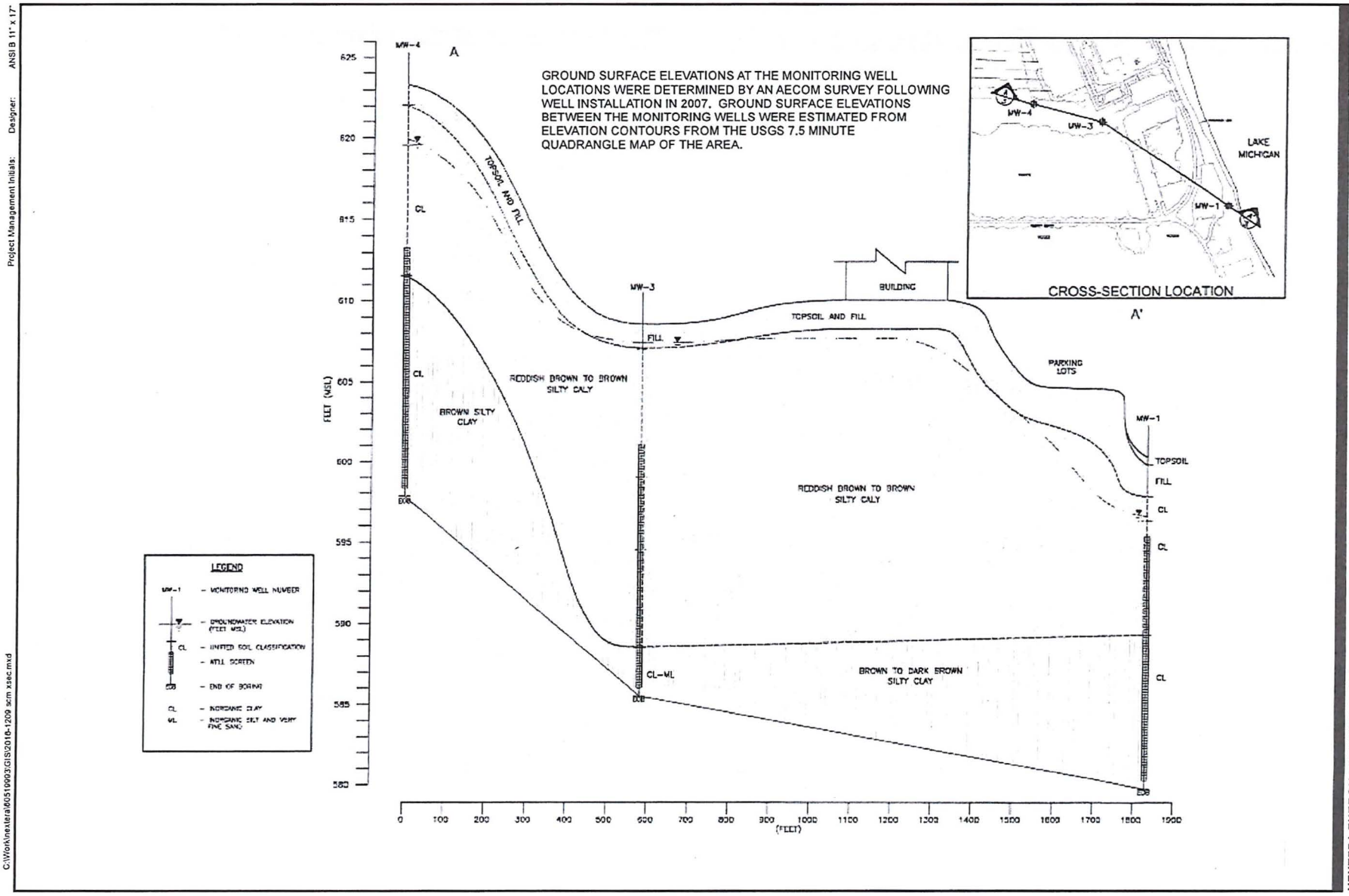
Figure: 4

AECOM



Cross-Section
Point Beach Nuclear Plant
NextEra Energy Resources, LLC
Two Rivers, Wisconsin

NEXTERA ENERGY RESOURCES, LLC
SITE CONCEPTUAL MODEL
POINT BEACH NUCLEAR PLANT
Project No.: 60519993 Date: 2017-01-09

Project Management Initials: Designer: ANSI B 11" x 17"

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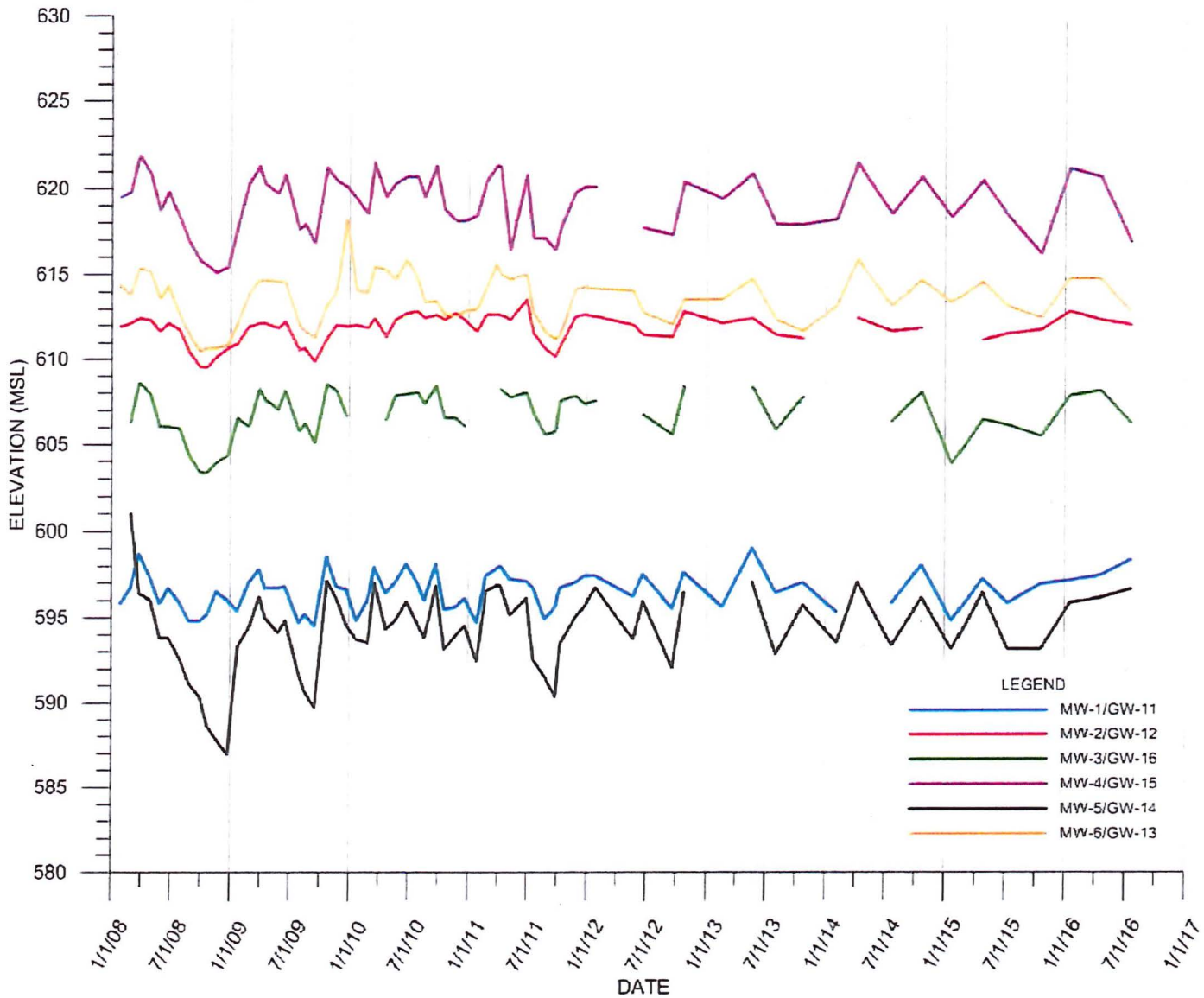

NEXTERA ENERGY RESOURCES, LLC
SITE CONCEPTUAL MODEL
POINT BEACH NUCLEAR PLANT
Project No.: 60519993 Date: 2016-12-05

Monitoring Well Hydrographs
Point Beach Nuclear Plant
NextEra Energy Resources, LLC
Two Rivers, Wisconsin

AECOM

Figure: 5

NEXTERA ENERGY RESOURCES, LLC
SITE CONCEPTUAL MODEL
POINT BEACH NUCLEAR PLANT
Project No.: 60159993 Date: 2016-12-12

Groundwater Table Contour Map (Low)
December 23, 2008
Point Beach Nuclear Plant
Two Rivers, Wisconsin

AECOM

Figure: 6

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Figure: 7

AECOM

Groundwater Table Contour Map (High)
January 15, 2016
Point Beach Nuclear Plant
Two Rivers, Wisconsin

NEXTERA ENERGY RESOURCES, LLC
SITE CONCEPTUAL MODEL
POINT BEACH NUCLEAR PLANT
Project No.: 60159993 Date: 2016-12-12

C:\Work\nextera\60159993\GIS\2016-1207 60159993_WT_MAP1.mxd Project Management Initials: JWK Designer: JWK ANSI B 11" x 17"

Tables

Table 1 – Monitoring Well Information

Table 2 – Monitoring Well Water Level Elevations

Table 1
Monitoring Well Information
Point Beach Nuclear Plant
Two Rivers, Wisconsin

Monitoring Well	Unique Well No.	Location (Wisconsin State Plane) NORTHING	EASTING	Ground Elevation (feet MSL)	TPVC Elevation (feet MSL)	Top of Well Screen Elevation (feet MSL)	Bottom of Well Screen Elevation (feet MSL)	Hydraulic Conductivity 'K' (cm/sec)	Date	Depth to Water from TPVC (feet)	Groundwater Elevation (feet MSL)
MW-1	VT6361	368321	266491	600.17	602.21	595.17	580.17	1.4E-05 to 2.2E-04	5/19/2008	5.77	596.44
MW-2	VT6371	368285	263918	613.81	615.84	605.81	590.81	7.8E-06 to 2.2E-05	5/19/2008	3.93	611.91
MW-3	VT641	369014	265448	608.51	610.54	601.51	586.51	2.8E-05 to 1.4E-04	5/19/2008	3.17	607.37
MW-4	VT640	369161	264886	623.27	625.11	613.27	598.27	5.8E-06 to 3.5E-04	5/19/2008	5.21	619.90
MW-5	VT639	370954	265333	599.31	601.01	594.31	581.31	8.6E-05 to 2.5E-04	5/19/2008	6.60	594.41
MW-6	VT638	370780	263935	619.69	621.67	615.69	600.69	8.5E-04	5/19/2008	7.45	614.22

TPVC = top of PVC casing

MSL = Mean Sea Level

Table 2 -
Water Elevations
NextERA/Point Beach Groundwater Monitoring Wells
Two Rivers, Wisconsin

Date	MW-1/GW-11	MW-2/GW-12	MW-3/GW-16	MW-4/GW-15	MW-5/GW-14	MW-6/GW-13	
1/28/2008	595.8	611.9		619.5		614.4	
2/29/2008	596.7	612.1	606.3	619.8	601.0	613.8	
3/26/2008	598.7	612.4	608.6	621.9	596.4	615.4	
4/30/2008	597.3	612.3	607.9	620.9	596.0	615.2	
5/29/2008	595.8	611.6	606.0	618.7	593.8	613.6	
6/24/2008	596.7	612.1	606.0	619.8	593.8	614.4	
7/28/2008	595.9	611.7	605.9	618.3	592.6	612.7	
8/27/2008	594.8	610.4	604.3	616.9	591.1	611.5	
9/29/2008	594.8	609.5	603.3	615.8	590.3	610.5	
10/22/2008	595.2	609.5	603.3	615.5	588.6	610.7	
11/19/2008	596.5	610.1	603.9	615.1	587.8	610.7	
12/23/2008	596.0	610.6	604.3	615.4	586.9	610.9	Low
1/23/2009	595.4	610.9	606.5	617.8	593.3	612.2	
2/26/2009	597.0	611.9	606.0	620.3	594.4	613.9	
3/30/2009	597.8	612.1	608.2	621.3	596.2	614.7	
4/16/2009	596.7	612.1	607.6	620.3	595.0	614.7	
5/26/2009	596.7	611.8	607.0	619.7	594.1	614.6	
6/17/2009	596.8	612.2	608.1	620.8	594.8	614.6	
7/30/2009	594.7	610.5	605.7	617.6	591.6	612.1	
8/17/2009	595.2	610.6	606.2	617.9	590.6	611.7	
9/16/2009	594.5	609.8	605.0	616.8	589.7	611.3	
10/24/2009	598.5	611.2	608.5	621.2	597.1	613.3	
11/21/2009	596.8	612.0	608.1	620.5	596.1	614.0	
12/23/2009	596.6	611.9	606.6	620.1	594.5	618.2	
1/22/2010	594.8	612.0		619.4	593.7	614.1	
2/26/2010	596.0	611.8		618.5	593.5	614.0	
3/18/2010	597.9	612.4		621.5	597.0	615.5	
4/23/2010	596.4	611.3	606.4	619.5	594.3	615.3	
5/21/2010	597.0	612.3	607.8	620.3	594.8	614.7	
6/25/2010	598.1	612.7	607.9	620.7	595.9	615.9	
7/29/2010	597.0	612.8	608.0	620.7	594.6	614.8	
8/19/2010	596.0	612.4	607.3	619.5	593.8	613.4	
9/24/2010	598.1	612.6	608.4	621.3	596.8	613.5	
10/19/2010	595.5	612.3	606.5	618.8	593.1	612.7	
11/22/2010	595.6	612.7	606.5	618.1	593.9	612.6	
12/20/2010	596.1	612.3	606.0	618.1	594.5	612.9	
1/27/2011	594.7	611.6		618.4	592.4	613.0	
2/23/2011	597.4	612.6		620.4	596.5	614.2	
3/27/2011	597.8	612.6		621.3	596.8	615.6	
4/9/2011	598.0	612.6	608.2	621.3	596.8	615.1	
5/8/2011	597.2	612.3	607.7	616.4	595.1	614.7	
6/28/2011	597.1	613.5	608.0	620.8	596.1	615.1	
7/19/2011	596.7	611.5	606.8	617.1	592.5	612.8	
8/23/2011	594.9	610.6	605.5	617.1	591.5	611.7	
9/25/2011	595.6	610.1	605.7	616.4	590.3	611.2	
10/9/2011	596.7	610.7	607.5	617.6	593.4	611.5	
11/25/2011	597.0	612.5	607.8	619.8	595.0	614.2	
12/23/2011	597.4	612.6	607.3	620.1	595.6	614.3	
1/26/2012	597.4	612.5	607.5	620.1	596.7	614.2	
5/21/2012	596.2	612.0			593.7	614.1	
6/20/2012	597.5	611.4	606.7	617.7	595.9	612.8	
9/18/2012	595.5	611.3	605.5	617.3	592.0	612.1	
10/23/2012	597.6	612.8	608.3	620.4	596.4	613.6	
2/18/2013	595.6	612.1		619.4		613.6	
5/21/2013	599.0	612.4	608.3	620.9	597.0	614.8	
8/1/2013	596.4	611.4	605.8	617.9	592.8	612.4	
10/23/2013	597.0	611.2	607.7	617.9	595.7	611.7	
2/4/2014	595.3			618.2	593.5	613.2	
4/8/2014		612.4		621.5	597.0	615.9	
7/22/2014	595.8	611.6	606.3	618.5	593.3	613.2	
10/21/2014	598.0	611.8	608.0	620.7	596.1	614.7	
1/21/2015	594.8		603.8	618.3	593.1	613.4	
4/24/2015	597.2	611.1	606.4	620.5	596.4	614.6	
7/9/2015	595.8	611.5	606.1	618.4	593.1	613.1	
10/19/2015	596.9	611.7	605.4	616.2	593.1	612.5	
1/15/2016	597.1	612.8	607.8	621.2	595.8	614.8	high
4/18/2016	597.4	612.3	608.1	620.7	596.1	614.8	
7/20/2016	598.3	612.0	606.2	616.9	596.6	612.8	

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