

WR-5. TCEQ ID No. 1610103/1610051 (Operation of public potable water system(s))



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## Central Registry

Detail of: **Public Water System/Supply Registration 1610051**

For: **MAIN POTABLE WATER SYSTEM (RN103127874)**

7 miles west of Wadsworth on FM 521 GT MAP 1044T

Registration Status: **ACTIVE**

Held by: **STP NUCLEAR OPERATING COMPANY (CN601658669)**

**RESPONSIBLE PARTY**

Mailing Address: Not on file

### Related Information:

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[Registration Information](#)

[Drinking Water Watch Information](#)

There is no information related to this Registration in the following categories:

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## Central Registry

Detail of: **Public Water System/Supply Registration 1610103**

For: **NSCINTF POATBLE WATER SYSTEM (RN102903697)**

7 MI W OF WADSWORTH ON FM 521 GT AMP 1044T

Registration Status: **ACTIVE**

Held by: **STP NUCLEAR OPERATING COMPANY (CN601658669)**

**RESPONSIBLE PARTY**

Mailing Address: Not on file

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### Related Information:

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[Investigations](#)

[Registration Information](#)

[Drinking Water Watch Information](#)

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WR-6. TCEQ Amendment to Certificate of Adjudication 14-5437A (Water rights for diversion and impoundment of Colorado River water).  
[STPLR-471]

WR-6

092392

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY



THE STATE OF TEXAS  
COUNTY OF TRAVIS

I hereby certify that this is a true and correct copy of a  
Texas Commission on Environmental Quality document,  
which is filed in the permanent records of the Commission.  
Given under my hand and the seal of office on

*LaDonna Castanuela* MAR 24 2009

LaDonna Castanuela, Chief Clerk  
Texas Commission on Environmental Quality

AMENDMENT TO  
CERTIFICATE OF ADJUDICATION

CERTIFICATE NO. 14-5437A

TYPE: §11.122 and 11.085

Owners: STP Nuclear Operating Company

Address: P.O. Box 289  
Wadsworth, Texas 77483

Lower Colorado River Authority

3700 Lake Austin Blvd.  
Austin, Texas 78703

Filed: February 9, 2007

Granted: MAR 17 2009

Purpose: Industrial

County: Matagorda

Watercourse: Colorado River

Watershed: Colorado River Basin,  
Colorado-Lavaca Coastal Basin

WHEREAS, Certificate of Adjudication No. 14-5437 was issued to Houston Lighting & Power Company (HLPC), as project manager of the South Texas Project (STP), and Lower Colorado River Authority (LCRA), authorizing the Owners to divert and use not to exceed 102,000 acre-feet of water per year from the Colorado River, Colorado River Basin for industrial purposes in Matagorda County. Certificate of Adjudication No. 14-5437 further authorizes the transportation to and storage of the diverted water in two existing off-channel reservoirs, impounding 202,600 acre-feet of water in the Colorado-Lavaca Coastal Basin and 388 acre-feet of water in the Colorado-Lavaca Coastal Basin, and subsequent diversions from the perimeter of the off-channel reservoirs; and

WHEREAS, the diverted water is used for industrial purposes including development of power by means other than hydroelectric; and

WHEREAS, the authorized maximum diversion rate from the Colorado River is 1,200 cfs (540,000 gpm); and

WHEREAS, HLPC is also authorized to divert, circulate, and recirculate water from the two off-channel reservoirs and to consumptively use water appropriated pursuant to this certificate through forced evaporation and other miscellaneous industrial uses an amount of water not to exceed 80,125 acre-feet per year; and

WHEREAS, the time priority of the Owners' right is June 10, 1974 for all authorizations except for the storage of 46 acre-feet of water in the 388 acre-foot capacity reservoir which has a time priority of March 25, 1986; and



03500191661001

Year: 2009 No: 092392 Type: CC

WHEREAS, STP Nuclear Operating Company (STPNOC) currently is the agent for the owners of the South Texas Project; and

WHEREAS, the participants in the South Texas Project are: (1) City Public Service Board of The City of San Antonio, Texas, holders of an undivided 40.0% interest; (2) the City of Austin, Texas holder of an undivided 16.0% interest; and (3) NRG South Texas LP, holder of an undivided 44.0% interest; and

WHEREAS, the respective ownership interests and the agreements of the Owners with respect to their rights recognized herein are set forth in the following instruments: (1) Amended and Restated Contract by and Between the Lower Colorado River Authority and STP Nuclear Operating Company, effective January 1, 2006; (2) Amended and Restated Partial Assignment and Transfer of Water Permit filed in the Official Records of Matagorda County as Instrument No. 064811; and (3) Contractual Permit No. 327, as amended; and

WHEREAS, STPNOC and LCRA (Applicants and Owners) seek to amend Certificate of Adjudication No. 14-5437 to add authorization to divert from an existing upstream diversion point on the Colorado River, Colorado River Basin in Matagorda County; and

WHEREAS, the proposed upstream diversion point is authorized by Certificate of Adjudication No. 14-5476, owned by LCRA and is described as a point located at 28.98060° N Latitude, 96.01156° W Longitude, on the west bank of a reservoir and known as Bay City Dam on the Colorado River located in the John F. Bowman and Henry Williams League, Abstract No. 9 and the Thomas Cayce Grant, Abstract No. 14, Matagorda County, Texas; and

WHEREAS, Applicants seek to divert the authorized water only at such times or in such quantities as will not affect existing water rights senior or superior to Certificate of Adjudication No. 14-5437; and

WHEREAS, Applicants indicate that no increase in the maximum rate of diversion or the maximum annual quantity to be diverted and consumptively used under Certificate of Adjudication No. 14-5437 is being requested; and

WHEREAS, the Applicants indicate that diversions from the upstream point will not exceed 561 cfs (252,450 gpm); and

WHEREAS, STPNOC and LCRA request that the time priority of June 10, 1974 for the right to divert water authorized under Certificate of Adjudication No. 14-5437 also apply at the additional proposed upstream diversion point; and

WHEREAS, Applicants further seek to amend the Certificate to revise various provisions to reflect current ownership and contracts and to clarify existing special conditions in the Certificate, described as follows:

1. Replace all references to Houston Lighting & Power Company as Project Manager of the South Texas Project with references to STP Nuclear Operating Company as Agent for the South Texas Project Owners. STPNOC's mailing address is P.O. Box 289, Wadsworth, Texas 77483.

Also, in the Recitals, the statement of authority for STPNOC to act as Agent should be revised to reflect the following:

This Certificate of Adjudication, as amended, to among other things, appropriate waters of the State of Texas in the Colorado River Basin is issued to the STP Nuclear Operating Company, as Agent for the Owners of the South Texas Project under the Amended and Restated South Texas Project Participation Agreement among the Owners and the Operating Agreement between the Owners and STP Nuclear Operating Company, both effective as of November 17, 1997 and the LCRA, subject to the following terms and conditions.

2. Revise Paragraph 2.B. (USE) to clarify that STPNOC's authority to store water in its off-channel reservoirs is not limited to water diverted from the Colorado River.
3. Revise Paragraph 2.C. (USE) to clarify that the referenced condition applies to water appropriated under the Certificate.
4. Revise Special Condition 5.A. of the original certificate to clarify that the referenced condition applies to water appropriated under the Certificate.
5. Revise Special Condition 5.C. of the original certificate to reflect those instruments that currently establish the respective ownership interests of STPNOC and LCRA in the Certificate as follows:

The respective ownership interests and the agreements of Owners with respect to their rights recognized herein are set forth in the following instruments: (1) Amended and Restated Contract By and Between The Lower Colorado River Authority and STP Nuclear Operating Company effective January 1, 2006; (2) Amended and Restated Partial Assignment and Transfer of Water Permit as recorded in the Official Records of Matagorda County as Instrument No. 064811; and (3) Contractual Permit No. CP-327, as amended.

6. Revise Special Condition 5.D. of the original certificate by inserting the words "of water appropriated under this Certificate of Adjudication" between "Colorado River" and "shall be limited." This request is intended only to clarify that diversions of water from other sources, including water purchased under the Amended and Restated Contract from other sources of supply provided by the LCRA but diverted from the same authorized points are not subject to the stated condition.
7. Revise Special Condition 5.E. of the original certificate to reflect current ownership of the South Texas Project and the proper statement of authority for STPNOC to act as Agent, as follows:

This Certificate of Adjudication is issued to the STP Nuclear Operating Company, as Agent for the Owners of the South Texas Project under the Amended and Restated South Texas Project Participation Agreement among the Owners and the Operating Agreement between the Owners and STP Nuclear Operating Company, and to the Lower Colorado River Authority. At the present time the participants in the South Texas Project are: (1) City Public Service Board of the City of San Antonio, Texas, holder of an undivided 40.0% interest; (2) the City of Austin, Texas, holder of an undivided 16.0% interest; and (3) NRG South Texas LP, holder of an undivided 44.0% interest. References to "Owner STP Nuclear Operating Company," are to such company in its capacity as Agent on behalf of and for the proportionate benefits of the participants in the

South Texas Project; references herein to "Owners" encompasses STP Nuclear Operating Company in such capacity and the Lower Colorado River Authority.

8. Revise Special Condition 5.F. of the original certificate to clarify that the referenced condition is not intended to limit the sources of water stored in the South Texas Project reservoirs and that STPNOC is authorized to store water at levels "up to and including" the two stated elevations.
9. Add a new special condition to reflect that STPNOC and LCRA have joint and several authority with regard to enforcement of the time priority of river diversion rights under the Certificate for so long as use of the river diversions remain committed to performance of the Amended and Restated Contract By and Between The Lower Colorado River Authority and STP Nuclear Operating Company and for the sole use of STPNOC. This right of enforcement is expressly retained to STPNOC under the terms of the Amended and Restated Partial Assignment and Transfer of Water Permit referenced above relative to Special Condition 5.C.
10. Update references to the Texas Commission on Environmental Quality; and

WHEREAS, the application for this amendment was declared administratively complete by the Executive Director on February 9, 2007; and

WHEREAS, the Texas Commission on Environmental Quality finds that jurisdiction over the application is established; and

WHEREAS, the Executive Director acknowledges that in addition to water that is diverted pursuant to this certificate and that is subject to the special conditions stated herein, water is transported and/or released, to the authorized off-channel reservoirs, from other sources, including from permitted groundwater wells and as supplied pursuant to the Amended and Restated Contract by and Between the Lower Colorado River Authority and STP Nuclear Operating Company referenced above; and

WHEREAS, the Executive Director recommends special conditions be included in the amendment; and

WHEREAS, the Applicants request that special conditions 5. A., C., D., E., and F. of the original certificate be modified and those modifications were reviewed by the Executive Director; and

WHEREAS, the Executive Director included the requested modifications of 5.C. and 5.E. in the recitals of this amendment and deleted special conditions 5.C. and 5.E. of the original certificate; and

WHEREAS, the Executive Director modified special conditions 5.A., 5.D. and 5.F. of the original certificate as requested, and these are now reflected as 6.A., 6.C. and 6.E. respectively in the amended certificate; and

WHEREAS, the applicants submitted an accounting plan, accounting procedures, and Water Rights application No. 14-5437A, which was approved by the Executive Director; and

WHEREAS, no one protested the granting of this application; and

WHEREAS, the applicants have requested that Certificate of Adjudication No. 14-5437 should be rewritten and superseded with Certificate of Adjudication No. 14-5437A; and

WHEREAS, the Commission has complied with the requirements of the Texas Water Code and Rules of the Texas Commission on Environmental Quality in issuing this amendment; and

NOW, THEREFORE, in lieu of Certificate of Adjudication No. 14-5437, this amended Certificate designated as Certificate of Adjudication No. 14-5437A to, among other things, appropriate water of the State of Texas in the Colorado River Basin is issued to the STP Nuclear Operating Company, as Agent for the Owners of the South Texas Project under the Amended and Restated South Texas Project Participation Agreement among the Owners and the Operating Agreement between the Owners and STP Nuclear Operating Company, both effective as of November 17, 1997 and the Lower Colorado River Authority, subject to the following terms and conditions:

1. IMPOUNDMENT

- A. Owner, STP Nuclear Operating Company (STPNOC), is authorized to maintain an existing 202,600 acre-foot capacity off-channel reservoir (Principal Reservoir) and impound therein not to exceed 202,600 acre-feet of water. The reservoir is located in the John Raney Grant, Abstract No. 80; and the Cornelius H. Vanderveer Grant, Abstract No. 95; and the Abram Sheppard Survey, Abstract No. 383, Matagorda County, Texas, in the Colorado-Lavaca Coastal Basin.
- B. Owner, STPNOC, is authorized to maintain an existing 388 acre-foot capacity off-channel reservoir (Second Reservoir) and impound therein not to exceed 388 acre-feet of water. The reservoir is located in the Raney Grant, Abstract No. 80, Matagorda County, Texas, in the Colorado-Lavaca Coastal Basin.

2. USE

- A. Owners, STPNOC and LCRA, are authorized to divert and use not to exceed 102,000 acre-feet of water per year from the Colorado River for industrial purposes, including development of power by means other than hydroelectric.
- B. Owner, STPNOC, is authorized to transport water lawfully diverted from the Colorado River into the two reservoirs for storage and subsequent use as authorized herein.
- C. Owner, STPNOC, is authorized to divert, circulate, and recirculate water from the two off-channel reservoirs for industrial purposes, including development of power by means other than hydroelectric, except that it may not consumptively use through forced evaporation and other miscellaneous industrial use more than 80,125 acre-feet of water per year appropriated under this Certificate.

3. DIVERSION

- A. Location: At a point on the west bank of the Colorado River in the Cornelius H. Vanderveer Grant, Abstract No. 95, Matagorda County, Texas.

Rate: not to exceed 1,200 cfs (540,000 gpm) from the Colorado River

- B. Location: At a point at 28.98060° N Latitude, 96.01156° W Longitude in the Thomas Cayce Grant Abstract 14, Matagorda County on the west bank of

reservoir authorized under Certificate of Adjudication No. 14-5476, as amended, and known as the Bay City Dam on the Colorado River located in the John F. Bowman and Henry Williams League Abstract No. 9 and the Thomas Cayce Grant, Abstract No. 14, Matagorda County, Texas.

Rate: not to exceed 561 cfs (252,450 gpm) for the Bay City Dam.

- C. The combined maximum diversion rate for Diversion Paragraph 3.A. and 3.B. is 1,200 cfs (540,000 gpm).

- D. Location: at a point on the north shore of Principal Reservoir.

Rate: not to exceed 8,087.00 cfs (3,639,150.00 gpm).

- E. Location: at a point on the west shore of the Second Reservoir.

Rate: not to exceed 287.00 cfs (129,150 gpm).

#### 4. TIME PRIORITY

The time priority of Owners' right is June 10, 1974, for all authorizations contained herein, except for the storage of 46 acre-feet of water in the aforesaid 388 acre-foot capacity second reservoir which is March 25, 1986.

#### 5. CONSERVATION

Owners, STPNOC and LCRA, shall implement a water conservation plan that provides for the utilization of those practices, techniques and technologies that reduce or maintain the consumption of water, prevent or reduce the loss or waste of water, maintain or improve the efficiency in the use of water, increase the recycling and reuse of water, or prevent the pollution of water, so that a water supply is made available for future or alternative uses. Such plans shall include a requirement that in every wholesale water contract entered into, on or after the effective date of this permit, including any contract extension or renewal, that each successive wholesale customer develop and implement conservation measures. If the customer intends to resell the water, then the contract for resale of the water must have water conservation requirements so that each successive wholesale customer in the resale of the water be required to implement water conservation measures.

#### 6. SPECIAL CONDITIONS

- A. Water appropriated under this Certificate and diverted from the Principal Reservoir but not consumed as a result of the uses authorized herein shall be returned to said Principal Reservoir, while water appropriated under this Certificate and diverted from the Second Reservoir but not consumed as a result of the uses authorized herein shall be returned either to said Principal Reservoir or said Second Reservoir.

- B. Surplus water not beneficially used will be returned to the Colorado River through a spillway discharge channel and outlet structures located in the William Selkirk Grant, Abstract 87, Matagorda County, Texas.



- C. Diversions from the Colorado River at the points authorized in Diversion Paragraph 3.A., of water appropriated under this Certificate, shall be limited to fifty-five percent of the flows of the Colorado River in excess of 300 cfs at the point authorized in Diversion Paragraph 3.A. on the Colorado River.
- D. Diversions from the Colorado River at the diversion point authorized in Diversion Paragraph 3.B. shall be made only when water would otherwise be available for diversion at the point authorized in Diversion Paragraph 3.A.
- E. Owner, STPNOC, is authorized to store not to exceed 202,600 acre-feet of water in the Principal Reservoir up to and including the elevation of 49.0 feet above mean sea level and 388 acre-feet of water in the Second Reservoir up to and including the elevation of 26.0 feet above sea level.
- F. Owners, STPNOC and LCRA, shall only divert and use water pursuant to Paragraphs 2. USE and 3.B. DIVERSION, in accordance with the most recent approved *Accounting Procedures Water Rights Application 14-5437A*. Owners shall maintain the accounting plan in electronic format and make the data available to the Executive Director and the public upon request. Any modifications to *Accounting Procedures Water Rights Application 14-5437A* shall be approved by the Executive Director. Any modification to the plan that changes the certificate terms must be in the form of an amendment to the certificate. Should Owners fail to maintain the accounting plan or notify the Executive Director of any such modifications to the plan, Owners shall immediately cease diversion pursuant to Paragraph 3.B. DIVERSION, and either apply to amend the certificate, or voluntarily forfeit this diversion point. If Owners fail to amend the certificate or forfeit this diversion point, the TCEQ may begin proceedings to cancel the authorization to use the point. The Commission shall be notified immediately by Owners upon modification of the accounting plan and provided with copies of the appropriate documents effectuating such changes.
- G. Owners, STPNOC and LCRA, have joint and several authority with regard to enforcement of the time priority of river diversion rights under the Certificate for so long as use of the river diversions remain committed to performance of the Amended and Restated Contract by and between The Lower Colorado River Authority and STP Nuclear Operating Company and for the sole use of STPNOC. This right of enforcement is expressly retained to STPNOC under the terms of the Amended and Restated Partial Assignment and Transfer of Water Permit.

This amendment is issued subject to all superior and senior water rights in the Colorado River Basin.

Owners agree to be bound by the terms, conditions, and provisions contained herein and such agreement is a condition precedent to the granting of this amendment.

All other matters requested in the application which are not specifically granted by this amendment are denied.

This amendment is issued subject to the Rules of the Texas Commission on Environmental Quality and to the right of continuing supervision of State water resources exercised by the Commission.

  
For the Commission

Date Issued: MAR 17 2009

FILED

2009 APR 17 AM 9:07

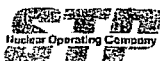
  
COUNTY CLERK  
MATAGORDA COUNTY, TEXAS

STATE OF TEXAS, COUNTY OF MATAGORDA  
I hereby certify that this amendment was FILED in file Number  
Sequence on the date and at the time stated herein by me,  
and was duly RECORDED in the OFFICIAL RECORDS of  
Matagorda County, Texas.

sldannhardt@stpegs.com

(361) 972-8328  
Fax (361) 972-7760

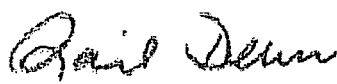
SANDRA L. DANNHARDT  
Environmental Manager



South Texas Project Electric Generating Station  
P.O. Box 289 Wattsboro, Texas 77483

APR 17 2009



  
COUNTY CLERK, Matagorda County, Texas

WR- 7. Water Conservation Plan, STP Nuclear Operating Company, South Texas  
Project Electric Generating Station, Certificate of Adjudication 14-5437A,  
May 1, 2009, Revision 2

# **Water Conservation Plan**

**STP Nuclear Operating Company  
South Texas Project Electric Generating Station**

**Certificate of Adjudication 14-5437A**

**May 1, 2009**

**Revision 2**

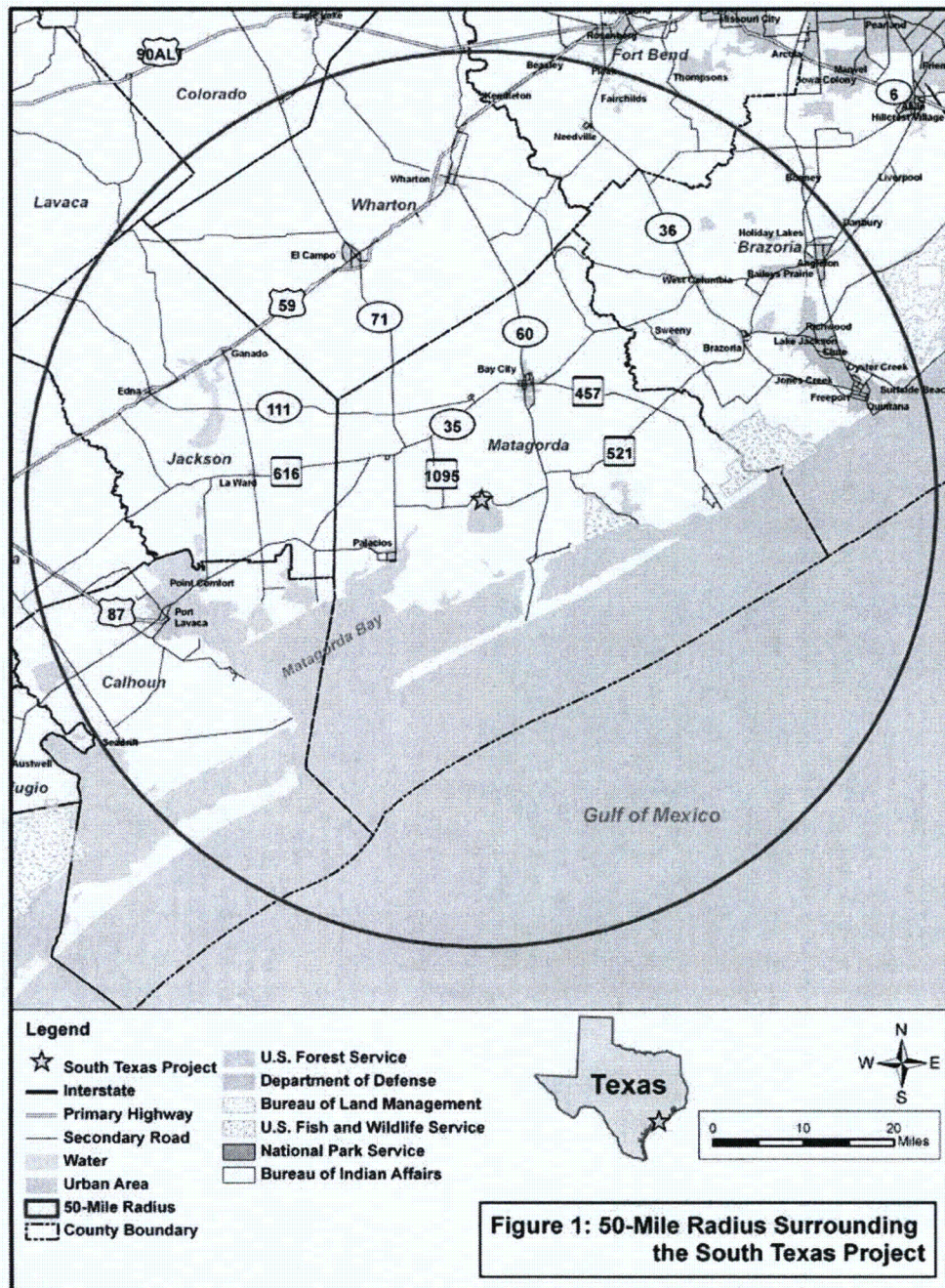
**South Texas Project Electric Generating Station  
Water Conservation Plan**

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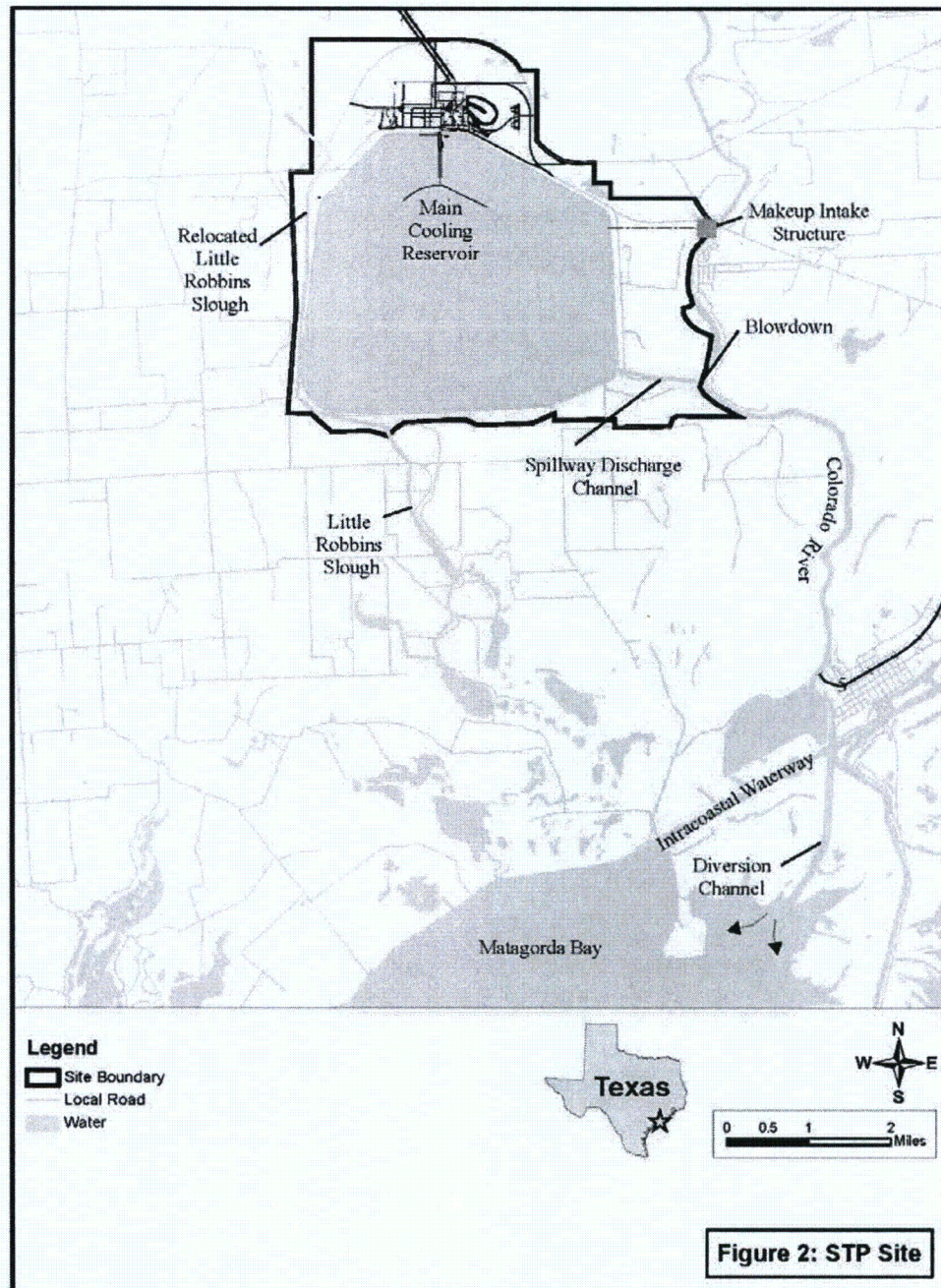


# 50-Mile Radius Surrounding the South Texas Project





**South Texas Project Site**



## Purpose

This water conservation plan has been developed in accordance with the 30 TAC 288.3 for Certificate of Adjudication 14-5437A and Contractual Permit No. 327. Certificate of Adjudication 14-5437A authorizes the diversion and use of up to 102,000 acre-feet of water per annum from the Colorado River for industrial purposes. The purpose is to identify and establish principles, practices and standards to effectively conserve and efficiently use available water supplies and provide historical and projected average industrial water demand.

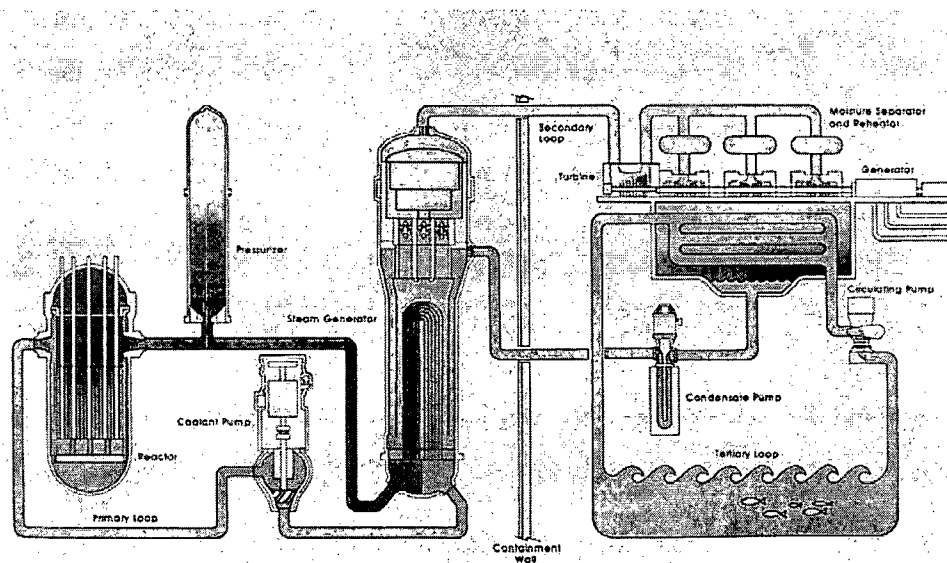
## Facility Location

The South Texas Project Electric Generating Station is owned by NRG Energy, Inc., Austin Energy and CPS Energy as tenants in common. Until late 1997, Houston Lighting & Power Company was the designated Project Manager for the owners. In November of 1997, the STP Nuclear Operating Company (STPNOC) assumed operational control of the South Texas Project. The South Texas Project is located approximately 15 miles southwest of Bay City, Matagorda County, Texas, along the west bank of the Colorado River. The station encompasses a total of 12,220 acres. The South Texas Project has two, 1,350-megawatt Westinghouse pressurized water reactors and both units together produce enough electricity to serve over two million homes and businesses throughout Texas. With nearly 1300 employees, the STP Nuclear Operating Company is the largest employer and source of revenue for Matagorda County.

## Water Use Data

### Water Accounting Data

Water is an essential component in electricity production. The South Texas Project uses both groundwater and surface water for station purposes. Most of the water used by the South Texas Project is needed to condense steam and provide cooling for plant generating systems. A diagram of the plant water systems is shown below.





South Texas Project  
Water Conservation Plan

Groundwater provides onsite drinking water for station personnel, replenishes the Essential Cooling Pond, and is used for other industrial purposes including makeup to the reactor and steam systems. Groundwater is supplied by five onsite wells with a combined capacity of approximately 1950 gallons per minute. Surface water is diverted intermittently, based on reservoir level and water quality, from the adjacent Colorado River to the station's Main Cooling Reservoir. The Main Cooling Reservoir is a 7000-acre, above grade, off-channel reservoir capable of impounding 202,600 acre-feet of water at its maximum level. In addition, the Essential Cooling Pond, a 47-acre, below grade, off-channel reservoir that supplies water to cool important plant components is capable of impounding 388 acre-feet of water. Various water rights permits, contractual agreements and compliance documents authorize the South Texas Project to maintain these reservoirs, impound water diverted from the Colorado River, and to circulate, divert and use water from these reservoirs for industrial purposes to operate the plant. Colorado River water is diverted using two 240 cubic feet per second and two 60 cubic feet per second pumps to the Main Cooling Reservoir through a 108-inch pipeline where the water is used for cooling. The table below lists surface water and ground water usage for the last 5 years.

**Table 1**  
**South Texas Project Electric Generating Station**  
**5 – Year Water Usage**

	2004	2005	2006	2007	2008	5 year Average	Previous Plan Average	Permitted Amount
Surface Water (Acre-feet)	62374	5694	50012	58740	10303	37425	46549	102,000*
Ground Water (Acre-feet)	1223	1296	1301	1255	1185	1252	1293	3000*

\* Certificate of Adjudication 14-5437A and Contractual Permit No. CP-327

\*\*Coastal Plains Groundwater Conservation District Permit No. OP-04122805

After being used in various processes at the generating station, the water is routed to wastewater treatment facilities located at the generating station where it is treated and discharged in accordance with a Texas Commission on Environmental Quality wastewater discharge permit into the Main Cooling Reservoir for reuse. The main consumptive use of water is evaporation and designed leakage of water from the Main Cooling Reservoir and Essential Cooling Pond. The annual consumptive use of water through evaporation is limited to 80,125 acre-feet per year by the Colorado River diversion permit. In 2008, the amount of water consumed from the Main Cooling Reservoir was 38,186 acre-feet or 0.58 gallons/kWh. The typical consumption for a

nuclear plant with pond cooling is 0.4- 0.72 gallons/kWh<sup>1</sup>. This is also consistent with the report "Water Demand Projections for Power Generation in Texas" prepared for the Texas Water Development Board by the Bureau of Economic Geology, 2008. STPNOC provided comments and a simplified water balance for inclusion in the 2008 report.

#### Projected Surface Water Demands

Surface water demand is dependent on climatic conditions as well as the capacity factors of the generating units. Although no routine discharge has occurred from the Main Cooling Reservoir, current projections on reservoir water quality and additional demands up-river may necessitate use of our permitted reservoir blowdown system to maintain water quality.

In September of 2007, NRG Energy, Inc., CPS Energy and STP Nuclear Operating Company filed a Combined Construction and Operating License Application (COLA) with the United States Nuclear Regulatory Commission to build and operate two new additional units, Units 3 and 4 at the South Texas Project site. In September of 2008, STP Nuclear Operating Company filed a revision to the COLA application to reflect a change in the engineering, procurement and construction contractor for Units 3 and 4. The proposed units will be built adjacent to the currently operating Units 1 and 2 on existing station property. The station's 12,220-acre site and 7,000-acre cooling reservoir were originally designed for four units. The proposed new units will produce 2700 megawatts, provide enough power for an additional two million homes and businesses, create jobs and provide other substantial local economic benefits. Surface water use is expected to increase to 102,000 acre-feet per year by 2020 versus 2030 due to the new units. The 2011 revision to the Lower Colorado Regional Water Plan will reflect use of 102,000 acre-feet of surface water per year by 2020 for steam-electric water demand in Matagorda County. The consumptive use limit remains the same as specified in the diversion permit.

The 2011 revision to the Lower Colorado Regional Water Plan will also reflect the 2006 amended contract between STP Nuclear Operating Co. and the Lower Colorado River Authority. Under the contract Water Delivery Plan, the available surface water supply of backup water from the Highland Lakes is limited to 20,000 acre-feet/year (as a 5-year rolling average) with two generating units in operation (as is the case through 2015) and to 40,000 acre-feet/year (as a 5-year rolling average) with any additional generating units in operation (beginning in the year 2016).

In 1996, the South Texas Project and Houston Industries Incorporated initiated a joint effort with Ducks Unlimited and other agencies to establish a 110- acre wetland habitat for migratory waterfowl at the station. Surface water (220 acre-feet in 2008) is diverted from an adjacent Lower Colorado River Authority rice canal to flood the area from November to March of each year. The agreement with Ducks Unlimited expires in 2011 but current plans are to continue flooding the area as in previous years.

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<sup>1</sup> Power Generation Water Use in Texas for the Years 2000 through 2060, Final Report. Prepared for the Texas Water Development Board by Representatives of Investor-Owned Utility Companies of Texas, January 2003

### Projected Groundwater Demands

Due to the addition of Units 3 and 4, groundwater demand is projected to double, up to the permitted limit, by 2020. STPNOC is also evaluating installing additional wells to meet the increased demand of a cooling tower that is part of the new units design. Any new wells will be installed and permitted through the Coastal Plains Groundwater Conservation District.

### Existing Water Conservation Measures

In past years, water conservation has not been the major impetus for operational changes or installation of new equipment at the generating station. The surface water contract has a guaranteed purchase price whether the water is pumped or not. The modification process associated with making changes to a nuclear generating facility is very costly so potential water savings do not necessarily equate to economic savings. However, the station traditionally has implemented water conservation measures to incorporate best management practices necessary to preserve this valuable resource. The following list identifies measures that are currently in place at the generating station. Please note that these measures are subject to change from time to time.

1. Main Cooling Reservoir Blowdown: No routine discharge has been required from the Main Cooling Reservoir. Main Cooling Reservoir water quality is maintained by selective diversion from the Colorado River during excess flow conditions.
2. Flush Valves: Automatic and manual flush valves have been installed to help maintain a minimum chlorine residual in the far reaches of the potable water systems while minimizing water use.
3. Cooling Towers: Cooling towers are used for the Nuclear Support Center. Cooling tower blowdown is routed to sanitary waste for ultimate discharge to the Main Cooling Reservoir for reuse.
4. Landscape Irrigation: Most of the area around the generating station is not watered. Limited watering is conducted at the east entrance and certain office buildings.
5. Closed Piping System: By using piping systems to transfer all water within the generating station, transportation losses are virtually eliminated.
6. Meters: Water meters on each well measure the amount of groundwater used at the generating station.
7. Main Cooling Reservoir: The Main Cooling Reservoir is capable of containing 202,600 acre-feet of water that is stored and re-used. Internal outfalls discharge into the Main Cooling Reservoir, which is then re-used as cooling water. The Main Cooling Reservoir Maximum Operating Level has been increased from 45' to 47' MSL to take advantage of reservoir makeup opportunities when river flows are high.

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8. Reuse of HVAC Condensate: Modifications were implemented to re-route the Mechanical Auxiliary Buildings and Fuel Handling Buildings HVAC condensate from sanitary waste to the Essential Cooling Pond.
9. Reuse of Steam Generator Blowdown: Blowdown from the steam generators is reused in the secondary system.
10. Chemical Addition: Addition of ethanolamine in the secondary system reduces the number of ion exchange demineralizer regenerations required which minimizes water use.
11. Reverse Osmosis for Demineralized Water Production: Use of reverse osmosis for production of demineralized water increases the capacity of ion exchange demineralizers. This reduces the number of demineralizer regenerations and associated water use.
12. Reverse Osmosis for Silica Removal: The use of a reverse osmosis unit to remove silica from the refueling water storage tank requires less makeup water than a feed and bleed operation.
13. Re-use of Stormwater: The majority of the stormwater collected in the berms that provide secondary containment for oil bearing equipment is treated and discharged to the Main Cooling Reservoir for re-use.
14. Essential Cooling Pond: Conjunctive use of groundwater for maintaining water level and quality reduces the need for blowdown from the pond to the Main Cooling Reservoir. Blowdown from the pond is returned to the Main Cooling Reservoir for re-use.
15. Rainwater Harvesting: Rainwater is collected in the 7000 acre Main Cooling Reservoir and 47 acre Essential Cooling Pond for reuse. The annual local rainfall is 42 inches. This equates to an average collection of 24,665 acre-feet per year.
16. Waterless Urinals: Waterless urinals conserve water and require less maintenance. One has been installed in the Nuclear Support Center, one in the Unit 1 One Stop Shop, and two at the Metrology Laboratory.

Conservation Measures Implemented Since the Last Revision

17. Main Plant Potable Water Meter: A flow totalizer was installed in June 2005 on the Main Plant Potable Water System to measure the amount of potable water supplied to the Units 1 and 2 Protected Area and the west side of the site.
18. Replacement of the Unit 1 and 2 Low Pressure Turbines: Replacement of the low pressure turbines in Unit 1 in October 2006 and Unit 2 in April 2007 gained approximately 70 megawatts for each unit. Due to the improved efficiency of the new turbines with no increase in reactor power, the heat load on the Main Cooling

Reservoir was reduced. This modification is an example of increased generation using the existing surface water resource.

19. Amendment to Certificate of Adjudication 14-5437A: This amendment was granted by the Texas Commission on Environmental Quality on March 17, 2009 and allows diversion of surface water above the Bay City Dam. Colorado River water above the Bay City Dam is not within the tidal influence of the Gulf of Mexico so water quality in the Main Cooling Reservoir can be preserved during low river flow conditions.
20. Flow Meter Instrumentation: Instrumentation was installed in the reservoir makeup pipeline in March 2008 to verify surface water diversion consistent with the surface water supply contract.
21. Fire Protection System: Extensive work has been done over the last 3 years to fire hydrants and valves to repair internal and external leakage.
22. Kaydon Units: Use of the Kaydon units was discontinued for turbine electro hydraulic control fluid filtration in 2008.

### Water Management during Drought Conditions

The water right for the South Texas Project, granted with a 1974 priority date, includes a special provision to limit diversion from the Colorado River to 55% of the flow over 300 cubic feet per second, to protect inflows during low river flow conditions. As the last diversion point on the Colorado River just upstream from Matagorda Bay, the diversion facility is within the tidal influence of the Gulf of Mexico. As mentioned previously, reservoir quality is maintained by selective pumping during high river flow conditions (>1200 cfs). The contract Water Delivery Plan shown in the table below has been incorporated into standard operating procedures that require actions at decreasing Main Cooling Reservoir levels, where reservoir water quality is sacrificed to maintain level during drought conditions.

Main Cooling Reservoir (MCR) Level	Actions
Normal operating level between 40 and 49 feet Mean Sea Level (MSL)	Pumping under River Permit when river conductivity is $<2100 \mu\text{S/cm}$ <b>OR</b> River TDS level is $\leq 1260 \text{ mg/L}$ . (Notes 1, 2 & 6)
MCR level between 36 and 40 feet MSL	Pumping under River Permit when river conductivity is $\leq$ MCR conductivity. (Notes 1, 2, & 6) <b>IF</b> water deliveries are being made to meet bay and estuary requirements, <b>THEN</b> daily communications with LCRA are required, as necessary. (Note 3) (Chemistry/Environmental action)
MCR Level at 37 feet MSL	STPNOC requests LCRA to prepare for delivery of backup water when MCR level drops to 35 feet MSL.



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MCR level between 32 and 36 feet MSL	Pumping under River Permit when river conductivity is $\leq 10,000 \mu\text{s/cm}$ <b>OR</b> River TDS level $\leq 6000 \text{ mg/L}$ . (Note 1) Daily communications, as necessary, with the LCRA if deliveries are being made to meet bay and estuary requirements. (Note 3) (Chemistry/Environmental action)
MCR level below 35 feet MSL	LCRA begins staged deliveries of firm water to ensure that MCR level does not drop below 27 feet MSL. (Notes 4 & 5) Delivery of firm water subject only to the LCRA bay and estuary restrictions; <b>NOT</b> River Permit stream flow restrictions.

- Note 1: Current stream flow restrictions of 55% of river flow over 300 cubic feet per second (cfs) would apply unless and until such time as permit is amended to establish other limitations for diversion.
- Note 2: Reservoir blowdown will commence as necessary to maintain MCR water at an average of  $3000 \mu\text{s/cm}$ .
- Note 3: To maintain MCR level as high as possible, the LCRA will communicate to STPNOC if the LCRA determines that any additional supply may be available in the river for diversion by STPNOC over and above the amounts to be supplied by the LCRA to meet its other demands. STPNOC may divert such water at its discretion, subject only to the LCRA bay and estuary restrictions. Any diversions of water by STPNOC that is made available under this condition and that would not be permitted under the River Permit stream flow restrictions would count towards the maximum quantities to be made available as provided in Note 4.
- Note 4: The LCRA will provide firm water for diversion by STPNOC up to installed pumping capacity, with a minimum rate to be specified by STPNOC to assist in maintaining the reservoir level at or above 27 feet MSL. Under no circumstances will the LCRA make available firm supply under this condition totaling more than 20,000 acre feet per year (af/y) (rolling five-year average) for 2-unit operation OR 40,000 af/y (rolling five-year average) for any additional generation capacity.
- Note 5: At 30 feet MSL, STPNOC and the LCRA will pursue an emergency suspension of permit pumping restrictions. (Chemistry/Environmental action)
- Note 6: WHEN river conductivity exceeds addendum specifications, THEN diversion only allowed with approval from Chemistry or Environmental Management.

### Water Conservation Goals and Initiatives

Although no routine discharge has occurred to date from the Main Cooling Reservoir, current projections on reservoir water quality and additional demands up-river may necessitate use of our permitted reservoir blowdown system to maintain water quality. The 2006 revision to the Lower Colorado Regional Water Plan reflects use of as much as 80,000 acre-feet per year by 2010 and the 2011 revision to the plan will reflect full utilization of the water right by 2020 to support four unit operations, making a run-of-river surface water reduction goal impractical other than to stay below the permitted amount under the water right for surface water and below the water supply contract for stored water.

STP Nuclear Operating Company is committed to operating the South Texas Project in a safe, reliable, economical and environmentally sound manner. Water conservation is part of this commitment. In reviewing water conservation measures, the ability to conserve water is most often a function of the design of the installed equipment and therefore there

is limited potential to conserve additional water after a system is installed. Including water conservation, and its associated economic benefit, as one of the considerations used when comparing new project alternatives may ultimately have the greatest impact on water use at the generating station in the future. Additional water conservation measures will be evaluated and implemented, when practical.

General water conservation initiatives are listed below.

1. Consider water conservation and its economic benefit when evaluating modification and project alternatives for systems, processes, or equipment that use water.
2. Monitor the quantity and quality of incoming water from both groundwater and surface water sources.
3. Ensure water leaks are prioritized and repaired in a timely manner.
4. Provide water conservation awareness to station personnel.

Specific conservation initiatives are listed below.

1. Continue with the plan to raise the Main Cooling Reservoir maximum operating level from 47' to 49' MSL.
2. Calibrate the instrumentation in the reservoir makeup pipeline to verify surface water diversion consistent with the surface water supply contract.
3. Monitor the amount of demineralized water produced per day.
4. Measure the amount of water being returned to the Main Cooling Reservoir via the well water header pressure relief valve to determine if a cost-effective alternative exists.
5. Add a totalizer to the Nuclear Support Center cooling tower blowdown supply line to optimize the amount of water supplied to the cooling tower.

### **Water Conservation Plan Elements**

Recommendations, evaluations and revisions to this plan will be tracked using the South Texas Project Corrective Action Program.

#### **Water Use Measurement**

Surface water is diverted from the Colorado River and stored in the Main Cooling Reservoir located onsite. River water is diverted using two 240 cubic feet per second and two 60 cubic feet per second pumps to the Main Cooling Reservoir through a 108-inch pipeline where the water is used for cooling. The quantity of surface water diverted is conservatively estimated using pump capacity and run time.

Groundwater supplied from five onsite wells located at the generating station is used for potable water and other industrial uses. Groundwater is measured at each well using an inline flow totalizer. Reports on water usage are submitted annually to the Texas Commission on Environmental Quality and the Texas Water Development Board. Reports of groundwater usage are also submitted to the Coastal Plains Groundwater Conservation District annually.

## Leak Detection

Inspection of piping for leaks is viewed as a normal part of all employees' duties. Operations personnel perform routine inspections each day; they note any evidence of leaks and submit work requests for repairs. Employees also report plumbing leaks promptly. A procedure has been developed for leak identification and prioritization for timely repair (0PGP03-ZA-0133, Fluid Leak Management Program). The program also provides guidance for a proactive approach to preventing leaks.

## Best Management Practices

Best Management Practices (BMP)<sup>2</sup> that were considered during the development of this plan are as follows:

- Industrial Water Audit
- Industrial Submetering

### Industrial Water Audit

The Industrial Water Audit BMP was used to identify the relationship between water coming into the facility and the various uses of water within. Based on the 2008 annual water use report, the largest use of surface water (100%) was evaporation and designed leakage from the Main Cooling Reservoir. The two largest uses of groundwater (80%) at the facility are associated with the production of demineralized water and makeup to the 47-acre Essential Cooling Pond.

### Industrial Submetering

The Industrial Submetering BMP was used to consider calibrating the meter in the reservoir makeup pipeline to verify surface water diversion. This meter has been installed but has not been calibrated at the higher river flows due to the prolonged drought that started in 2008. This BMP was also used to consider addition of meters or other flow totalizers for potable water supply as well as the Nuclear Support Center cooling tower water supply. Additional evaluation of adding a flow totalizer or other measure device in the makeup line to the Essential Cooling Pond was not feasible due to its underground location and safety function. Adding a totalizer in the secondary makeup line also proved to not be feasible. A strap on flow meter is used periodically to estimate the supply to the secondary system.

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<sup>2</sup> Water Conservation Best Management Practices Guide, Texas Water Development Board Report No. 362, November 2004.



### **Other Water Planning and Conservation Involvement**

The South Texas Project was chosen to represent the electric generating utility interest for the water-planning region that encompasses the Colorado River Basin. The South Texas Project actively participates in the Lower Colorado Regional Water Planning Group to identify strategies to meet future water supply demand projections for the region and update the regional plan accordingly. The South Texas Project was also actively involved in providing review and comment on the Coastal Plains Groundwater Conservation district rules prior to their adoption and subsequent revision.

### **Regional Water Planning and Coordination**

This plan is effective May 1, 2009 and the next revision must be submitted not later than May 1, 2014, and every five years after that date to coincide with the Lower Colorado regional water planning process.

WR-8. OPOP02-LM-0001. Rev. 41 dated 2/1/2011. Reservoir Makeup  
Pumping Facility.

WR-8

## SOUTH TEXAS PROJECT NUCLEAR GENERATING STATION

D0527

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Non-Quality	Non Safety-Related	Usage: <b>IN HAND</b>	Effective Date: 02/01/2011
Mark Page	Gary Williams	Crew 2A	Operations
PREPARER	TECHNICAL	USER	COGNIZANT DEPT

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Usage

1 - IN HAND

2 - IN HAND CONTROLLING STATION

3 - REFERENCED

4 - AVAILABLE

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## 1.0 Purpose and Scope

- 1.1 Provide instructions for operation of the Reservoir Makeup Pumping Facility (RMPF).

## 2.0 References

### 2.1 Procedures / SPRs

- 2.1.1 0POP02-AE-0005, 138KV Circuit Switcher Operation
- 2.1.2 0POP02-NM-0001, Cathodic Protection Systems
- 2.1.3 0POP02-WW-0001, Well Water System Operations
- 2.1.4 0POP02-CW-0001, Circulating Water System Pump Operation
- 2.1.5 0PGP03-ZI-0032, Miscellaneous Safety
- 2.1.6 0POP01-ZO-0004, Extreme Cold Weather Guidelines
- 2.1.7 MATS Item 8901279-936 (SPR 890552)

### 2.2 P&IDs

- 2.2.1 9Y500F10008, RMPF Traveling Water Screens
- 2.2.2 6Y500F10009, Reservoir Makeup Pumps

### 2.3 Logic Diagrams

- 2.3.1 0-Z-40325, Reservoir Make-up Wtr Pmps
- 2.3.2 0-Z-40326, Screen Wash Spray Valves
- 2.3.3 0-Z-40328, Screen Wash Pumps No. 11, 12 and 13
- 2.3.4 0-Z-40330, Reservoir Make-up Pumps Discharge Valve
- 2.3.5 0-Z-40331, Screen Wash Sluice Valves

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- 2.4 Electrical One-Line Diagrams
  - 2.4.1 0-E-1208-0, 4160V Switchgear 1M
  - 2.4.2 0-E-1210-E, Reservoir Makeup Pump Facilities 125 VDC
  - 2.4.3 0-E-1401-L, 480V MCC 1M2
  - 2.4.4 0-E-1400-I, 480V MCC 1M1
  - 2.4.5 0-E-1402-I, 480V MCC 1M3
  - 2.4.6 0-E-2982-5, Power & Control
  - 2.4.7 0-E-6273-3, Control Wiring Diagram
  - 2.4.8 0-E-1209-I, 480V Switchgear 1M
- 2.5 DCN MD2986, Removal of River Water Makeup Pumps 5, 6, 7, & 8
- 2.6 NDCC 95-9137-7, Abandoned in place Traveling Screens 1 and 14 through 24
- 2.7 DCP 97-12632-2, Removal of RMPF Discharge MOVs 005, 006, 007, & 008
- 2.8 Environmental Report of June 16, 1987
- 2.9 NUREG-1171, Final Environmental Statement of August 1986
- 2.10 ST-HL-FC-106, Correspondence Between HL&P and USEPA
- 2.11 VTD-Z010-0007, Instruction Manual Duplex Strainer, Gate Type, 570 Series
- 2.12 CR 05-15975, Seal Water Booster Pump Damage Due to Loss of Facilities Transformer
- 2.13 Amended and Restated Contract Between the Lower Colorado River Authority and STP Nuclear Operating Company (effective January 1, 2006)
- 2.14 CREE 09-322-415, procedural guidance to operate the River Screen Wash Seal Water System in temperatures below 34° Fahrenheit. No longer valid due to DCP 09-91-162
- 2.15 VTD-C173-0014, C&D Technologies Are Series Single Phase Input Installation And Operating Instructions For Standby Power Chargers.
- 2.16 DCP 09-91-162, RMPF Screen Wash without seal water

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<p style="text-align: center;"><u>NOTE</u></p> <p style="text-align: center;">Prerequisites MAY be completed in any order.</p>
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### 3.0 Prerequisites

- 3.1 ENSURE RMPF Cathodic Protection is aligned per 0POP02-NM-0001, Cathodic Protection Systems. \_\_\_\_\_
- 3.2 ENSURE the following Lineup are complete:
  - Lineup 1, Valve Lineup \_\_\_\_\_
  - Lineup 2, Instrument Vent Lineup \_\_\_\_\_
  - Lineup 3, Control Panel Lineup \_\_\_\_\_
- 3.3 WHEN work is being performed in the battery room, THEN ENSURE a portable eye wash station is available per 0PGP03-ZI-0032, Miscellaneous Safety. \_\_\_\_\_

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#### 4.0 Notes and Precautions

- 4.1 WHEN the RMPF will be completely de-energized, THEN the Battery Chargers AND Battery SHOULD be secured from the DC buss per Section 6.0 Battery and Battery Charger Operations.
- 4.2 WHEN re-energizing AC power to the RMPF following a power outage, THEN the battery SHOULD be placed in service prior to restoring AC to the RMPF for breaker control.
- 4.3 The makeup pump discharge valve pits are enclosed spaces. An oxygen (O<sub>2</sub>) monitor SHALL be used when working/operating in the discharge valve pits.
- 4.4 WHEN Colorado River flow is >10000 cfs, THEN RMPF Traveling Screens SHOULD be rotated shiftly to prevent silting up of the screens.
- 4.5 Traveling screens SHOULD NOT be rotated unless screen wash water pressure is greater than or equal to 80 psig nozzle pressure.
- 4.6 During pumping operations with the traveling screens non-operational and a differential water level is indicated, pumping capacity SHOULD be reduced to eliminate the differential water level.
- 4.7 Screen Wash Pump 11 and 12 supplies their own seal water.
- 4.8 Bearing water flow SHOULD be maintained to the Reservoir Make-up Pumps continuously to preclude entry of foreign material into the bearings.
- 4.9 IF bearing water flow is lost to any Reservoir Make-up Pump, THEN bearing water flow SHALL be re-established for 30 minutes prior to restarting the affected pump.
- 4.10 Motor duty cycles for RMPF Pump starts are as follows:
  - 4.10.1 One unit MAY be started every 60 seconds.
  - 4.10.2 For a cold start, two consecutive starts MAY be attempted. IF the two attempted starts fail, THEN another start MAY NOT be attempted for one hour.
  - 4.10.3 For a hot start, one restart MAY be attempted. IF the restart attempt fails, THEN another start **SHALL NOT** be attempted for one hour.
  - 4.10.4 After a station power failure, an RMPF Pump MAY be restarted after one hour has elapsed since power restoration.
  - 4.10.5 All start attempts SHALL be made with the discharge valve 20-25 percent open. The RMPF Pump discharge valve must be at least 20% open for pump start permissive.
- 4.11 RMPF discharge valves are normally maintained in "AUTO" except for manual pump starts/stops per Section 13.0, Pumping Operations.

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- 4.12 Pumping rate diversion SHALL **NOT** exceed 55% of river flow in excess of 300 cfs at the diversion point. (Environmental Limit)
- 4.13 Maximum instantaneous pumping rate SHALL **NOT** exceed 1200 cfs. Present capacity with 4 pumps is 600 cfs. (Environmental Limit)
- 4.14 Maximum annual diversion SHOULD **NOT** exceed 102,000 acre feet of water. (Environmental Limit)
- 4.15 WHEN conductivity in the pump bay is greater than 2100  $\mu\text{s}/\text{cm}$ , THEN pump only as specified in Addendum 3, Main Cooling Reservoir Water Delivery Plan During Drought Conditions **AND** with additional conductivity monitoring by Chemistry. WHEN river conductivity exceeds the maximum specifications of Addendum 3, Main Cooling Reservoir Water Delivery Plan During Drought Conditions, THEN diversion is only allowed with approval from Chemistry or Environmental Management.
- 4.16 Chemistry is responsible for additional monitoring of conductivity when pump bay is greater than 2100  $\mu\text{s}/\text{cm}$  and pumping is sustained.
- 4.17 Reservoir level SHALL **NOT** be raised greater than +47 feet using CWIS Local digital level indicator (PREFERRED) or ICS WAVE Point L6537 (ALTERNATE).
- 4.18 Guidance for reservoir level control is provided in Addendum 3, Main Cooling Reservoir Water Delivery Plan During Drought Conditions.
- 4.19 During pumping operations, the River Flow Rate vs. Maximum Allowed Pumping Rate/Pump Combination SHOULD be verified at least twice per shift.
- 4.20 The following limitations apply due to the 10 hour lag time between the Bay City gauging station and the RMPF.
- 4.20.1 IF river flow increases, THEN a 10 hour wait period SHALL be observed before increasing the flow to the reservoir.
- 4.20.2 IF river flow decreases, THEN credit SHALL **NOT** be taken for the 10 hours. Flow to the reservoir SHALL be decreased immediately.
- 4.21 The LCRA web site and the USGS web site use the same gauge, therefore it is acceptable to use either web site for river information. The times SHOULD be noted as the web site updates MAY **NOT** occur at the same time, the 10 hour requirements are still valid.
- 4.22 The Bay City GAUGE is specified in the contractual agreement with LCRA, so the Lane City gauge SHOULD **NOT** be used.
- 4.23 IF Seal Water is lost to an operating RMPF Pump, THEN the affected pump SHALL be immediately stopped by placing the appropriate control switch in "PULL FOR E. STOP".
- 4.24 Pump area SHALL remain free of articles that could get caught by the rotating pump shaft or block motor ventilation.



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- 4.25 RMPF Pump motor oil reservoirs SHALL be maintained at normal operating levels to prevent bearing damage.
- 4.26 IF performing the first RMPF Pump start, THEN two people, with radios, are required to monitor pump amperage. This is performed to protect the pump/motor in the event that the pump bay has silted up. This is **NOT** required on subsequent pump starts.
- 4.27 Starting current for an initial RMPF Pump start SHALL be observed at the respective breaker cubicle. IF the starting current DOES **NOT** return to an acceptable run current within 10 seconds after RMPF Pump start, THEN the associated RMPF Pump control switch SHALL be immediately placed in the "PULL FOR E. STOP" position.
- 4.28 Only one operating RMPF Pump SHOULD be shutdown at a time. IF a 240 cfs AND a 60 cfs pump are operating, THEN the 240 CFS RMPF Pump SHOULD normally be shutdown before the 60 cfs RMPF Pump.
- 4.29 WHEN the river flow dictates a RMPF Pump configuration with only a 240 cfs pump in operation for maximum reservoir makeup per Addendum 2, River Flow Rate vs Maximum Allowed Pumping Rate/Pump Combination, THEN a 60 cfs pump MAY be secured before the 240 cfs as noted prior to Steps 13.10.2.1 and 13.11.2.1.
- 4.30 A **MINIMUM** of 5 minutes SHOULD be allowed between sequential RMPF Pump stops to minimize hydraulic surges in the pipeline.
- 4.31 IF a RMPF Pump critical bearing temperature is reached, THEN the applicable pump SHALL be shutdown as rapidly as possible. (Reference 2.1.7)
- |                |          |       |
|----------------|----------|-------|
| Upper bearing: | Alarm    | 185°F |
|                | Critical | 200°F |
| Lower bearing: | Alarm    | 160°F |
|                | Critical | 175°F |
- 4.32 The 138 KV Transformer Circuit Switcher SHALL **NOT** be operated unless the loads on the transformer secondary are deenergized. This restriction DOES **NOT** apply to emergency conditions.
- 4.33 Standard electrical safety precautions SHALL be observed.
- 4.34 Fire Protection SHALL be notified prior to deenergizing MCC 1M2, due to loss of power to the local Fire Protection Panel.
- 4.35 The Seal Water Booster Pumps SHALL **NOT** be allowed to run without the Well Water System in operation.
- 4.36 A minimum of 1 Sand Separator SHALL be in service at Well Water Pump 7 prior to placing any RMPF Pumps in service which require seal water.

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- 4.37 To prevent exceeding the design pressure of the oil coolers for RMPF Pumps 3 and 4, only the "MOTOR OIL COOLER INLET" valves SHALL be throttled to maintain required oil cooler flow.
- 4.38 Battery Room Ventilation SHALL be in continuous operation. IF Battery Room Ventilation fails during an equalizing charge, THEN the battery equalizing charge SHALL be secured.
- 4.39 IF battery acid is spilled on skin or in eyes, THEN the affected area SHALL be washed immediately to avoid injury.
- 4.40 Smoking and sparks are prohibited in the Battery Room. Insulated non-sparking tools only are allowed in the Battery Room.
- 4.41 WHEN energizing the Battery Charger, THEN the Battery Charger DC Breaker SHALL be closed prior to closing the charger AC Breaker.
- 4.42 WHEN deenergizing the Battery Charger, THEN the Battery Charger AC Breaker SHALL be opened prior to opening the DC Breaker.
- 4.43 IF a ground fault exists on the battery or the Battery Charger, THEN the battery SHALL **NOT** be charged.
- 4.44 The twelve available traveling screens are flush with the river shoreline and SHOULD all be operational. A material condition report SHALL be initiated for any of the available traveling screens **NOT** operational.
- 4.45 The RMPF intake structure has the following design features:
- 4.45.1 The maximum approach velocity to the traveling water screens is 0.5 feet per second.
  - 4.45.2 Fish passageways were constructed in the wing walls between the traveling screens to facilitate fish migration parallel to the screen faces.
  - 4.45.3 A sluice and discharge line was installed for the purpose of returning all impinged organisms directly to the river, downstream of the intake structure, immediately after being backwashed from the screens.
- 4.46 When outside ambient temperatures < 25° F, THEN Secure RMFP Operations as follows:
- Stop Reservoir Make-up Pumps per Step 13.12.
  - Secure Screen Wash Operations per Section 15.0

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- 4.47 Power to the Well Water System will be lost with a loss of the 138 KV Facilities Transformer. If the Seal Water Booster Pumps are running, pump damage will occur. To prevent this, the Seal Water Booster Pumps and the Screen Wash Pumps SHALL be secured following each RMPF pumping/screen wash evolution. The Seal Water Booster Pumps and the Screen Wash Pumps will also have to be placed in service prior to the start of any RMPF pumping/screen wash evolution.

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## 5.0 Electrical Operations

### 5.1 Electrical alignment of the RMPF

5.1.1 ENSURE the following Breakers on “125 VOLT DISTRIBUTION PANEL DCDP 20 A” are in the “ON” position:

5.1.1.1 BKR 2 (125VDC Battery and 2M Charger to Bus DCDP20A) \_\_\_\_\_

5.1.1.2 BKR 4 (138 KV Circuit Switcher) \_\_\_\_\_

5.1.1.3 BKR 6 (High Speed Ground Switch) \_\_\_\_\_

5.1.1.4 BKR 8 (4160V Switchgear 1M) \_\_\_\_\_

5.1.1.5 BKR 10 (480V Switchgear 1M) \_\_\_\_\_

5.1.2 ENSURE the “125 VOLT CONTROL POWER BREAKER” inside 4160V Switchgear 1M/13 cubicle is in the “ON” position. \_\_\_\_\_

5.1.3 ENSURE the “125 VDC CONTROL CIRCUIT” breaker inside the 480V LC 1M/1B cubicle Control Panel is in the “ON” position. \_\_\_\_\_

5.1.4 VERIFY AC power is available on the feeder to the 138 KV River Service Transformer, by contacting the Control Room. \_\_\_\_\_

5.1.5 VERIFY the following conditions on the RMPF 138 KV River Service Transformer:

#### NOTE

The 25°C mark is the normal level at 25°C oil temperature. IF temperature is GREATER THAN 25°C, THEN the oil level SHOULD be above the 25°C mark.

5.1.5.1 Oil level in Main Tank is between the “HI” mark and “LO” mark. \_\_\_\_\_

5.1.5.2 Oil level in ALL three transformer bushings is between the “HI” and “LO” level indication. \_\_\_\_\_

5.1.5.3 ALL oil cooling system valves are in the “OPEN” position. (W. side of Transformer, 6 inlet and 6 outlet) \_\_\_\_\_

5.1.5.4 ENSURE transformer Nitrogen pressure between 0.5 psig and 6.5 psig as indicated locally. \_\_\_\_\_

5.1.6 VERIFY oil level in the main tank is between the “HI” mark and the “LO” mark on the 1500 KVA 4160V/480V Transformer. \_\_\_\_\_

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- 5.1.7 IF the Circuit Switcher is **NOT** coupled, THEN REFER TO OPOP02-AE-0005, 138KV Circuit Switcher Operation, to couple the Circuit Switcher. \_\_\_\_\_
- 5.1.8 PERFORM a visual inspection of the following to ensure system ready for operation:
- 5.1.8.1 The Circuit Switcher is locked in the "COUPLED" position. (At Circuit Switcher local cabinet) \_\_\_\_\_

**NOTE**

The term "brain" used in the following step is referring to the unit for operating disconnects and is located at each circuit switcher interrupter. Although the target is **NOT** reliable until after the circuit switcher is closed, it MAY indicate a broken linkage.

- 5.1.8.2 **NO** yellow targets are visible on brain unit.  
(Window on North side of brain unit for each interrupter) \_\_\_\_\_
- 5.1.8.3 **NO** red targets are visible for SF<sub>6</sub> gas.  
(Window on East side of circuit switcher interrupter) \_\_\_\_\_
- 5.1.9 ALIGN the 138 KV River Service Transformer controls as follows:  
(Local Cabinet, South side of transformer)
- 5.1.9.1 ENSURE the following manual power supply breakers are in the "ON" position:
- a. 8-1 POT Circuit \_\_\_\_\_
  - b. 8-2 Fan Control \_\_\_\_\_
  - c. 8-3 LTC Control \_\_\_\_\_
  - d. 8-4 Heater Circuit \_\_\_\_\_
  - e. 8-5 LTC Motor Circuit \_\_\_\_\_

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- 5.1.10 ENSURE the River Service Transformer controls are aligned as follows: (local cabinet, South side of transformer)
- 5.1.10.1 “43” Fans “MAN/AUTO” Switch is in the “AUTO” position. \_\_\_\_\_
- 5.1.10.2 “TS” Switch is in the “RELAY/OPERATE” position. \_\_\_\_\_
- 5.1.10.3 “43T” Control Selector Switch is in the “MANUAL CONTROL” position. \_\_\_\_\_
- 5.1.10.4 “CS” Control Switch is in the “NEUTRAL” position. \_\_\_\_\_
- 5.1.10.5 VERIFY 10 amp Fuse Window indicates **NOT BLOWN**. \_\_\_\_\_
- 5.1.11 ENSURE the 86 Lockout AND 86-1 Lockout and the associated relay targets are reset. (4160V Switchgear cubicle 1M/6 and cubicle 1M/7) \_\_\_\_\_

**CAUTION**

The High Speed Ground Switch in the tripped position is **NOT** a normal alignment. The Shift Manager/Unit Supervisor SHOULD contact AEP TDSP to investigate the cause of the trip.

- 5.1.12 IF the High Speed Ground Switch is tripped, THEN ARM the High Speed Ground Switch as follows:
- 5.1.12.1 ROTATE “T1GS” handle to the “LATCH” position. \_\_\_\_\_
- 5.1.12.2 ROTATE “T1GS” handle to the “NORMAL” position. \_\_\_\_\_
- 5.1.13 ENSURE local high speed ground switch “G014” isolation link closed. \_\_\_\_\_
- 5.1.14 ENSURE ALL Reservoir Make-up Pump Control Switches are in the “PULL FOR E. STOP” position. \_\_\_\_\_
- 5.1.15 ENSURE the “REMOTE/LOCAL M/U STA/SPILLWAY TRANSFER SWITCH” is in the “LOCAL” position. (ZLP-500) \_\_\_\_\_
- 5.1.16 VERIFY ALL Loads Breakers are in the “OFF” position for the following 480V MCC’s:
- 480V MCC 1M1 \_\_\_\_\_
  - 480V MCC 1M2 \_\_\_\_\_
  - 480V MCC 1M3 \_\_\_\_\_

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- 5.1.17 VERIFY ALL 4160V Switchgear 1M Breakers are in the “OPEN” position. \_\_\_\_\_
- 5.1.18 VERIFY 480V LC 1M/1C “4160V SWGR 1M TO 480V LC 1M” is in the “OPEN” position. \_\_\_\_\_
- 5.1.19 VERIFY the following 480V LC 1M Feeder Breakers are in the “OPEN” position:
- LC 1M/2C “TO 480V MCC 1M3” \_\_\_\_\_
  - LC 1M/1D “TO 480V MCC 1M1” \_\_\_\_\_
  - LC 1M/2D “TO 480V MCC 1M2” \_\_\_\_\_
- 5.1.20 ENSURE the following prior to energizing the 138 KV River Service Transformer or any other RMPF electrical equipment:
- Personnel are clear of equipment. \_\_\_\_\_
  - ALL temporary grounding devices are removed. \_\_\_\_\_
  - Electrical equipment enclosures are closed and clear of obstacles or potential hazards. \_\_\_\_\_
- 5.2 ENERGIZE the 138 KV River Service Transformer as follows:
- 5.2.1 IF 138 KV Circuit Switcher manual operation is required, THEN CLOSE the 138 KV Circuit Switcher per OPOP02-AE-0005, 138KV Circuit Switcher Operation, **AND** GO TO Step 5.2.3. \_\_\_\_\_
- 5.2.2 CLOSE the 138 KV Circuit Switcher with the “INCOMING LINE” Remote Control Switch at 4160V Switchgear 1M/7. \_\_\_\_\_
- 5.2.3 VERIFY CLOSED indication for Incoming Line at 4160V Switchgear 1M/7. \_\_\_\_\_

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**CAUTION**

IF the 138 KV Circuit Switcher **DOES NOT** close after 2 attempts, THEN the Unit 2 Shift Manager SHALL be notified.

5.2.4      ENSURE by visual observation the following after closing the Circuit Switcher:

- Disconnects are fully engaged \_\_\_\_\_
- NO yellow targets are visible on brain unit  
(Window on North side of brain unit for each interrupter) \_\_\_\_\_
- NO red targets are visible for SF<sub>6</sub> gas  
(Window on East side of circuit switcher interrupter) \_\_\_\_\_



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5.3 Energizing RMPF Electrical Distribution System.

- 5.3.1 CLOSE the “4160V SWGR 1M TO 480V LC 1M XFMR” breaker to energize the 1500 KVA 4160/480V Transformer.  
(4160 V SWGR 1M/1)
- 5.3.2 VERIFY CLOSED indication for “4160V SWGR 1M TO 480V LC 1M XFMR” at 4160V Switchgear 1M/1.

NOTE

The toggle switch located on the breaker panel SHOULD be in the “ON” position prior to operating any breaker on 480 VAC Load Center. (This allows power to recharge closing springs)

- 5.3.3 CLOSE the “4160V SWGR 1M TO 480V LC 1M” Supply Breaker using the “MAIN” control switch to energize 480 VAC LC 1M.  
(480 VAC SWGR 1M/1B)
- 5.3.4 VERIFY CLOSED indication for “4160V SWGR 1M TO 480V LC 1M” at 480V LC 1M/1C.
- 5.3.5 VERIFY 480V LC 1M voltages using the voltmeter and selector switch to view all phases. (480 VAC SWGR 1M/1B)
- 5.3.6 CLOSE “MCC 1M1 FEEDER BREAKER” (480V LC 1M/1D) using the Control Switch at 480V LC 1M/1B.
- 5.3.7 VERIFY “CLOSED” indication for “MCC 1M1 FEEDER BREAKER” at 480V LC 1M/1D.
- 5.3.8 CLOSE “MCC 1M2 FEEDER BREAKER” (480V LC 1M/2D) using the Control Switch at 480V LC 1M/1B
- 5.3.9 VERIFY “CLOSED” indication for “MCC 1M2 FEEDER BREAKER” at 480V LC 1M/2D.
- 5.3.10 CLOSE “MCC 1M3 FEEDER BREAKER” (480V LC 1M/2C) using the Control Switch at 480V LC 1M/1B
- 5.3.11 VERIFY “CLOSED” indication for “MCC 1M3 FEEDER BREAKER” at 480V LC 1M/2C.

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- 5.3.12 ADJUST voltage as necessary, to approximately 4200 volts.  
(local cabinet, South side of transformer) \_\_\_\_\_
- 5.3.13 PLACE “43T” Control Selector Switch is in the “AUTO CONTROL”  
position. (local cabinet, South side of transformer) \_\_\_\_\_
- 5.3.14 IF the Tap Changer (S side of Transformer, 6 ft above local cabinet)  
begins stepping greater than 2 steps either direction, THEN  
PERFORM the following: (local cabinet, South side of transformer)
- 5.3.14.1 PLACE “43T” Control Selector Switch is in the  
“MANUAL CONTROL” position. \_\_\_\_\_
- 5.3.14.2 ADJUST voltage to approximately 4200 volts. \_\_\_\_\_
- 5.3.14.3 REQUEST Electrical Maintenance assistance in  
resetting the tap changer. \_\_\_\_\_
- 5.3.15 WHEN the Load Tap Changer has Stabilized, THEN DEPRESS the  
“POSITION INDICATOR RESET” pushbutton to reset the  
High/Low Indications. \_\_\_\_\_
- 5.3.16 PERFORM Lineup 4, Electrical Lineup for MCC’s 1M1 and 1M2. \_\_\_\_\_

**NOTE**

The battery SHOULD be recharged before battery terminal voltage decreases to 104 volts. Electrical Maintenance SHOULD be notified so that the quarterly battery inspection PM is performed no less than 72 hours and no more than 7 days after power is restored.

- 5.3.17 PERFORM Section 6.0 to align a battery charger for service. \_\_\_\_\_
- 5.3.18 COMPLETE Lineup 4, Electrical Lineup. \_\_\_\_\_
- 5.3.19 ENSURE RMPF Cathodic Protection System in service per  
0POP02-NM-0001, Cathodic Protection Systems. \_\_\_\_\_
- 5.3.20 IF RMPF AC power has been off for a significant amount of time  
(greater than 8 hours), THEN REQUEST Electrical Maintenance  
perform the quarterly battery inspection PM no less than 72 hours  
and no more than 7 days after power is restored. \_\_\_\_\_

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5.4 Deenergizing 480V MCC 1M1

- 5.4.1 ENSURE Reservoir Make-up Pumps are secured per Step 13.12. \_\_\_\_\_
- 5.4.2 ENSURE ALL Load Breakers on 480V MCC 1M1 are in the "OFF" position. \_\_\_\_\_
- 5.4.3 OPEN "MCC 1M1 FEEDER BREAKER" (480V LC 1M/1D) using the Control Switch at 480V LC 1M/1B. \_\_\_\_\_
- 5.4.4 VERIFY "OPEN" indication for "MCC 1M1 FEEDER BREAKER" at 480V LC 1M/1D. \_\_\_\_\_

5.5 De-energizing 480V MCC 1M2

- 5.5.1 NOTIFY Fire Protection that MCC 1M2 is to be deenergized. (Local Fire Protection power) \_\_\_\_\_
- 5.5.2 DEENERGIZE Battery Chargers 1M and 2M in accordance with Step 6.3. \_\_\_\_\_
- 5.5.3 ENSURE ALL Load Breakers on MCC 1M2 are the "OFF" position. \_\_\_\_\_
- 5.5.4 OPEN "MCC 1M2 FEEDER BREAKER" (480V LC 1M/2D) using the Control Switch at 480V LC 1M/1B \_\_\_\_\_
- 5.5.5 VERIFY "OPEN" indication for "MCC 1M2 FEEDER BREAKER" at 480V LC 1M/2D. \_\_\_\_\_

**Reservoir Makeup Pumping Facility****CAUTION**

DO **NOT** allow the battery to be fully discharged. The 138 KV Circuit Switcher Motor Operator requires DC power to be able to energize the RMPF AC system

## 5.6 Deenergizing 480V MCC 1M3

- 5.6.1 ENSURE the Screen Washing System is secured per Section 15.0. \_\_\_\_\_
- 5.6.2 ENSURE ALL Load Breakers on 480V MCC 1M3 are in the "OFF" position. \_\_\_\_\_
- 5.6.3 OPEN "MCC 1M3 FEEDER BREAKER" (480V LC 1M/2C) using the Control Switch at 480V LC 1M/1B \_\_\_\_\_
- 5.6.4 VERIFY "OPEN" indication for "MCC 1M3 FEEDER BREAKER" at 480V LC 1M/2C. \_\_\_\_\_

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5.7 Deenergize 4160V Switchgear 1M:

5.7.1 ENSURE the following 480V MCCs are DEENERGIZED:

- 480V MCC 1M1
- 480V MCC 1M2
- 480V MCC 1M3

5.7.2 OPEN the “4160V SWGR 1M TO 480V LC 1M” Supply Breaker using the “MAIN BREAKER” control switch.  
(480 VAC SWGR 1M/1B)

5.7.3 VERIFY “OPEN” indication for “4160V SWGR 1M TO 480V LC 1M” at 480V LC 1M/1C.

5.7.4 OPEN the “4160V SWGR 1M TO 480V LC 1M XFMR” breaker.  
(4160 V SWGR 1M/1)

5.7.5 VERIFY “OPEN” indication for “4160V SWGR 1M TO 480V LC 1M XFMR” at 4160 V SWGR 1M/1.

5.7.6 IF 138 KV Circuit Switcher manual operation is required, THEN OPEN the 138 KV Circuit Switcher per OPOP02-AE-0005, 138 KV CIRCUIT SWITCHER OPERATION, **AND** GO TO Step 5.7.8.

5.7.7 OPEN the 138 KV Circuit Switcher using the “INCOMING LINE” Remote Switch on 4160 V SWGR 1M/7.

5.7.8 VERIFY “OPEN” indication for “INCOMING LINE” at 4160 V SWGR 1M/7.

5.7.9 IF desired to decouple the 138 KV Circuit Switcher, THEN REFER TO OPOP02-AE-0005, 138KV Circuit Switcher Operation.

**Reservoir Makeup Pumping Facility****CAUTION**

DO **NOT** allow the battery to be fully discharged. The 138 KV Circuit Switcher Motor Operator requires DC power to be able to energize the RMPF AC system.

- 5.7.10 MONITOR the battery voltage AND specific gravity. \_\_\_\_\_
- 5.7.11 PERFORM a battery charge before battery terminal voltage reaches 104 volts or 1.75 volts across a cell. \_\_\_\_\_
- 5.7.12 IF the AC system AND one Battery Charger can **NOT** be restored within 8 hours, THEN OPEN the DC Feeder Breakers to DCDP 20A for Battery Charger 1M and 2M before the Battery is completely discharged.
- BKR 2 (125VDC Battery and 2M Charger to Bus DCDP20A) \_\_\_\_\_
  - BKR 1 (1M CHARGER TO BUS DCDP 20A) \_\_\_\_\_
  - BKR 12 (2M CHARGER TO BUS DCDP 20A) \_\_\_\_\_

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## 6.0 Battery and Battery Charger Operations

### NOTE

- WHEN the RMPF will be completely de-energized, THEN the Battery Chargers AND Battery SHOULD be secured from the DC buss per Section 6.0 Battery and Battery Charger Operations.
- WHEN re-energizing AC power to the RMPF following a power outage, THEN the battery SHOULD be placed in service prior to restoring AC to the RMPF for breaker control.
- The Battery chargers are **NOT** designed for load share. When swapping chargers, secure the in-service charger before starting up the other charger. A single charger will maintain the battery fully charged.
- Initial system startup from a complete shutdown condition requires the performance of Steps 6.1 through 6.2.9.
- Steps 6.2.2 through 6.2.8 are to be performed to startup an individual Battery Charger.
- Step 6.3 is to be performed to secure an individual Battery Charger.
- Step 6.4 is to be performed to deenergize the RMPF Battery.
- Step 6.5 is to be performed to return the RMPF Battery to service.

### 6.1 IF restoring power to the RMPF, THEN PERFORM the following:

- 6.1.1 WHEN AC power is available, THEN ENSURE Battery Room Ventilation is in service.
- 6.1.2 ENSURE Battery Cell Fill Caps and Flash Arrestors are in place on each cell.
- 6.1.3 ENSURE 480V MCC 1M2 is energized.
- 6.1.4 VERIFY Battery Charger 1M AC Breaker, "CB 1" is in the "OFF" position. (front of battery charger)
- 6.1.5 VERIFY Battery Charger 2M AC Breaker, "CB 1" is in the "OFF" position. (front of battery charger)
- 6.1.6 VERIFY Battery Charger 1M DC Breaker, "CB 2" is in the "OFF" position. (front of battery charger)
- 6.1.7 VERIFY Battery Charger 2M DC Breaker, "CB 2" is in the "OFF" position. (front of battery charger)
- 6.1.8 ENSURE the 120 VAC Space heater Feeder Breakers are in the "ON" position.
  - DP20-B BKR 24 SPACE HTR for Battery Charger 1M
  - DP20-B BKR 26 SPACE HTR for Battery Charger 2M

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- 6.2 PERFORM the following to place RMPF DC System Chargers in service:
- 6.2.1 ENSURE DCDP 20A BKR 2 (125VDC Battery and 2M Charger to Bus DCDP20A) in the “ON” position. \_\_\_\_\_
  - 6.2.2 ENSURE the DC Feeder Breaker to DCDP 20A for the selected Battery Charger in the “ON” position. \_\_\_\_\_
    - BKR 1 (1M CHARGER TO BUS DCDP 20A) (50amp) \_\_\_\_\_
    - BKR 12 (2M Charger to Bus DCDP20A) (50amp) \_\_\_\_\_
  - 6.2.3 ENSURE AC Feeder Breaker for selected Battery Charger in the “ON” position: \_\_\_\_\_
    - 480V MCC 1M2/C1U “BATTERY CHARGER 1M” \_\_\_\_\_
    - 480V MCC 1M2/C1L “BATTERY CHARGER 2M” \_\_\_\_\_

NOTE

- The Battery chargers are **NOT** designed for load share.
- When swapping chargers, secure the in-service charger before starting the other charger.
- A single charger will maintain the battery fully charged.
- The high initial in-rush current charging the filter capacitors MAY cause ANY of the DC breakers to trip. This is an expected occurrence for the startup procedure.
- IF ANY DC breakers trip, THEN the affected breakers SHOULD be RESET AND placed back in the “ON” position.

The RMPF Battery Chargers MAY be energized using either method.

- Alternate - Breakers for the chargers are closed AC first, Wait for voltage to build to normal range, then DC. (Step 6.2.4) This method reduces the number of tripped breakers and SHOULD be the preferred method.
- Normal – Breakers for the chargers are closed DC first, then AC. (Step 6.2.4)

- 6.2.4 IF desired to perform the ALTERNATE START of Battery Charger 1M or 2M, THEN PERFORM the following:

- 6.2.4.1 PLACE the “FLOAT/EQUALIZE” switch on the selected Battery Charger in the following position: \_\_\_\_\_
  - Battery Charger 1M – “FL” \_\_\_\_\_
  - Battery Charger 2M – “FL” \_\_\_\_\_
- 6.2.4.2 PLACE the AC Breaker, “CB1” for the selected Battery Charger in the “ON” position. \_\_\_\_\_
- 6.2.4.3 WAIT for several seconds for the DC Voltage to reach normal setpoint. \_\_\_\_\_



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NOTE

IF ANY DC breakers trip, THEN the affected breakers SHOULD be RESET AND placed back in the "ON" position. This is an expected occurrence for the startup procedure.

6.2.4.4 PLACE the DC Breaker, "CB2" for the selected Battery Charger in the "ON" position. \_\_\_\_\_

6.2.4.5 IF ANY of the following DC Breakers trip following initial closure during charger startup, THEN RESET and PLACE the affected DC Breakers, in the "ON" position and PROCEED.

- DCDP 20A BKR 1 (1M CHARGER TO BUS DCDP 20A) (50amp) \_\_\_\_\_
- DCDP 20A BKR 2 125VDC Battery and 2M Charger to Bus DCDP20A. \_\_\_\_\_
- DCDP 20A BKR 12 (2M Charger to Bus DCDP20A) (50amp) \_\_\_\_\_
- CB-2, DC Breaker for Selected Charger. \_\_\_\_\_

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6.2.5 IF desired to perform the NORMAL START of Battery Charger 1M or 2M, THEN PERFORM the following:

6.2.5.1 PLACE the "FLOAT/EQUALIZE" switch on the selected Battery Charger in the following position:

- Battery Charger 1M – "FL" \_\_\_\_\_
- Battery Charger 2M – "FL" \_\_\_\_\_

NOTE

IF ANY DC breakers trip, THEN the affected breakers SHOULD be RESET AND PLACED back in the "ON" position. This is an expected occurrence for the startup procedure.

6.2.5.2 PLACE the DC Breaker, "CB2" for the selected Battery Charger in the "ON" position. \_\_\_\_\_

6.2.5.3 PLACE the AC Breaker, "CB1" for the selected Battery Charger in the "ON" position. \_\_\_\_\_

6.2.5.4 IF ANY of the following DC Breakers trip following initial closure during charger startup, THEN RESET and PLACE the affected DC Breakers, in the "ON" position and PROCEED.

- DCDP 20A BKR 1 (1M CHARGER TO BUS DCDP 20A) (50amp) \_\_\_\_\_
- DCDP 20A BKR 2 125VDC Battery and 2M Charger to Bus DCDP20A. \_\_\_\_\_
- DCDP 20A BKR 12 (2M Charger to Bus DCDP20A) (50amp) \_\_\_\_\_
- CB-2, DC Breaker for Selected Charger. \_\_\_\_\_

6.2.6 VERIFY the following light on the selected Battery Charger is illuminated:

- Battery Charger 1M - "AC ON" \_\_\_\_\_
- Battery Charger 2M - "AC ON" \_\_\_\_\_

6.2.7 VERIFY the Battery Charger DC Voltmeter indicates approximately 130 VDC. \_\_\_\_\_

6.2.8 CHECK battery voltage to ground at the DC Control Panel "DCCP 20A". \_\_\_\_\_

6.2.9 ENERGIZE DC loads as necessary. \_\_\_\_\_

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6.3 IF a RMPF Battery Charger (1M or 2M) is to be secured, THEN PERFORM the following steps:

6.3.1 VERIFY the FLOAT/EQUALIZE switch on the selected Battery Charger in the following position:

- Battery Charger 1M – “FL”
- Battery Charger 2M – “FL”

### **CAUTION**

WHEN deenergizing the Battery Charger, THEN the Battery Charger AC Breaker SHALL be opened prior to opening the DC Breaker.

6.3.2 PLACE the AC Breaker, “CB 1” for the selected Battery Charger in the “OFF” position.

6.3.3 PLACE the DC Breaker, “CB 2” for the selected Battery Charger in the “OFF” position.

6.3.4 IF Securing Charger 1M, THEN PLACE DCDP 20A BKR 1 in the “OFF” position. (50amp).

6.3.5 IF Securing Charger 2M, THEN PLACE DCDP 20A BKR 12 in the “OFF” position. (50amp) (2M Charger to Bus DCDP20A).

6.3.6 VERIFY the following light on the selected Battery Charger is extinguished:

- Battery Charger 1M - “AC ON”
- Battery Charger 2M - “AC ON”

6.3.7 VERIFY zero volts are indicated on the DC voltmeter for the selected Battery Charger.

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- 6.3.8 IF maintenance is to be performed on the Battery Charger, THEN PERFORM the following:
- 6.3.8.1 PLACE the 480V AC Feeder Breaker for the selected Battery Charger in the "OFF" position.
- 480V MCC 1M2/C1U "BATTERY CHARGER 1M" \_\_\_\_\_
  - 480V MCC 1M2/C1L "BATTERY CHARGER 2M" \_\_\_\_\_
- 6.3.8.2 PLACE the 120 VAC Space heater Feeder Breaker for the selected Battery Charger in the "OFF" position.
- DP20-B BKR 24 SPACE HTR for Battery Charger 1M \_\_\_\_\_
  - DP20-B BKR 26 SPACE HTR for Battery Charger 2M \_\_\_\_\_
- 6.4 IF the RMPF Battery is to be deenergized, THEN PERFORM the following:
- 6.4.1 ENSURE BOTH Battery Charger removed from service per Step 6.3. \_\_\_\_\_
- 6.4.2 PLACE DCDP 20A BKR 2 (125VDC Battery and 2M Charger to Bus DCDP20A) in the "OFF" position. (225amp) \_\_\_\_\_
- 6.5 WHEN the RMPF Battery is to be returned to service, THEN PERFORM the following:
- 6.5.1 PLACE DCDP 20A BKR 2 (125VDC Battery and 2M Charger to Bus DCDP20A) in the "ON" position. (225amp) \_\_\_\_\_
- 6.5.2 PERFORM Steps 6.1 through Step 6.2.9. \_\_\_\_\_

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## 7.0 Initiating Traveling Screen Operations

### NOTE

- WHEN Colorado River flow is >10000 cfs, THEN RMPF Traveling Screens **SHOULD** be rotated shiftly to prevent silting up of the screens.
- The Traveling Screen Level Differential Circuit must be in operation for automatic traveling screen operation on high differential pressure. IF the circuit is OOS, THEN continuous screen wash must be manually initiated during pumping operations.
- IF ALL traveling screens are inoperable during pumping operations, THEN the screens **SHOULD** be inspected hourly for signs of differential water level. **SHOULD** a differential water level develop across the screens then pumping capacity **SHALL** be reduced **OR** pumping secured until screen wash capabilities are restored.
- A material condition report **SHALL** be initiated for any of the available traveling screens **NOT** operational.
- Traveling screens 1, 14 through 24, and Screen Wash Pump 3 are abandoned in place.
- Traveling Screen Sequenced Wash Cycle Controls are located at 480V MCC 1M3/G1.

7.1 VERIFY Sluice Trench Catch Baskets are in place **AND** aligned to receive the wash trash. \_\_\_\_\_

7.2 IF manual screen wash operation is required, THEN GO TO Section 9.0. \_\_\_\_\_

7.3 VERIFY with Chemistry that the river sample supports reservoir makeup. \_\_\_\_\_

7.4 ENSURE BOTH sluice trench isolation valves are fully OPEN:  
(Upstream RL-047 between Traveling Screens 12 and 13)

- “0-RL-0015 RMPF TRAVELING SCREENS 1-12 SPRAY WASH TO SLUICE TRENCH ISOLATION VALVE”. \_\_\_\_\_
- “0-RL-0016 RMPF TRAVELING SCREENS 13-24 SPRAY WASH TO SLUICE TRENCH ISOLATION VALVE” \_\_\_\_\_

7.5 ENSURE BOTH “RL047” and “RL048” Sluice Valve Control Switches are in the “AUTO” position. (Between traveling screens 12 & 13) \_\_\_\_\_

7.6 ENSURE a Screen Wash Pump Control Switch is in the “AUTO” position:

- “RESERVOIR MAKEUP STRAINER SCREEN WASH PUMP 11” \_\_\_\_\_
- “RESERVOIR MAKEUP STRAINER SCREEN WASH PUMP 12” \_\_\_\_\_

**Reservoir Makeup Pumping Facility**NOTE

- IF the screen wash discharge contains small trash content, THEN the screen wash discharge MAY be directed to the river.
- IF the screen wash discharge is directed to the river, THEN the screen wash discharge SHOULD be monitored for an increase in trash content.
- WHEN river salinity exceeds 3 ppt (5000  $\mu\text{s}/\text{cm}$ ), THEN high conductivity sea water is being pumped into the reservoir.
- There is the potential to impinge fish on the traveling screens. IF fish are being impinged on the screens, THEN Environmental SHALL be contacted for guidance on whether the screen wash SHOULD be routed to the river due to impingement concerns **OR** if pumping operations SHOULD be secured.

7.7 IF it is desired to align screen wash discharge to the river, THEN PERFORM the following:

7.7.1 ALIGN the screen wash discharge to the river using the slide gate southeast of #1 Screen. \_\_\_\_\_

7.7.2 IF the screen wash discharge trash content becomes excessive, THEN ALIGN the discharge back to the Sluice Trench Catch Baskets. \_\_\_\_\_

7.8 PERFORM following to commence Traveling Screen Sequenced Wash Cycle:

7.8.1 DEPRESS Screen Wash Control Panel "PAUSE" pushbutton. \_\_\_\_\_

7.8.2 DEPRESS Screen Wash Control Panel "RESET" pushbutton. \_\_\_\_\_

7.8.3 DEPRESS Screen Wash Control Panel "RESUME" pushbutton. \_\_\_\_\_

7.8.4 DEPRESS Screen Wash Control Panel "START" pushbutton. \_\_\_\_\_

7.8.5 VERIFY the Traveling Screens "START" the sequencing process. \_\_\_\_\_

NOTE

The sequencer will time out after 11 minutes for each inoperable screen, then it will proceed to the next screen.

7.8.6 WHEN the sequencer has stepped through all functional screens, THEN VERIFY the screen wash system automatically stops. \_\_\_\_\_

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8.0 Operation of Sequencer Controls During a Wash Cycle

8.1 IF it is desired to stop the washing of a screen, THEN PERFORM the following:

NOTE

This feature stops the washing operations so that functions such as emptying the trash collection basket can be done without resetting the sequencer back to No. 2 screen.

8.1.1 DEPRESS Screen Wash Control Panel "PAUSE" pushbutton. \_\_\_\_\_

8.1.2 PLACE the Control Switch for the operating screen in the "STOP" position. \_\_\_\_\_

8.1.3 PLACE the Operating Screen Wash Pump Control Switch in the "OFF" position. \_\_\_\_\_

8.2 IF it is desired to resume automatic screen washing, THEN PERFORM the following:

8.2.1.1 PLACE a Screen Wash Pump Control Switch in the "AUTO" position. \_\_\_\_\_

8.2.1.2 PLACE Traveling Screen Control Switch to "AUTO". \_\_\_\_\_

8.2.1.3 DEPRESS Screen Wash Control Panel "RESUME" pushbutton. \_\_\_\_\_

NOTE

Depressing the Screen Wash Control Panel "RESET" pushbutton during sequenced wash cycle stops the cycle and resets the sequencer back to Number 2 screen.

8.3 IF desired to reset the operation of the Traveling Screen Sequencer back to screen No. 2, THEN PERFORM the following:

8.3.1 DEPRESS Screen Wash Control Panel "RESET" pushbutton. \_\_\_\_\_

8.3.2 MOMENTARILY DEPRESS Screen Wash Control Panel "START" pushbutton to activate the Sequencer. \_\_\_\_\_

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## 9.0 Performing a Manual Wash Cycle (Local Operation)

### NOTE

- WHEN Colorado River flow is >10000 cfs, THEN RMPF Traveling Screens SHOULD be rotated shiftly to prevent silting up of the screens.
- Removing a screen local control switch from the “AUTO” position removes the associated screen from Sequencer Control.
- IF ONLY one Screen Wash pump is available for operation, THEN ONLY one of the Spray Wash to Sluice Trench MOVs SHOULD be opened in Step 9.1 to ensure the discharge pressure will be maintained above the 80 psig required to start the screen wash.

9.1 ENSURE Step 7.1 has been completed. \_\_\_\_\_

9.2 PLACE Sluice Valve Control Switch(es) for the desired Spray Wash to Sluice Trench MOV isolation valve(s) in the “OPEN” position.  
(Between traveling screens 12 and 13)

- “RL047” – Traveling screens 2 through 12 \_\_\_\_\_
- “RL048” – Traveling screen 13 \_\_\_\_\_

9.3 START one or both Screen Wash Pumps by placing the Control Switch(es) in the “RUN” position:

- “RESERVOIR MAKEUP STRAINER SCREEN WASH PUMP 11” \_\_\_\_\_
- “RESERVOIR MAKEUP STRAINER SCREEN WASH PUMP 12” \_\_\_\_\_

9.4 IF at any time, it is desired to provide flow through both Sluice Trench MOV isolation valves with only one Spray Wash pump available for operation, THEN PERFORM the following:

9.4.1 OPEN the Spray Wash to Sluice Trench MOV left CLOSED in Step 9.2.

- “RL047” – Traveling screens 2 through 12 \_\_\_\_\_
- “RL048” – Traveling screen 13 \_\_\_\_\_



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- 9.4.2 MAINTAIN the indicated pressure on “0-RL-PI-6724 RMPF TRAVELING SCREENS SPRAY WASH SUPPLY HEADER PRESSURE INDICATOR” GREATER THAN 80 PSIG throughout the screen wash operation by throttling one or both of the following valves: (ZLC403, Behind Traveling Screen 12)
- “0-RL-0015 RMPF TRAVELING SCREENS 1-12 SPRAY WASH TO SLUICE TRENCH ISOLATION VALVE”. (Upstream RL-047 Between Traveling Screens 12 and 13)
  - “0-RL-0016 RMPF TRAVELING SCREENS 13-24 SPRAY WASH TO SLUICE TRENCH ISOLATION VALVE” (Upstream RL048 Between Traveling Screens 12 and 13)

NOTE

Placing too many traveling screens in service will lower screen wash pressure below rotating pressure and the screens will stop rotation. IF ALL screens stop rotation, THEN remove a screen(s) from service until screen rotation is restarted.

- 9.5 START the desired number of Traveling Screens by placing the Traveling Screen Control Switch(es) in the “START” position.
- 9.6 VERIFY spray wash valve(s) opens **AND** screen(s) are rotating.
- 9.7 CONTINUE washing operation for a minimum of 11 minutes or until the screen(s) are determined to be clean by visual observation.
- 9.8 WHEN the above manual screen wash operations are complete, THEN PERFORM the following:
- 9.8.1 ENSURE the Traveling Screen Control Switch for ALL operational Traveling Screens are in the “AUTO” position.
- 9.8.2 ENSURE BOTH Screen Wash Pump Control Switches are in the “AUTO” position: (On Stanchion South of each Screen Wash Pump)
- “RESERVOIR MAKEUP STRAINER SCREEN WASH PUMP 11”
  - “RESERVOIR MAKEUP STRAINER SCREEN WASH PUMP 12”
- 9.9 IF follow-on automatic screen wash operation is required to support Reservoir Makeup Pump operation, THEN GO TO Step 7.3; OTHERWISE PERFORM Section 15.0 to secure from screen wash operations.

## 10.0 Shifting River Screen Wash Pump Discharge Strainers

### NOTE

- The required direction for turning the strainer handwheels is as follows:

<b>STRAINER TO BE PLACED INSERVICE</b>	<b>REQUIRED DIRECTION</b>
East Strainer	Counter Clockwise
West Strainer	Clockwise

- Initial unseating and final seating of the handwheels SHOULD be done individually to take up the inherent slack in the chain-sprocket valve interlock mechanism.
- Operate only one handwheel when shifting strainers.
- The strainer drain valves are located beneath and south of each Screen Wash Discharge Strainer.

- 10.1.1 ENSURE the common strainer drain valve is CLOSED. \_\_\_\_\_
- 10.1.2 OPEN BOTH east and west strainer drain valves to pressurize the standby strainer. \_\_\_\_\_
- 10.1.3 SLOWLY TURN each handwheel in the required direction to initially unseat each transfer gate off its travel stop. \_\_\_\_\_
- 10.1.4 TURN the selected handwheel in the required direction to place the standby strainer in operation. \_\_\_\_\_
- 10.1.5 WHEN the strainer transfer is complete, THEN TURN each handwheel in the required direction to seat each transfer gate.
- 10.1.6 CLOSE the drain valve to the strainer being placed in service. \_\_\_\_\_
- 10.1.7 OPEN the common strainer drain valve to drain the strainer being removed from service. \_\_\_\_\_
- 10.1.8 WHEN the strainer being removed from service is drained, THEN CLOSE the following valves:
  - Drain valve to the strainer being removed from service. \_\_\_\_\_
  - Common strainer drain valve. \_\_\_\_\_
- 10.1.9 INITIATE a Condition Report to have Maintenance clean the standby strainer. \_\_\_\_\_

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## 11.0 Seal Water Operations

### NOTE

- WHEN outside air temperature decreases to LESS THAN OR EQUAL TO 34°F, THEN OPOP01-ZO-0004, Extreme Cold Weather Guidelines apply.
- A minimum of 1 Sand Separators SHALL be in service at Well Water Pump 7 prior to placing any RMPF Pumps in service which require seal water.

11.1 ENSURE the Well Water System is in operation per OPOP02-WW-0001, Well Water System Operations.

11.2 ENSURE at least one Sand Separators is in service per OPOP02-WW-0001, Well Water System Operations.

11.3 ENSURE BOTH RMPF Seal Water Booster Pump control switches are in the "AUTO" position:

- "RMS BOOSTER PUMP A"
- "RMS BOOSTER PUMP B"

11.4 PERFORM the following to align seal water to a Reservoir Make-up Pump: (South of respective Reservoir Make-up Pump)

11.4.1 IF seal water flow to Reservoir Make-up Pump 1 is required, THEN PERFORM the following:

11.4.1.1 THROTTLE "0-RK-0022 RESERVOIR MAKEUP PUMP 1 SEAL WATER INLET VALVE" to maintain a minimum of 2 gpm on FISL-6730.

11.4.1.2 THROTTLE "0-RK-0010 RESERVOIR MAKEUP PUMP 1 BEARING WATER INLET VALVE" valve to maintain minimum of 7 gpm on FISL (FISLL)-6729.

11.4.2 IF seal water flow to Reservoir Make-up Pump 2 is required, THEN PERFORM the following:

11.4.2.1 THROTTLE "0-RK-0023 RESERVOIR MAKEUP PUMP 2 SEAL WATER INLET VALVE" valve to maintain minimum of 2 gpm on FISL-6730A.

11.4.2.2 THROTTLE "0-RK-0011 RESERVOIR MAKEUP PUMP 2 BEARING WATER INLET VALVE" valve to maintain minimum of 7 gpm on FISL(FISLL)-6729A.

**Reservoir Makeup Pumping Facility**

- 11.4.3 IF seal water flow to Reservoir Make-up Pump 3 is required, THEN PERFORM the following:
- 11.4.3.1 THROTTLE “0-RK-0024 RESERVOIR MAKEUP PUMP 3 SEAL WATER INLET VALVE” valve to maintain minimum of 2 gpm on FISL-6730B. \_\_\_\_\_
- 11.4.3.2 THROTTLE “0-RK-0013 RESERVOIR MAKEUP PUMP 3 BEARING WATER INLET VALVE” valve to maintain minimum of 11 gpm on FISL(FISLL)-6729B. \_\_\_\_\_
- 11.4.4 IF seal water flow to Reservoir Make-up Pump 4 is required, THEN PERFORM the following:
- 11.4.4.1 THROTTLE “0-RK-0025 RESERVOIR MAKEUP PUMP 4 SEAL WATER INLET VALVE” valve to maintain minimum of 2 gpm on FISL-6730C. \_\_\_\_\_
- 11.4.4.2 THROTTLE “0-RK-0015 RESERVOIR MAKEUP PUMP 4 BEARING WATER INLET VALVE” valve to maintain minimum of 11 gpm on FISL(FISLL)-6729C. \_\_\_\_\_

**NOTE**

Component designations for the RMPF Seal Water Filter Differential Pressure Indicators are:

- RMPF Seal Water Filter #1 - 0-WW-PDI-6737
- RMPF Seal Water Filter #2 - 0-WW-PDI-6737A

- 11.5 IF a RMPF Seal Water Filter Differential Pressure Indicator reads GREATER THAN 5 psid, THEN PERFORM the following to shift the RMPF Seal Water Filters: (S of RMPF 138KV/4160V XFMR)
- 11.5.1 IF shifting from Filter 1 to Filter 2, THEN PERFORM the following:
- 11.5.1.1 OPEN “0-WW-0025 RMPF SEAL WATER FILTER 2 INLET VALVE”. \_\_\_\_\_
- 11.5.1.2 OPEN “0-WW-0026 RMPF SEAL WATER FILTER 2 OUTLET VALVE”. \_\_\_\_\_
- 11.5.1.3 CLOSE “0-WW-0023 RMPF SEAL WATER FILTER 1 INLET VALVE”. \_\_\_\_\_
- 11.5.1.4 CLOSE “0-WW-0024 RMPF SEAL WATER FILTER 1 OUTLET VALVE”. \_\_\_\_\_
- 11.5.1.5 ENSURE “0-WW-PDI-6737A RMPF SEAL WATER FILTER 2 DIFFERENTIAL PRESSURE INDICATOR” is < 5 psid to ensure filter is **NOT** clogged. \_\_\_\_\_

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11.5.2 IF shifting from Filter 2 to Filter 1, THEN PERFORM the following:

11.5.2.1 OPEN "0-WW-0023 RMPF SEAL WATER FILTER 1 INLET VALVE". \_\_\_\_\_

11.5.2.2 OPEN "0-WW-0024 RMPF SEAL WATER FILTER 1 OUTLET VALVE". \_\_\_\_\_

11.5.2.3 CLOSE "0-WW-0025 RMPF SEAL WATER FILTER 2 INLET VALVE". \_\_\_\_\_

11.5.2.4 CLOSE "0-WW-0026 RMPF SEAL WATER FILTER 2 OUTLET VALVE". \_\_\_\_\_

11.5.2.5 ENSURE "0-WW-PDI-6737 RMPF SEAL WATER FILTER 1 DIFFERENTIAL PRESSURE INDICATOR" is < 5 psid to ensure filter is **NOT** clogged. \_\_\_\_\_

|

**Reservoir Makeup Pumping Facility**12.0 Seal Water Booster Pump Operation**CAUTION**

The Seal Water Booster Pumps SHALL **NOT** be allowed to run without the Well Water System in operation.

**NOTE**

- The Seal Water Booster Pump selected to “AUTO” will automatically start on low seal water header pressure, and must be manually stopped after low pressure is reset.
- The Seal Water Booster Pumps SHALL be secured following completion of each RMPF pumping. (Reference 2.12)

12.1 ENSURE the Well Water System is in operation per 0POP02-WW-0001, Well Water System Operations.

12.2 ENSURE BOTH Seal Water Booster Pump control switches are in the “AUTO” position: (On Stanchion North of Booster Pumps)

- “RMS BOOSTER PUMP A”
- “RMS BOOSTER PUMP B”

12.3 IF seal water header pressure is **NOT** restored after the automatic start of a booster pump, THEN SECURE ALL running RMPF Pumps per Step 13.12.

**NOTE**

- BOTH Seal Water Booster Pumps must be manually stopped by placing the respective Control Switch in “OFF”, as there are no associated automatic trip features.
- Well Water SHALL remain in service to supply seal water flow to the RMFPs to keep the pump seals wet.

12.4 WHEN ALL River Makeup Pumps have been secured following the completion of River Makeup pumping activities, THEN ENSURE BOTH Seal Water Booster Pump control switches in the “OFF” position:

- “RMS BOOSTER PUMP A”
- “RMS BOOSTER PUMP B”

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### 13.0 Pumping Operations

#### NOTE

- WHEN outside air temperature decreases to LESS THAN or EQUAL TO 34°F, THEN OPOP01-ZO-0004, Extreme Cold Weather Guidelines apply.
- Environmental SHALL be notified if conductivity exceeds 5000 µs/cm (3 ppt salinity), AND when conductivity returns to LESS THAN 5000 µs/cm (3 ppt salinity).
- WHEN river salinity exceeds 3 ppt (5000 µs/cm), THEN high conductivity sea water is being pumped into the reservoir. There is the potential to impinge fish on the traveling screens. IF fish are being impinged on the screens, THEN Environmental SHALL be contacted for guidance on whether the screen wash SHOULD be routed to the river due to impingement concerns (See Step 7.7.) **OR** if pumping operations SHOULD be secured.
- The LCRA web site and the USGS web site use the same gage, therefore it is acceptable to use either web site for river information. The times SHOULD be noted as the web site updates MAY **NOT** occur at the same time, the 10 hour requirements are still valid.
- The Bay City gauge is specified in the contractual agreement with LCRA, so the Lane City gauge SHOULD **NOT** be used.

13.1 NOTIFY Chemistry that reservoir fill operations are to begin. \_\_\_\_\_

13.2 PERFORM the following to determine river level and river flow: \_\_\_\_\_

13.2.1 OBTAIN Bay City Gauging Station river level and flow from the LCRA **AND** RECORD the values below. \_\_\_\_\_

13.2.2 IF the LCRA is unable to furnish the flow rate, THEN RECORD river flow as determined from Addendum 1, LCRA River Level-To-Flow Conversion Chart (based on river level). \_\_\_\_\_

River Level (ft)	River Flow (cfs)

13.2.3 IF the LCRA is unable to furnish the river level, THEN DISCONTINUE pumping operations. \_\_\_\_\_

13.3 ENSURE traveling screens wash aligned for automatic operation per Section 7.0. \_\_\_\_\_

13.4 IF LESS THAN ten traveling screens are operable during pumping operations, THEN CHECK the traveling screens at least once per shift for indications differential water level. \_\_\_\_\_



**Reservoir Makeup Pumping Facility**

13.5 IF, at any time, a differential water level exists across the screens, THEN PERFORM one or both of the following, as required, to eliminate the differential water level:

- PERFORM a manual screen wash of the operable screens per Section 9.0. \_\_\_\_\_
- REDUCE the number of running pumps to reduce flow through the screens. \_\_\_\_\_

**NOTE**

The following limitations apply due to the 10 hour lag time between the Bay City gauging station and the RMPF:

- IF river flow increases, THEN a 10 hour wait period SHALL be observed before increasing the flow to the reservoir.
- IF river flow decreases, THEN credit SHALL **NOT** be taken for the 10 hours. Flow to the reservoir SHALL be decreased immediately.
- IF pumps are being run for a short duration due to maintenance, THEN the 10 hour lag time and minimum river flow requirements **DO NOT** apply.

13.6 DETERMINE the maximum pumping combination per the following:

- DETERMINE pump combination using flow rates from Step 13.2.2 per Addendum 2, River Flow Rate vs Maximum Allowed Pumping Rate/Pump Combination. \_\_\_\_\_
- DETERMINE pump combination using Addendum 4, Silt vs. Pumping Restrictions. \_\_\_\_\_

13.6.1 ENTER the maximum allowed pumping rate AND the actual pumping rate in the Yard Operator Log. \_\_\_\_\_

13.7 ENSURE Seal Water System is aligned per Section 11.0. \_\_\_\_\_

13.8 ENSURE the “REMOTE LOCAL M/U STA/SPILLWAY TRANSFER SWITCH” is in the “LOCAL” position. (ZLP-500) \_\_\_\_\_

13.9 PERFORM the following steps to fill the Reservoir Makeup Pipeline:

**CAUTION**

Only one 60 cfs pump SHALL be used to fill the south pipeline. The north pipeline is effectively spared in place.

**NOTE**

- The discharge valve control switches are labeled “CLOSE”, “NORM/PULL AUTO”, and “OPEN”. Pushing the switch in, releases it from automatic operation and places it in manual control. IF in manual control, THEN the Reservoir Make-up Pumps 1 and 2 have pipeline low level override capability.
- Reservoir Make-up Pumps 1 or 2 will fill the south pipeline. The pipeline must be filled before the 240 cfs pumps can be started.

13.9.1 ENSURE the associated Reservoir Make-up Pump Discharge Valve Control Switch in “NORM” position for MANUAL CONTROL by pushing the handswitch in from the “PULL AUTO” position.

PUMP

DISCHARGE VALVE

- |                   |             |       |
|-------------------|-------------|-------|
| • RMPF Pump No. 1 | LM-MOV-0001 | _____ |
| • RMPF Pump No. 2 | LM-MOV-0002 | _____ |

13.9.2 HOLD the associated Reservoir Make-up Pump Discharge Valve Control Switch in the “OPEN” position until permissive light illuminates (20-25% OPEN):

PUMP

DISCHARGE VALVE

- |                   |             |       |
|-------------------|-------------|-------|
| • RMPF Pump No. 1 | LM-MOV-0001 | _____ |
| • RMPF Pump No. 2 | LM-MOV-0002 | _____ |

**Reservoir Makeup Pumping Facility****CAUTION**

- IF performing the first start of a RMPF Pump, THEN two people, with radios, are required to monitor the RMPF Pump's amperage. This is performed to protect the pump/motor in the event that the pump bay has silted up. (**NOT** required on subsequent pump starts)
- Starting current for an initial RMPF Pump start **SHALL** be observed at the respective breaker cubicle. IF the starting current **DOES NOT** return to an acceptable run current within 10 seconds after RMPF Pump start, THEN the associated RMPF Pump control switch **SHALL** be immediately placed in the "PULL FOR E. STOP" position.

## 13.9.3 START the associated Reservoir Make-up Pump:

- RMPF Pump No. 1
- RMPF Pump No. 2

**NOTE**

The pump discharge valve **MAY** be throttled by using the handwheel at the valve or, if a second person is available to watch the pump discharge pressure locally at the valve, by using the handswitch in **MANUAL CONTROL** on ZLP 500.

## 13.9.4 THROTTLE the associated Reservoir Make-up Pump Discharge Valve as necessary to maintain the pump discharge pressure at 15 -20 psig:

<u>PUMP</u>	<u>DISCHARGE VALVE</u>	<u>PRESSURE GAGE</u>
• RMPF Pump No. 1	LM-MOV-0001	PI-6731
• RMPF Pump No. 2	LM-MOV-0002	PI-6731A

## 13.9.5 OPEN the associated Reservoir Make-up Pump Discharge Valve fully at least two minutes after the associated pipeline "SOUTH MAKEUP PIPELINE NOT FULL" annunciator resets:

<u>PUMP</u>	<u>DISCHARGE VALVE</u>
• RMPF Pump No. 1	LM-MOV-0001
• RMPF Pump No. 2	LM-MOV-0002

## 13.9.6 PLACE the handswitch for the associated Reservoir Make-up Pump Discharge Valve in the "PULL AUTO" position:

<u>PUMP</u>	<u>DISCHARGE VALVE</u>
• RMPF Pump No. 1	LM-MOV-0001
• RMPF Pump No. 2	LM-MOV-0002

**Reservoir Makeup Pumping Facility****NOTE**

WHEN the south pipeline is full AND River flow is sufficient, THEN the 240 cfs Pumps MAY be started.

13.10 IF starting a Reservoir Make-up Pump Locally with the Discharge Valve in manual to fill the reservoir, THEN PERFORM the following:

13.10.1 IF starting a 60 cfs pump, THEN PERFORM the following steps:

13.10.1.1 REFER to Addendum 2, River Flow Rate vs Maximum Allowed Pumping Rate/Pump Combination for allowable pump combinations.

13.10.1.2 ENSURE the associated Reservoir Make-up Pump Discharge Valve Control Switch is in the "NORM" position for MANUAL CONTROL by pushing handswitch in from the "PULL AUTO" position:

**PUMP****DISCHARGE VALVE**

- RMPF Pump No. 1 LM-MOV-0001
- RMPF Pump No. 2 LM-MOV-0002

13.10.1.3 HOLD the associated Reservoir Make-up Pump Discharge Valve Control Switch in the "OPEN" position until the permissive light is illuminated. (20-25% OPEN):

**PUMP****DISCHARGE VALVE**

- RMPF Pump No. 1 LM-MOV-0001
- RMPF Pump No. 2 LM-MOV-0002

**CAUTION**

Starting current for an initial RMPF Pump start SHALL be observed at the respective breaker cubicle. IF the starting current DOES **NOT** return to an acceptable run current within 10 seconds after RMPF Pump start, THEN the associated RMPF Pump control switch SHALL be immediately placed in the "PULL FOR E. STOP" position.  
(**NOT** required on subsequent pump starts)

13.10.1.4 START the associated Reservoir Make-up Pump:

- RMPF Pump No. 1
- RMPF Pump No. 2

**Reservoir Makeup Pumping Facility**

- 13.10.1.5 FULLY OPEN the associated Reservoir Make-up Pump Discharge Valve:

PUMPDISCHARGE VALVE

- RMPF Pump No. 1 LM-MOV-0001 \_\_\_\_\_
- RMPF Pump No. 2 LM-MOV-0002 \_\_\_\_\_

- 13.10.1.6 PLACE the handswitch for the associated Reservoir Make-up Pump Discharge Valve in the "PULL AUTO" position:

PUMPDISCHARGE VALVE

- RMPF Pump No. 1 LM-MOV-0001 \_\_\_\_\_
- RMPF Pump No. 2 LM-MOV-0002 \_\_\_\_\_

- 13.10.2 IF starting a 240 cfs pump, THEN PERFORM the following steps:

NOTE

WHEN river flow rate is between 738 and 845 cfs, THEN a 240 cfs MAY be started by first initiating a start sequence on one 240 cfs pump and a stop sequence on the 60 cfs pumps.

- 13.10.2.1 THROTTLE the "MOTOR COOLING WATER INLET VALVE" for the affected Reservoir Make-up Pump to obtain 6 to 9 gpm on the associated "MOTOR COOLING WATER RETURN LOW FLOW INDICATOR SWITCH":

RMPF PUMPINDICATORINLET VALVE

- PUMP No. 3 0-RK-FISL-6731 0-RK-0012 \_\_\_\_\_
- PUMP No. 4 0-RK-FISL-6732 0-RK-0014 \_\_\_\_\_

- 13.10.2.2 ENSURE the associated Reservoir Make-up Pump Discharge Valve Control Switch in "NORMAL" position for MANUAL CONTROL by pushing switch in from the "PULL AUTO" position.

PUMPDISCHARGE VALVE

- RMPF Pump No. 3 LM-MOV-0003 \_\_\_\_\_
- RMPF Pump No. 4 LM-MOV-0004 \_\_\_\_\_

**Reservoir Makeup Pumping Facility**

- 13.10.2.3 HOLD the associated Reservoir Make-up Pump Discharge Valve Control Switch in the "OPEN" position until permissive light illuminates (20-25% open):

PUMPDISCHARGE VALVE

- RMPF Pump No. 3 LM-MOV-0003 \_\_\_\_\_
- RMPF Pump No. 4 LM-MOV-0004 \_\_\_\_\_

**CAUTION**

Starting current for an initial RMPF Pump start SHALL be observed at the respective breaker cubicle. IF the starting current DOES **NOT** return to an acceptable run current within ten seconds after RMPF Pump start, THEN the associated RMPF Pump control switch SHALL be immediately placed in the "PULL FOR E. STOP" position. (**NOT** required on subsequent pump starts)

- 13.10.2.4 START the associated Reservoir Make-up Pump:

- RMPF Pump No. 3 \_\_\_\_\_
- RMPF Pump No. 4 \_\_\_\_\_

- 13.10.2.5 FULLY OPEN the associated Reservoir Make-up Pump Discharge Valve:

PUMPDISCHARGE VALVE

- RMPF Pump No. 3 LM-MOV-0003 \_\_\_\_\_
- RMPF Pump No. 4 LM-MOV-0004 \_\_\_\_\_

- 13.10.2.6 PLACE the handswitch for the associated Reservoir Make-up Pump Discharge Valve in the "PULL AUTO" position:

PUMPDISCHARGE VALVE

- RMPF Pump No. 3 LM-MOV-0003 \_\_\_\_\_
- RMPF Pump No. 4 LM-MOV-0004 \_\_\_\_\_

**Reservoir Makeup Pumping Facility**

13.11 IF starting a Reservoir Make-up Pump Locally with Discharge Valve in Automatic to fill the reservoir, THEN PERFORM the following:

13.11.1 IF starting a 60 cfs pump, THEN PERFORM the following steps:

13.11.1.1 ENSURE the associated Reservoir Make-up Pump Discharge Valve is in the "NORMAL/PULL AUTO" position **AND** pull the handswitch out until it latches:

PUMPDISCHARGE VALVE

- RMPF Pump No. 1      LM-MOV-0001
- RMPF Pump No. 2      LM-MOV-0002

**CAUTION**

Starting current for an initial RMPF Pump start SHALL be observed at the respective breaker cubicle. IF the starting current DOES **NOT** return to an acceptable run current within 10 seconds after RMPF Pump start, THEN the associated RMPF Pump control switch SHALL be immediately placed in the "PULL FOR E. STOP" position. (**NOT** required on subsequent pump starts)

13.11.1.2 START the associated Reservoir Make-up Pump:

- RMPF Pump No. 1
- RMPF Pump No. 2

13.11.1.3 WHEN the permissive light illuminates, THEN ENSURE the associated Reservoir Make-up Pump starts **AND** Discharge Valve fully opens:

PUMPDISCHARGE VALVE

- RMPF Pump No. 1      LM-MOV-0001
- RMPF Pump No. 2      LM-MOV-0002

## Reservoir Makeup Pumping Facility

13.11.2 IF starting a 240 cfs pump, THEN PERFORM the following steps:

NOTE

WHEN the river flow rate is between 738 and 845 cfs, THEN a 240 cfs MAY be started by first initiating a start sequence on one 240 cfs pump and then a stop sequence on the 60 cfs pumps.

13.11.2.1 THROTTLE the "MOTOR COOLING WATER INLET VALVE" for the affected Reservoir Make-up Pump to obtain 6 to 9 gpm on the associated "MOTOR COOLING WATER RETURN LOW FLOW INDICATOR SWITCH":

<u>RMPF PUMP</u>	<u>INDICATOR</u>	<u>INLET VALVE</u>
• PUMP No. 3	0-RK-FISL-6731	0-RK-0012
• PUMP No. 4	0-RK-FISL-6732	0-RK-0014

13.11.2.2 ENSURE the associated Reservoir Make-up Pump Discharge Valve is in the "NORMAL/PULL AUTO" position **AND** pull the handswitch out until it latches.

<u>PUMP</u>	<u>DISCHARGE VALVE</u>
• RMPF Pump No. 3	LM-MOV-0003
• RMPF Pump No. 4	LM-MOV-0004

CAUTION

Starting current for an initial RMPF Pump start SHALL be observed at the respective breaker cubicle. IF the starting current DOES **NOT** return to an acceptable run current within ten seconds after RMPF Pump start, THEN the associated RMPF Pump control switch SHALL be immediately placed in the "PULL FOR E. STOP" position. (**NOT** required on subsequent pump starts)

13.11.2.3 START the associated Reservoir Make-up Pump:

- RMPF Pump No. 3

- RMPF Pump No. 4

13.11.2.4 WHEN the permissive light illuminates, THEN ENSURE the associated Reservoir Make-up Pump starts **AND** Discharge Valve fully opens:

<u>PUMP</u>	<u>DISCHARGE VALVE</u>
• RMPF Pump No. 3	LM-MOV-0003
• RMPF Pump No. 4	LM-MOV-0004



**CAUTION**

A **MINIMUM** of 5 minutes SHOULD be allowed between sequential RMPF Pump stops to minimize hydraulic surges in the pipeline.

**NOTE**

- 240 cfs RMPF Pumps SHOULD normally be stopped with a 60 cfs RMPF Pump on the same pipeline running, except as noted prior to Steps 13.10.2.1 and 13.11.2.1.
- WHEN only a 240 cfs RMPF Pump is running, THEN a 60 cfs RMPF Pump SHALL be started to allow a normal pump stopping sequence ( i.e., 240 cfs RMPF Pump and then 60 cfs RMPF Pump) in order to minimize hydraulic surges in the pipeline.
- WHEN ALL River Makeup Pumping evolutions have been completed, THEN the performance of Section 12.4 is required to secure the Seal Water Booster Pumps.

13.12 WHEN reservoir makeup is NO longer required, THEN PERFORM the following to stop the Reservoir Make-up Pumps:

13.12.1 IF a 240 cfs RMPF Pump is to be stopped by a Local Normal Stop, THEN PERFORM the following:

13.12.1.1 ENSURE THE associated Reservoir Make-up Pump Discharge Valve Control Switch is in the "PULL AUTO" position:

<u>PUMP</u>	<u>DISCHARGE VALVE</u>
-------------	------------------------

- |                   |             |       |
|-------------------|-------------|-------|
| • RMPF Pump No. 3 | LM-MOV-0003 | _____ |
| • RMPF Pump No. 4 | LM-MOV-0004 | _____ |

13.12.1.2 STOP the associated Reservoir Make-up Pump:

- RMPF Pump No. 3
- RMPF Pump No. 4

13.12.1.3 WHEN the associated Reservoir Make-up Pump Discharge Valve reaches 85% Open, THEN VERIFY the Reservoir Make-up Pump stops **AND** the Discharge Valve continues to full closed:

<u>PUMP</u>	<u>DISCHARGE VALVE</u>
-------------	------------------------

- |                   |             |       |
|-------------------|-------------|-------|
| • RMPF Pump No. 3 | LM-MOV-0003 | _____ |
| • RMPF Pump No. 4 | LM-MOV-0004 | _____ |

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- 13.12.1.4 WHEN the Discharge Valve indicates full closed, THEN PLACE the associated Reservoir Make-up Pump Discharge Valve Control Switch in the "NORM" position by pushing in on the handswitch until it unlatches.
- | <u>PUMP</u>       | <u>DISCHARGE VALVE</u> |       |
|-------------------|------------------------|-------|
| • RMPF Pump No. 3 | LM-MOV-0003            | _____ |
| • RMPF Pump No. 4 | LM-MOV-0004            | _____ |
- 13.12.1.5 PLACE the Reservoir Make-up Pump Control Switch in the "PULL FOR E. STOP" position **AND** pulling the switch outward until it latches:
- |                   |  |       |
|-------------------|--|-------|
| • RMPF Pump No. 3 |  | _____ |
| • RMPF Pump No. 4 |  | _____ |
- 13.12.1.6 CLOSE the associated "RESERVOIR MAKE-UP PUMP MOTOR COOLING WATER INLET VALVE":
- | <u>PUMP</u>       | <u>INLET VALVE</u> |       |
|-------------------|--------------------|-------|
| • RMPF PUMP No. 3 | 0-RK-0012          | _____ |
| • RMPF PUMP No. 4 | 0-RK-0014          | _____ |
- 13.12.2 IF a 240 cfs RMPF Pump is to be stopped with an Emergency Stop, THEN **PERFORM** the following:
- 13.12.2.1 PUSH the associated Reservoir Make-up Pump Discharge Valve Control Switch in to prevent discharge valve from automatically closing:
- | <u>PUMP</u>       | <u>DISCHARGE VALVE</u> |       |
|-------------------|------------------------|-------|
| • RMPF Pump No. 3 | LM-MOV-0003            | _____ |
| • RMPF Pump No. 4 | LM-MOV-0004            | _____ |
- 13.12.2.2 STOP the associate Reservoir Make-up Pump by placing the Control Switch in the "PULL FOR E. STOP" position **AND** pulling the switch outward until it latches:
- |                   |  |       |
|-------------------|--|-------|
| • RMPF Pump No. 3 |  | _____ |
| • RMPF Pump No. 4 |  | _____ |
- 13.12.2.3 After one minute, CLOSE the associated Reservoir Make-up Pump Discharge Valve:
- | <u>PUMP</u>       | <u>DISCHARGE VALVE</u> |       |
|-------------------|------------------------|-------|
| • RMPF Pump No. 3 | LM-MOV-0003            | _____ |
| • RMPF Pump No. 4 | LM-MOV-0004            | _____ |
- 13.12.2.4 CLOSE the associated Reservoir Make-up Pump Cooling Water Inlet Valve to Motor Bearing Cooler:
- | <u>PUMP</u>       | <u>INLET VALVE</u> |       |
|-------------------|--------------------|-------|
| • RMPF PUMP No. 3 | 0-RK-0012          | _____ |
| • RMPF PUMP No. 4 | 0-RK-0014          | _____ |

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- 13.12.3 IF a 60 cfs RMPF Pump is to be secured with a Local Normal Stop, THEN **PERFORM** the following:

**CAUTION**

A **MINIMUM** of 5 minutes SHOULD be allowed between sequential RMPF Pump stops to minimize hydraulic surges in the pipeline.

- 13.12.3.1 ENSURE the associated Reservoir Make-up Pump Discharge Valve Control Switch is in the "PULL AUTO" position:

PUMP

DISCHARGE VALVE

- |                   |             |       |
|-------------------|-------------|-------|
| • RMPF Pump No. 1 | LM-MOV-0001 | _____ |
| • RMPF Pump No. 2 | LM-MOV-0002 | _____ |

- 13.12.3.2 STOP the associated Reservoir Make-up Pump:

- |                   |       |
|-------------------|-------|
| • RMPF Pump No. 1 | _____ |
| • RMPF Pump No. 2 | _____ |

- 13.12.3.3 WHEN the associated Reservoir Make-up Pump Discharge Valve reaches 85% Open, THEN **VERIFY** the Reservoir Make-up Pump stops **AND** the Discharge Valve continues to full closed:

PUMP

DISCHARGE VALVE

- |                   |             |       |
|-------------------|-------------|-------|
| • RMPF Pump No. 1 | LM-MOV-0001 | _____ |
| • RMPF Pump No. 2 | LM-MOV-0002 | _____ |

- 13.12.3.4 PLACE the associated Reservoir Make-up Pump Control Switch in the "PULL FOR E. STOP" position **AND** pulling the switch outward until it latches:

PUMP

DISCHARGE VALVE

- |                   |             |       |
|-------------------|-------------|-------|
| • RMPF Pump No. 1 | LM-MOV-0001 | _____ |
| • RMPF Pump No. 2 | LM-MOV-0002 | _____ |

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13.12.4 IF a 60 cfs RMPF Pump is to be secured with a Local Emergency Stop, THEN PERFORM the following:

13.12.4.1 STOP the associated Reservoir Make-up Pump by placing the Control Switch in the "PULL FOR E. STOP" position **AND** pulling the switch outward until it latches:

<u>PUMP</u>	<u>DISCHARGE VALVE</u>	
• RMPF Pump No. 1	LM-MOV-0001	_____
• RMPF Pump No. 2	LM-MOV-0002	_____

13.12.4.2 VERIFY the associated Reservoir Make-up Pump stops **AND** discharge valve closes:

<u>PUMP</u>	<u>DISCHARGE VALVE</u>	
• RMPF Pump No. 1	LM-MOV-0001	_____
• RMPF Pump No. 2	LM-MOV-0002	_____

13.12.4.3 IF discharge valve fails to close, THEN PUSH the Discharge Valve Control Switch in **AND** hold in the "CLOSE" position until the discharge valve is closed:

<u>PUMP</u>	<u>DISCHARGE VALVE</u>	
• RMPF Pump No. 1	LM-MOV-0001	_____
• RMPF Pump No. 2	LM-MOV-0002	_____

13.12.4.4 IF ALL River Makeup Pumps are secure, THEN PERFORM Section 12.4 to secure the Seal Water Booster Pumps.

**Reservoir Makeup Pumping Facility**NOTE

The purpose of Section 14.0 is to perform a 5 minute back flush of reservoir water through an idle RMPF Pump to remove any built-up silt from the pump's impeller.

**14.0 Special Ops Removal of Silt Buildup from a Reservoir Make-Up Pump Impeller**

- 14.1 ENSURE the Reservoir Make-up Pump Discharge Valve Control Switch for the pump to be started is in the "NORMAL" position for MANUAL CONTROL by pushing the handswitch in from the "PULL AUTO" position:

<u>PUMP</u>	<u>DISCHARGE VALVE</u>
• RMPF Pump No. 1	LM-MOV-0001
• RMPF Pump No. 2	LM-MOV-0002

- 14.2 INITIATE a normal start sequence for the selected pump per Section 13.0.
- 14.3 ENSURE the south pipeline is full by visual observation of water from the pipeline Air Discharge Valves.
- 14.4 PLACE the control switch for the Reservoir Make-up Pump to be backwashed in the "PULL FOR E. STOP" position **AND** pull outward until it latches.
- 14.5 PLACE the associated Discharge Valve Control Switch for the pump to be backwashed in MANUAL CONTROL by pushing the switch in from the "PULL FOR AUTO" position.

**CAUTION**

The discharge control valve for the RMPF Pump being backwashed SHALL **NOT** be turned past the point at which permissive light illuminates (20-25% OPEN).

- 14.6 INITIATE a normal stop sequence for the running 60 cfs pump per Step 13.12.3.
- 14.7 OPEN the Discharge Valve on the Reservoir Make-up Pump to be backwashed.
- 14.8 WHEN a minimum of five minutes has elapsed, THEN CLOSE the Discharge Valve on the Reservoir Make-up Pump that was backwashed.
- 14.9 RETURN to Step 14.1 for each pump that is to be backwashed.

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15.0 Securing from Screen Wash Operations

15.1 ENSURE BOTH Screen Wash Pump Control Switches are in the “OFF” position: (On Stanchion South of each Screen Wash Pump)

- “RESERVOIR MAKEUP STRAINER SCREEN WASH PUMP 11” \_\_\_\_\_
- “RESERVOIR MAKEUP STRAINER SCREEN WASH PUMP 12” \_\_\_\_\_

15.2 ENSURE BOTH Sluice Valve Control Switches are in the “AUTO” position: (Between traveling screens 12 and 13)

- “RL047” – Traveling screens 2 through 12 \_\_\_\_\_
- “RL048” – Traveling screen 13 \_\_\_\_\_

15.3 ENSURE BOTH sluice trench isolation valves are fully OPEN: (Upstream RL-047 between Traveling Screens 12 and 13)

- “0-RL-0015 RMPF TRAVELING SCREENS 1-12 SPRAY WASH TO SLUICE TRENCH ISOLATION VALVE”. \_\_\_\_\_
- “0-RL-0016 RMPF TRAVELING SCREENS 13-24 SPRAY WASH TO SLUICE TRENCH ISOLATION VALVE” \_\_\_\_\_

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16.0 Support Documents

- 16.1 Addendum 1, LCRA River Level-To-Flow Conversion Chart
- 16.2 Addendum 2, River Flow Rate vs Maximum Allowed Pumping Rate/Pump Combination
- 16.3 Addendum 3, Main Cooling Reservoir Water Delivery Plan During Drought Conditions
- 16.4 Addendum 4, Silt vs. Pumping Restrictions
- 16.5 Lineup 1, Valve Lineup
- 16.6 Lineup 2, Instrument Vent Lineup
- 16.7 Lineup 3, Control Panel Lineup
- 16.8 Lineup 4, Electrical Lineup

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<b>Addendum 1</b>	<b>LCRA River Level-To-Flow Conversion Chart</b>	Page 1 of 3	

Height in Feet  
at Bay City  
Station

River Flow in Cubic Feet Per Second

	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
3.00	136.8	160.0	184.2	209.8	236.8	265.2	295.0	325.4	357.1	390.0
4.00	423.7	458.6	494.6	531.8	570.0	608.5	648.0	688.5	729.9	772.3
5.00	815.7	860.0	903.9	948.6	994.2	1041	1088	1136	1187	1240
6.00	1295	1351	1408	1466	1525	1580	1636	1693	1751	1809
7.00	1868	1928	1989	2050	2109	2169	2230	2291	2352	2415
8.00	2477	2541	2605	2669	2734	2800	2863	2927	2992	3057
9.00	3122	3188	3254	3321	3388	3456	3524	3592	3661	3730
10.00	3800	3871	3943	4015	4088	4161	4234	4308	4383	4458
11.00	4533	4609	4685	4761	4838	4915	4993	5071	5150	5230
12.00	5310	5391	5472	5553	5635	5717	5800	5883	5967	6050
13.00	6135	6220	6305	6390	6476	6562	6649	6736	6824	6912
14.00	7000	7094	7189	7284	7380	7476	7573	7670	7768	7866
15.00	7965	8064	8163	8263	8364	8465	8566	8668	8771	8873
16.00	8977	9080	9185	9289	9394	9500	9610	9720	9831	9943



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<b>Addendum 1</b>	<b>LCRA River Level-To-Flow Conversion Chart</b>	Page 2 of 3	

Height in Feet  
at Bay City  
Station

River Flow in Cubic Feet Per Second

	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
17.00	10050	10170	10280	10390	10510	10620	10740	10850	10970	11090
18.00	11200	11320	11440	11560	11680	11800	11920	12040	12160	12280
19.00	12400	12550	12690	12840	12990	13140	13290	13450	13600	13750
20.00	13910	14060	14220	14380	14530	14690	14850	15010	15170	15340
21.00	15500	15670	15840	16010	16180	16350	16530	16700	16880	17050
22.00	17230	17410	17590	17770	17950	18130	18310	18500	18680	18870
23.00	19050	19240	19430	19620	19810	20000	20210	20410	20620	20830
24.00	21040	21250	21470	21680	21900	22110	22330	22550	22770	22990
25.00	23210	23440	23660	23890	24110	24340	24570	24800	25030	25270
26.00	25500	25740	25980	26220	26460	26700	26950	27190	27440	27690
27.00	27940	28190	28440	28690	28950	29200	29460	29720	29980	30240
28.00	30500	30760	31030	31290	31560	31830	32100	32370	32640	32910
29.00	33190	33460	33740	34020	34300	34580	34860	35140	35430	35710
30.00	36000	36320	36640	36960	37280	37600	37930	38250	38580	38910

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Addendum 1	LCRA River Level-To-Flow Conversion Chart	Page 3 of 3	

### Height in Feet at Bay City Station

### River Flow in Cubic Feet Per Second

[illegible]

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Addendum 2	River Flow Rate vs Maximum Allowed Pumping Rate/Pump Combination		Page 1 of 1

River Flow at Bay City Gauge Station (CFS)	Maximum Allowed Pumping Rate (CFS)	Pump Combination	
		60 CFS pump	240 CFS pump
410	60	1	0
519	120	2	0
737	240	0	1
846	300	1	1
955	360	2	1
1173	480	0	2
1282	540	1	2
1391	600	2	2

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<b>Reservoir Makeup Pumping Facility</b>			
Addendum 3	<b>Main Cooling Reservoir Water Delivery Plan During Drought Conditions</b>		Page 1 of 1

<b>Main Cooling Reservoir (MCR) Level</b>	<b>Actions</b>
Normal operating level between 40 and 49 feet Mean Sea Level (MSL)	Pumping under River Permit when river conductivity is <2100 $\mu\text{s}/\text{cm}$ <b>OR</b> River TDS level is $\leq 1260$ mg/L. (Notes 1, 2 & 6)
MCR level between 36 and 40 feet MSL	Pumping under River Permit when river conductivity is $\leq$ MCR conductivity. (Notes 1, 2, & 6) <u>IF</u> water deliveries are being made to meet bay and estuary requirements, <u>THEN</u> daily communications with LCRA are required, as necessary. (Note 3) (Chemistry/Environmental action)
MCR Level at 37 feet MSL	STPNOC requests LCRA to prepare for delivery of backup water when MCR level drops to 35 feet MSL.
MCR level between 32 and 36 feet MSL	Pumping under River Permit when river conductivity is $\leq 10,000$ $\mu\text{s}/\text{cm}$ <b>OR</b> River TDS level $\leq 6000$ mg/L. (Note 1) Daily communications, as necessary, with the LCRA if deliveries are being made to meet bay and estuary requirements. (Note 3) (Chemistry/Environmental action)
MCR level below 35 feet MSL	LCRA begins staged deliveries of firm water to ensure that MCR level does not drop below 27 feet MSL. (Notes 4 & 5) Delivery of firm water subject only to the LCRA bay and estuary restrictions; <b>NOT</b> River Permit stream flow restrictions.

- Note 1: Current stream flow restrictions of 55% of river flow over 300 cubic feet per second (cfs) would apply unless and until such time as permit is amended to establish other limitations for diversion.
- Note 2: Reservoir blowdown will commence as necessary to maintain MCR water at an average of 3000  $\mu\text{s}/\text{cm}$ .
- Note 3: To maintain MCR level as high as possible, the LCRA will communicate to STPNOC if the LCRA determines that any additional supply may be available in the river for diversion by STPNOC over and above the amounts to be supplied by the LCRA to meet its other demands. STPNOC may divert such water at its discretion, subject only to the LCRA bay and estuary restrictions. Any diversions of water by STPNOC that is made available under this condition and that would not be permitted under the River Permit stream flow restrictions would count towards the maximum quantities to be made available as provided in Note 4.
- Note 4: The LCRA will provide firm water for diversion by STPNOC up to installed pumping capacity, with a minimum rate to be specified by STPNOC to assist in maintaining the reservoir level at or above 27 feet MSL. Under no circumstances will the LCRA make available firm supply under this condition totaling more than 20,000 acre feet per year (acre-ft/yr) (rolling five-year average) for 2-unit operation OR 40,000 acre-ft/yr (rolling five-year average) for any additional generation capacity.
- Note 5: At 30 feet MSL, STPNOC and the LCRA will pursue an emergency suspension of permit pumping restrictions. (Chemistry/Environmental action)
- Note 6: WHEN river conductivity exceeds addendum specifications, THEN diversion only allowed with approval from Chemistry or Environmental Management.

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Addendum 4	Silt vs. Pumping Restrictions Chart	Page 1 of 2	

NOTE

- Silt buildup reduces the usable screen surfaces AND affects the velocity of water moving through the screens.
- Water Velocity limitations are based upon marine life considerations per the original design and permit. (refer to CREE 07-15490-2)

Water level above silt (circle)	Allowable Pump Combinations	Pump Combination			
		60 cfs	60 cfs	240 cfs	240 cfs
<b>1 ft</b>	1 small pump	1			
<b>2 ft</b>	2 small pumps	1	1		
<b>3 ft</b>					
<b>4 ft</b>	1 large pump			1	
	1 small/1 large pump	1		1	
<b>5 ft</b>	2 small/1 large pump	1	1	1	
<b>6 ft</b>					
<b>7 ft</b>	2 large pumps			1	1
<b>8 ft</b>	1 small/2 large pumps	1		1	1
	2 small/2 large pumps	1	1	1	1

Determine the water level above the silt per diagram next page..  
 \_\_\_\_\_ ft of water (average)

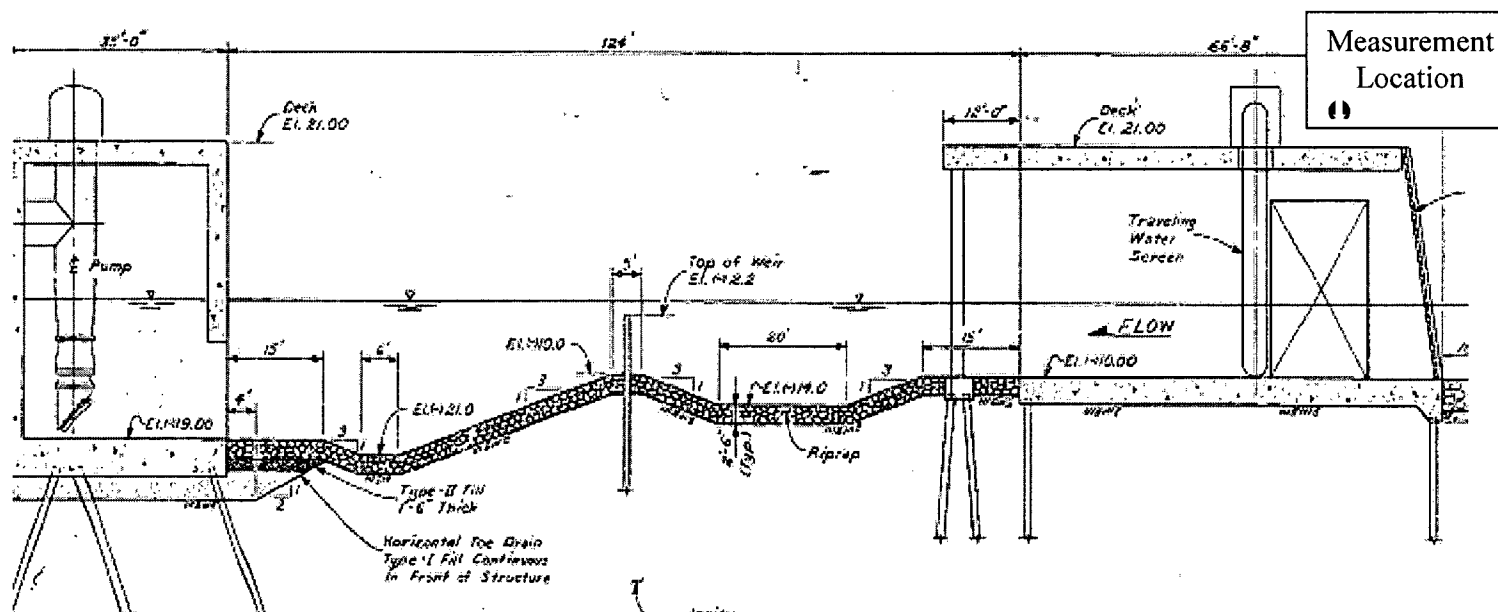
Determine maximum available pump combinations.

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Addendum 4	Silt vs. Pumping Restrictions Chart	Page 2 of 2	

Measurements SHOULD be taken through Grating from the top of the screen structure deck (21' elevation) a weighted tape measure of at least 30 ft, or an alternative measuring process.

Measurements to establish average water depth at screen structure:

1. Measurements SHOULD be taken at the river side of the traveling screens through Grating at every other bay and then averaged to establish an average top of silt level.
2. Take measurement from the top of concrete to top of water.
3. Take measurement from the top concrete to the top of sediment in each location.
4. Subtract the water level distance from the average top of sediment distance to establish the average water depth in the bays.



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Lineup 1	Valve Lineup	Page 1 of 11	

EXCEPTIONS

DEVICE NUMBER	COMPONENT NOUN DESCRIPTION	REMARKS

Personnel participating in device manipulation:

Name	Initials	Name	Initials

Device lineup completed by: \_\_\_\_\_  
Operator
Date
Time

Lineup 1 Reviewed: \_\_\_\_\_  
Unit Supervisor
Date

This form, when completed, SHALL be retained until superseded.



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Lineup 1	Valve Lineup	Page 2 of 11	

DEVICE NUMBER	COMPONENT NOUN DESCRIPTION	LOCATION	POSITION REQUIRED	ALIGNED BY	NEW TAG NEEDED
0-FP-0544	RMPF FIRE HOSE CONNECTION ISOLATION VALVE	RMPF Screen Wash Structure	CLOSED CAP INSTALLED		
0-FP-0545	RMPF FIRE HOSE CONNECTION ISOLATION VALVE	RMPF Screen Wash Structure	CLOSED CAP INSTALLED		
0-RL-0049	RMPF SCREEN WASH STRUCTURE FIRE PROTECTION SUPPLY VALVE	RMPF Screen Wash Structure	OPEN		
0-RL-0132	SCREEN WASH HEADER DRAIN	RMPF Intake Structure Under Manhole Cover by Screen 1	CLOSED		
0-RL-0051	RMPF TRAVEL SCREEN 2 SPRAY WASH ISOLATION VALVE	RMPF Screen Wash Structure	OPEN		
0-RL-0074	RMPF TRAVEL SCREEN 2 SPRAY WASH SUPPLY PSH-6726A ROOT VALVE	RMPF Screen Wash Structure	OPEN		
0-RL-0109	RMPF TRAVELING SCREEN 2 SPRAY WASH SUPPLY HEADER DRAIN VALVE	RMPF Screen Wash Structure	CLOSED		
0-RL-0022	RMPF TRAVELING SCREENS FLUSHING HOSE CONNECTION ISOLATION VALVE	RMPF Screen Wash Structure	CLOSED		
0-RL-0052	RMPF TRAVEL SCREEN 3 SPRAY WASH ISOLATION VALVE	RMPF Screen Wash Structure	OPEN		
0-RL-0075	RMPF TRAVEL SCREEN 3 SPRAY WASH SUPPLY PSH-6726B ROOT VALVE	RMPF Screen Wash Structure	OPEN		
0-RL-0110	RMPF TRAVELING SCREEN 3 SPRAY WASH SUPPLY HEADER DRAIN VALVE	RMPF Screen Wash Structure	CLOSED		
0-RL-0053	RMPF TRAVEL SCREEN 4 SPRAY WASH ISOLATION VALVE	RMPF Screen Wash Structure	OPEN		



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DEVICE NUMBER	COMPONENT NOUN DESCRIPTION	LOCATION	POSITION REQUIRED	ALIGNED BY	NEW TAG NEEDED
0-RL-0076	RMPF TRAVEL SCREEN 4 SPRAY WASH SUPPLY PSH-6726C ROOT VALVE	RMPF Screen Wash Structure	OPEN		
0-RL-0111	RMPF TRAVELING SCREEN 4 SPRAY WASH SUPPLY HEADER DRAIN VALVE	RMPF Screen Wash Structure	CLOSED		
0-RL-0054	RMPF TRAVEL SCREEN 5 SPRAY WASH ISOLATION VALVE	RMPF Screen Wash Structure	OPEN		
0-RL-0077	RMPF TRAVEL SCREEN 5 SPRAY WASH SUPPLY PSH-6726D ROOT VALVE	RMPF Screen Wash Structure	OPEN		
0-RL-0112	RMPF TRAVELING SCREEN 5 SPRAY WASH SUPPLY HEADER DRAIN VALVE	RMPF Screen Wash Structure	CLOSED		
0-RL-0055	RMPF TRAVEL SCREEN 6 SPRAY WASH ISOLATION VALVE	RMPF Screen Wash Structure	OPEN		
0-RL-0078	RMPF TRAVEL SCREEN 6 SPRAY WASH SUPPLY PSH-6726E ROOT VALVE	RMPF Screen Wash Structure	OPEN		
0-RL-0113	RMPF TRAVELING SCREEN 6 SPRAY WASH SUPPLY HEADER DRAIN VALVE	RMPF Screen Wash Structure	CLOSED		
0-RL-0021	RMPF TRAVELING SCREENS FLUSHING HOSE CONNECTION ISOLATION VALVE	RMPF Screen Wash Structure	CLOSED		
0-RL-0056	RMPF TRAVEL SCREEN 7 SPRAY WASH ISOLATION VALVE	RMPF Screen Wash Structure	OPEN		
0-RL-0079	RMPF TRAVEL SCREEN 7 SPRAY WASH SUPPLY PSH-6726F ROOT VALVE	RMPF Screen Wash Structure	OPEN		
0-RL-0114	RMPF TRAVELING SCREEN 7 SPRAY WASH SUPPLY HEADER DRAIN VALVE	RMPF Screen Wash Structure	CLOSED		
0-RL-0057	RMPF TRAVEL SCREEN 8 SPRAY WASH ISOLATION VALVE	RMPF Screen Wash Structure	OPEN		
0-RL-0080	RMPF TRAVEL SCREEN 8 SPRAY WASH SUPPLY PSH-6726G ROOT VALVE	RMPF Screen Wash Structure	OPEN		
0-RL-0115	RMPF TRAVELING SCREEN 8 SPRAY WASH SUPPLY HEADER DRAIN VALVE	RMPF Screen Wash Structure	CLOSED		

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DEVICE NUMBER	COMPONENT NOUN DESCRIPTION	LOCATION	POSITION REQUIRED	ALIGNED BY	NEW TAG NEEDED
0-RL-0004	RIVER SCREEN WASH PUMP 11 DISCHARGE VALVE	RMPF Screen Wash Structure	OPEN		
0-RL-0007	RIVER SCREEN WASH PUMP 11 DISCH STRAINER PI/PDI/PDS-6717 HIGH SIDE ROOT VALVE	RMPF Screen Wash Structure	OPEN		
0-RL-0008	RIVER SCREEN WASH PUMP 11 DISCH STRAINER PI/PDI/PDS-6717 LOW SIDE ROOT VALVE	RMPF Screen Wash Structure	OPEN		
0-RL-0058	RMPF TRAVEL SCREEN 9 SPRAY WASH ISOLATION VALVE	RMPF Screen Wash Structure	OPEN		
0-RL-0081	RMPF TRAVEL SCREEN 9 SPRAY WASH SUPPLY PSH-6726H ROOT VALVE	RMPF Screen Wash Structure	OPEN		
0-RL-0116	RMPF TRAVELING SCREEN 9 SPRAY WASH SUPPLY HEADER DRAIN VALVE	RMPF Screen Wash Structure	CLOSED		
0-RL-0059	RMPF TRAVEL SCREEN 10 SPRAY WASH ISOLATION VALVE	RMPF Screen Wash Structure	OPEN		
0-RL-0082	RMPF TRAVEL SCREEN 10 SPRAY WASH SUPPLY PSH-6726J ROOT VALVE	RMPF Screen Wash Structure	OPEN		
0-RL-0117	RMPF TRAVELING SCREEN 10 SPRAY WASH SUPPLY HEADER DRAIN VALVE	RMPF Screen Wash Structure	CLOSED		
0-RL-0020	RMPF TRAVELING SCREENS FLUSHING HOSE CONNECTION ISOLATION VALVE	RMPF Screen Wash Structure	CLOSED		
0-RL-0060	RMPF TRAVEL SCREEN 11 SPRAY WASH ISOLATION VALVE	RMPF Screen Wash Structure	OPEN		
0-RL-0083	RMPF TRAVEL SCREEN 11 SPRAY WASH SUPPLY PSH-6726K ROOT VALVE	RMPF Screen Wash Structure	OPEN		
0-RL-0118	RMPF TRAVELING SCREEN 11 SPRAY WASH SUPPLY HEADER DRAIN VALVE	RMPF Screen Wash Structure	CLOSED		
0-RL-0061	RMPF TRAVEL SCREEN 12 SPRAY WASH ISOLATION VALVE	RMPF Screen Wash Structure	OPEN		
0-RL-0084	RMPF TRAVEL SCREEN 12 SPRAY WASH SUPPLY PSH-6726L ROOT VALVE	RMPF Screen Wash Structure	OPEN		

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DEVICE NUMBER	COMPONENT NOUN DESCRIPTION	LOCATION	POSITION REQUIRED	ALIGNED BY	NEW TAG NEEDED
0-RL-0119	RMPF TRAVELING SCREEN 12 SPRAY WASH SUPPLY HEADER DRAIN VALVE	RMPF Screen Wash Structure	CLOSED		
0-RL-0015	RMPF TRAVELING SCREENS 1-12 SPRAY WASH TO SLUICE TRENCH ISOLATION VALVE	RMPF Screen Wash Structure	OPEN		
0-RL-0016	RMPF TRAVELING SCREENS 13-24 SPRAY WASH TO SLUICE TRENCH ISOLATION VALVE	RMPF Screen Wash Structure	OPEN		
0-RL-0009	RIVER SCREEN WASH PUMP 12 DISCH STRAINER PI/PDI/PDS-6720 HIGH SIDE ROOT VALVE	RMPF Screen Wash Structure	OPEN		
0-RL-0010	RIVER SCREEN WASH PUMP 12 DISCH STRAINER PI/PDI/PDS-6720 LOW SIDE ROOT VALVE	RMPF Screen Wash Structure	OPEN		
0-RL-0005	RIVER SCREEN WASH PUMP 12 DISCHARGE VALVE	RMPF Screen Wash Structure	OPEN		
0-RL-0062	RMPF TRAVEL SCREEN 13 SPRAY WASH ISOLATION VALVE	RMPF Screen Wash Structure	OPEN		
0-RL-0085	RMPF TRAVEL SCREEN 13 SPRAY WASH SUPPLY PSH-6726M ROOT VALVE	RMPF Screen Wash Structure	OPEN		
0-RL-0120	RMPF TRAVELING SCREEN 13 SPRAY WASH SUPPLY HEADER DRAIN VALVE	RMPF Screen Wash Structure	CLOSED		
0-RL-0013	RMPF TRAVELING SCREENS SPRAY WASH SUPPLY HEADER PI/PSL-6724 ROOT VALVE	RMPF Screen Wash Structure	OPEN		

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DEVICE NUMBER	COMPONENT NOUN DESCRIPTION	LOCATION	POSITION REQUIRED	ALIGNED BY	NEW TAG NEEDED
0-RK-0001	RESERVOIR MAKEUP PUMP 1 SEAL WATER SUPPLY VALVE	RMPF West Side of RMPF Pump 1	OPEN		
0-LM-0149	RESERVOIR MAKEUP PUMP 1 DISCHARGE PI-6731 ROOT VALVE	RMPF Pump 1 Disch Valve Pit	OPEN		
0-RK-0010	RESERVOIR MAKEUP PUMP 1 BEARING WATER INLET VALVE	RMPF South Side of RMPF Pump 1	THROTTLED		
0-RK-0022	RESERVOIR MAKEUP PUMP 1 SEAL WATER INLET VALVE	RMPF South Side of RMPF Pump 1	THROTTLED		
0-RK-0002	RESERVOIR MAKEUP PUMP 2 SEAL WATER SUPPLY VALVE	RMPF West Side of RMPF Pump 2	OPEN		
0-RK-0011	RESERVOIR MAKEUP PUMP 2 BEARING WATER INLET VALVE	RMPF South Side of RMPF Pump 2	THROTTLED		
0-RK-0023	RESERVOIR MAKEUP PUMP 2 SEAL WATER INLET VALVE	RMPF South Side of RMPF Pump 2	THROTTLED		
0-LM-0150	RESERVOIR MAKEUP PUMP 2 DISCHARGE PI-6731A ROOT VALVE	RMPF Pump 2 Disch Valve Pit	OPEN		
0-RK-0003	RESERVOIR MAKEUP PUMP 3 SEAL WATER SUPPLY VALVE	RMPF West Side of RMPF Pump 3	OPEN		
0-RK-0044	RESERVOIR MAKEUP PUMP 3 MOTOR COOLING WATER SUPPLY DRAIN VALVE	RMPF South Side of RMPF Pump 3	CLOSED		
0-RK-0012	RESERVOIR MAKEUP PUMP 3 MOTOR COOLING WATER INLET VALVE	RMPF South Side of RMPF Pump 3	CLOSED		
0-RK-0013	RESERVOIR MAKEUP PUMP 3 BEARING WATER INLET VALVE	RMPF South Side of RMPF Pump 3	THROTTLED		
0-RK-0024	RESERVOIR MAKEUP PUMP 3 SEAL WATER INLET VALVE	RMPF South Side of RMPF Pump 3	THROTTLED		
0-LM-0151	RESERVOIR MAKEUP PUMP 3 DISCHARGE PI-6731B ROOT VALVE	RMPF Pump 3 Disch Valve Pit	OPEN		
0-RK-0034	RESERVOIR MAKEUP PUMP 3 MOTOR COOLING WATER RETURN FISL/FISLL-6731 INLET VALVE	RMPF South Side of RMPF Pump 3	OPEN		

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DEVICE NUMBER	COMPONENT NOUN DESCRIPTION	LOCATION	POSITION REQUIRED	ALIGNED BY	NEW TAG NEEDED
0-RK-0030	RESERVOIR MAKEUP PUMP 3 MOTOR COOLING WATER RETURN FISL/FISLL-6731 BYPASS VALVE	RMPF South Side of RMPF Pump 3	CLOSED		
0-RK-0035	RESERVOIR MAKEUP PUMP 3 MOTOR COOLING WATER RETURN FISL/FISLL-6731 OUTLET VALVE	RMPF South Side of RMPF Pump 3	OPEN		
0-RK-0004	RESERVOIR MAKEUP PUMP 4 SEAL WATER SUPPLY VALVE	RMPF West Side of RMPF Pump 4	OPEN		
0-RK-0015	RESERVOIR MAKEUP PUMP 4 BEARING WATER INLET VALVE	RMPF South of RMPF Pump 4	THROTTLED		
0-RK-0025	RESERVOIR MAKEUP PUMP 4 SEAL WATER INLET VALVE	RMPF South of RMPF Pump 4	THROTTLED		
0-RK-0045	RESERVOIR MAKEUP PUMP 4 MOTOR COOLING WATER SUPPLY DRAIN VALVE	RMPF South Side of RMPF Pump 4	CLOSED		
0-RK-0014	RESERVOIR MAKEUP PUMP 4 MOTOR COOLING WATER INLET VALVE	RMPF South Side of RMPF Pump 4	CLOSED		
0-RK-0036	RESERVOIR MAKEUP PUMP 4 MOTOR COOLING WATER RETURN FISL/FISLL-6732 INLET VALVE	RMPF South Side of RMPF Pump 4	OPEN		
0-RK-0031	RESERVOIR MAKEUP PUMP 4 MOTOR COOLING WATER RETURN FISL/FISLL-6732 BYPASS VALVE	RMPF South Side of RMPF Pump 4	CLOSED		
0-RK-0037	RESERVOIR MAKEUP PUMP 4 MOTOR COOLING WATER RETURN FISL/FISLL-6732 OUTLET VALVE	RMPF South Side of RMPF Pump 4	OPEN		
0-LM-0152	RESERVOIR MAKEUP PUMP 4 DISCHARGE PI-6731C ROOT VALVE	RMPF Pump 4 Disch Valve Pit	OPEN		
0-RK-0005	RESERVOIR MAKEUP PUMP 5 SEAL WATER SUPPLY VALVE	RMPF	CLOSED		
0-RK-0016	RESERVOIR MAKEUP PUMP 5 MOTOR COOLING WATER INLET VALVE	RMPF	CLOSED		
0-RK-0026	RESERVOIR MAKEUP PUMP 5 SEAL WATER INLET VALVE	RMPF	CLOSED		

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DEVICE NUMBER	COMPONENT NOUN DESCRIPTION	LOCATION	POSITION REQUIRED	ALIGNED BY	NEW TAG NEEDED
0-RK-0017	RESERVOIR MAKEUP PUMP 5 BEARING WATER INLET VALVE	RMPF	CLOSED		
0-RK-0019	RESERVOIR MAKEUP PUMP 6 BEARING WATER INLET VALVE	RMPF	CLOSED		
0-LM-0153	RESERVOIR MAKEUP PUMP 5 DISCHARGE PI-6731D ROOT VALVE	RMPF Pump 5 Disch Valve Pit	CLOSED		
0-RK-0006	RESERVOIR MAKEUP PUMP 6 SEAL WATER SUPPLY VALVE	RMPF South Side of RMPF Pump 6 Well	CLOSED		
0-RK-0027	RESERVOIR MAKEUP PUMP 6 SEAL WATER INLET VALVE	RMPF	CLOSED		
0-RK-0020	RESERVOIR MAKEUP PUMP 7 BEARING WATER INLET VALVE	RMPF	CLOSED		
0-RK-0028	RESERVOIR MAKEUP PUMP 7 SEAL WATER INLET VALVE	RMPF	CLOSED		
0-RK-0029	RESERVOIR MAKEUP PUMP 8 SEAL WATER INLET VALVE	RMPF	CLOSED		
0-RK-0021	RESERVOIR MAKEUP PUMP 8 BEARING WATER INLET VALVE	RMPF	CLOSED		
0-LM-0154	RESERVOIR MAKEUP PUMP 6 DISCHARGE PI-6731E ROOT VALVE	RMPF South Side of RMPF Pump 6 Well	CLOSED		
0-RK-0007	RESERVOIR MAKEUP PUMP 7 SEAL WATER SUPPLY VALVE	RMPF South Side of RMPF Pump 7 Well	CLOSED		
0-LM-0155	RESERVOIR MAKEUP PUMP 7 DISCHARGE PI-6731F ROOT VALVE	RMPF Pump 7 Disch Valve Pit	CLOSED		
0-RK-0008	RESERVOIR MAKEUP PUMP 8 SEAL WATER SUPPLY VALVE	RMPF West Side of RMPF Pump 8 Well	CLOSED		
0-LM-0156	RESERVOIR MAKEUP PUMP 8 DISCHARGE PI-6731G ROOT VALVE	RMPF Pump 8 Disch Valve Pit	CLOSED		
0-WW-0112	R.M.S. BOOSTER PUMPS WELL WATER SUPPLY WW-0110 TELLTALE DRAIN VALVE	RMPF West of RMS Booster Pumps	CLOSED		

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DEVICE NUMBER	COMPONENT NOUN DESCRIPTION	LOCATION	POSITION REQUIRED	ALIGNED BY	NEW TAG NEEDED
0-WW-0113	R.M.S. BOOSTER PUMPS WELL WATER SUPPLY WW-0110 TELLTALE DRAIN VALVE	RMPF West of RMS Booster Pumps	CLOSED		
0-WW-0114	R.M.S. BOOSTER PUMPS WELL WATER ISOLATION WW-0111 TELLTALE DRAIN VALVE	RMPF West of RMS Booster Pumps	CLOSED		
0-WW-0115	R.M.S. BOOSTER PUMPS WELL WATER ISOLATION WW-0111 TELLTALE DRAIN VALVE	RMPF West of RMS Booster Pumps	CLOSED		
0-WW-0110	R.M.S. BOOSTER PUMPS WELL WATER SUPPLY VALVE	RMPF West of RMS Booster Pumps	OPEN		
0-WW-0111	R.M.S. BOOSTER PUMPS WELL WATER SUPPLY ISOLATION VALVE	RMPF West of RMS Booster Pumps	OPEN		
0-WW-0036	R.M.S. BOOSTER PUMPS SUPPLY HEADER PSL-6741 ROOT VALVE	RMPF West of RMS Booster Pumps	OPEN		
0-WW-0040	R.M.S. BOOSTER PUMPS SUPPLY HEADER VENT VALVE	RMPF West of RMS Booster Pumps	CLOSED		
0-WW-0015	R.M.S. BOOSTER PUMP 1 SUCTION VALVE	RMPF at RMS Booster Pump 1	OPEN		
0-WW-0042	R.M.S. BOOSTER PUMP 1 SUCTION DRAIN VALVE	RMPF at RMS Booster Pump 1	CLOSED		
0-WW-0019	R.M.S. BOOSTER PUMP 1 DISCHARGE PI-6736 ROOT VALVE	RMPF at RMS Booster Pump 1	OPEN		
0-WW-0018	R.M.S. BOOSTER PUMP 1 DISCHARGE VALVE	RMPF RMS Booster Pump 1 Disch	OPEN		
0-WW-0016	R.M.S. BOOSTER PUMP 2 SUCTION VALVE	RMPF RMS Booster Pump 2 Inlet	OPEN		
0-WW-0041	R.M.S. BOOSTER PUMP 2 SUCTION DRAIN VALVE	RMPF RMS Booster Pump 2 Inlet	CLOSED		
0-WW-0022	R.M.S. BOOSTER PUMP 2 DISCHARGE PI-6736A ROOT VALVE	RMPF RMS Booster Pump 2 Outlet	OPEN		
0-WW-0021	R.M.S. BOOSTER PUMP 2 DISCHARGE VALVE	RMPF RMS Booster Pump 2 Outlet	OPEN		

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DEVICE NUMBER	COMPONENT NOUN DESCRIPTION	LOCATION	POSITION REQUIRED	ALIGNED BY	NEW TAG NEEDED
0-WW-0043	R.M.S. BOOSTER PUMPS DISCHARGE HEADER VENT VALVE	RMPF RMS Booster Pump 2 Outlet	CLOSED		
0-WW-0023	RMPF SEAL WATER FILTER 1 INLET VALVE	RMPF Seal Water Filter 1 Inlet	OPEN		
0-WW-0027	RMPF SEAL WATER FILTER 1 PDI/PDS-6737 HIGH SIDE ROOT VALVE	RMPF Seal Water Filter 1 Inlet	OPEN		
0-WW-0028	RMPF SEAL WATER FILTER 1 PDI/PDS-6737 LOW SIDE ROOT VALVE	RMPF Seal Water Filter 1 Outlet	OPEN		
0-WW-0024	RMPF SEAL WATER FILTER 1 OUTLET VALVE	RMPF Seal Water Filter 1 Outlet	OPEN		
0-WW-0025	RMPF SEAL WATER FILTER 2 INLET VALVE	RMPF Seal Water Filter 2 Inlet	CLOSED		
0-WW-0029	RMPF SEAL WATER FILTER 2 PDI/PDS-6737A HIGH SIDE ROOT VALVE	RMPF Seal Water Filter 2 Inlet	OPEN		
0-WW-0030	RMPF SEAL WATER FILTER 2 PDI/PDS-6737A LOW SIDE ROOT VALVE	RMPF Seal Water Filter 2 Outlet	OPEN		
0-WW-0026	RMPF SEAL WATER FILTER 2 OUTLET VALVE	RMPF Seal Water Filter 2 Outlet	CLOSED		
0-WW-0133	RIVER SCREEN WASH PUMP ISOLATION VALVE	RMPF, East of RMPF Seal Water System pumps/filters	CLOSED		
0-LM-0163	RESERVOIR MAKEUP PUMPS SOUTH DISCHARGE HEADER PSV-6736A/B ISOLATION VALVE	RMPF, West of Makeup Pumps 1, 2, 3, 4	OPEN		
0-LM-0164	RESERVOIR MAKEUP PUMPS SOUTH DISCHARGE HEADER PSV-6736D/E ISOLATION VALVE	RMPF, West of Makeup Pumps 1, 2, 3, 4	OPEN		
0-LM-0159	RESERVOIR MAKEUP PUMPS SOUTH DISCHARGE HEADER PSV-6736A/B/C ISOLATION VALVE	RMPF, West of Makeup Pump Wells 5, 6, 7, 8	OPEN		
0-LM-0160	RESERVOIR MAKEUP PUMPS SOUTH DISCHARGE HEADER PSV-6736D/E/F ISOLATION VALVE	RMPF, West of Makeup Pump Wells 5, 6, 7, 8	OPEN		



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DEVICE NUMBER	COMPONENT NOUN DESCRIPTION	LOCATION	POSITION REQUIRED	ALIGNED BY	NEW TAG NEEDED
0-LM-0157	WELL WATER SUPPLY ISOL TO SOUTH PIPELINE FLUSH	RMPF West of Makeup Pumps 1, 2, 3, 4	OPEN		
0-WW-0059	WELL WATER SUPPLY TO SOUTH DISCHARGE HEADER FLUSH ISOLATION VALVE	RMPF	OPEN		
0-WW-0108	SOUTH DISCHARGE HEADER FLUSH WELL WATER SUPPLY VALVE	RMPF	OPEN		
0-LM-0172	RESERVOIR MAKEUP PUMPS SOUTH DISCHARGE HEADER ENVIRONMENTAL SAMPLE VALVE	RMPF On South Pipeline West of Makeup Pumps 1, 2, 3, 4	CLOSED		
0-LM-0173	RESERVOIR MAKEUP PUMPS SOUTH DISCHARGE HEADER PI-6731J ROOT VALVE	RMPF in Valve Well Beside 0-LM-0172	OPEN		
0-LM-0165	RESERVOIR MAKEUP PUMPS NORTH DISCHARGE HEADER PSV-6735A/B ISOLATION VALVE	RMPF on North Pipeline West of Makeup Pump Wells 5, 6, 7, 8	OPEN		
0-LM-0166	RESERVOIR MAKEUP PUMPS NORTH DISCHARGE HEADER PSV-6735D/E ISOLATION VALVE	RMPF on North Pipeline West of Makeup Pump Wells 5, 6, 7, 8	OPEN		
0-LM-0161	RESERVOIR MAKEUP PUMPS NORTH DISCHARGE HEADER PSV-6735A/B/C ISOLATION VALVE	RMPF on North Pipeline West of Makeup Pump Wells 5, 6, 7, 8	OPEN		
0-LM-0162	RESERVOIR MAKEUP PUMPS NORTH DISCHARGE HEADER PSV-6735D/E/F ISOLATION VALVE	RMPF on North Pipeline West of Makeup Pump Wells 5, 6, 7, 8	OPEN		
0-LM-0158	WELL WATER SUPPLY ISOL TO NORTH PIPELINE FLUSH	RMPF on North Pipeline West of Makeup Pump Wells 5, 6, 7, 8	CLOSED		
0-WW-0057	WELL WATER SUPPLY HEADER TO FT-6728/28A INSTR FLUSH ISOLATION VALVE	100 ft. west of RMPF between concrete valve pits	OPEN		
0-WW-0109	WELL WATER SUPPLY ISOL TO FV-6728E	RMPF	CLOSED		
0-LM-0171	RESERVOIR MAKEUP PUMPS NORTH DISCHARGE HEADER ENVIRONMENTAL SAMPLE VALVE	RMPF on North Pipeline West of Makeup Pump Wells 5, 6, 7, 8	CLOSED		
0-LM-0174	RESERVOIR MAKEUP PUMP NORTH DISCHARGE FLUSH LINE PI-6731H ROOT VALVE	RMPF In Valve Well adjacent to 0-LM-0171	OPEN		
0-WW-0079	RESERVOIR MAKEUP PUMP SEAL WATER SUPPLY HEADER PRESSURE INSTR ROOT VALVE	RMPF	OPEN		

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EXCEPTIONS

DEVICE NUMBER	COMPONENT NOUN DESCRIPTION	REMARKS

Personnel participating  
in device manipulation:

_____	_____
Name	Initials
_____	_____
_____	_____
_____	_____

Device lineup completed by:

_____	_____	_____
Operator	Date	Time

Lineup 2 Reviewed:

_____	_____
Unit Supervisor	Date

This form, when completed, SHALL be retained until superseded.

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DEVICE NUMBER	COMPONENT NOUN DESCRIPTION	LOCATION	POSITION REQUIRED	ALIGNED BY	NEW TAG NEEDED
PI-6731	RMPF PUMP 1 DISCH PRESS	RMPF	IN SERVICE		
PI-6731A	RMPF PUMP 2 DISCH PRESS	RMPF	IN SERVICE		
PI-6731B	RMPF PUMP 3 DISCH PRESS	RMPF	IN SERVICE		
PI-6731C	RMPF PUMP 4 DISCH PRESS	RMPF	IN SERVICE		
PI-6731J	SOUTH PIPE PRESS	RMPF	IN SERVICE		
PI-6717	SCREEN WASH PUMP 11 DISCH PRESS	RMPF Screen Wash Pump 11	IN SERVICE		
PDI-6717	SCREEN WASH PUMP 11 STRAINER DP	RMPF Screen Wash Pump 11	IN SERVICE		
PDS-6717	SCREEN WASH PUMP 11 STRAINER DP SWITCH	RMPF Screen Wash Pump 11	IN SERVICE		
PI-6720	SCREEN WASH PUMP 12 DISCH PRESS	RMPF Screen Wash Pump 12	IN SERVICE		
PDI-6720	SCREEN WASH PUMP 12 STRAINER DP	RMPF Screen Wash Pump 12	IN SERVICE		
PDS-6720	SCREEN WASH PUMP 12 STRAINER DP SWITCH	RMPF Screen Wash Pump 12	IN SERVICE		

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DEVICE NUMBER	COMPONENT NOUN DESCRIPTION	LOCATION	POSITION REQUIRED	ALIGNED BY	NEW TAG NEEDED
PI-6724	SCREEN WASH HDR PRESS	RMPF Screen Wash Structure	IN SERVICE		
PSL-6724	SCREEN WASH PRESS LO	RMPF Screen Wash Structure	IN SERVICE		
PSH-6726A	PRESSURE SWITCH HI	RMPF Screen 2	IN SERVICE		
PSH-6726B	PRESSURE SWITCH HI	RMPF Screen 3	IN SERVICE		
PSH-6726C	PRESSURE SWITCH HI	RMPF Screen 4	IN SERVICE		
PSH-6726D	PRESSURE SWITCH HI	RMPF Screen 5	IN SERVICE		
PSH-6726E	PRESSURE SWITCH HI	RMPF Screen 6	IN SERVICE		
PSH-6726F	PRESSURE SWITCH HI	RMPF Screen 7	IN SERVICE		
PSH-6726G	PRESSURE SWITCH HI	RMPF Screen 8	IN SERVICE		
PSH-6726H	PRESSURE SWITCH HI	RMPF Screen 9	IN SERVICE		
PSH-6726J	PRESSURE SWITCH HI	RMPF Screen 10	IN SERVICE		
PSH-6726K	PRESSURE SWITCH HI	RMPF Screen 11	IN SERVICE		

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DEVICE NUMBER	COMPONENT NOUN DESCRIPTION	LOCATION	POSITION REQUIRED	ALIGNED BY	NEW TAG NEEDED
PDS-6726L	PRESSURE SWITCH HI	RMPF Screen 12	IN SERVICE		
PI-6726M	PRESSURE SWITCH HI	RMPF Screen 13	IN SERVICE		
PSL-6741	SUCTION PRESS S.W. LO	RMPF	IN SERVICE		
PI-6736	BOOSTER PUMP 1 DISCH PRESS	RMPF	IN SERVICE		
PI-6736A	BOOSTER PUMP 2 DISCH PRESS	RMPF	IN SERVICE		
PDI-6737	SEAL WATER FILTER 1 D/P INDICATOR	RMPF	IN SERVICE		
PDS-6737	SEAL WATER FILTER 1 D/P SWITCH	RMPF	IN SERVICE		
PDI-6737A	SEAL WATER FILTER 2 D/P INDICATOR	RMPF	IN SERVICE		
PDS-6737A	SEAL WATER FILTER 2 D/P SWITCH	RMPF	IN SERVICE		
PI-6738	HEADER PRESS INDICATOR	RMPF	IN SERVICE		
PSL-6738	HEADER PRESS LO	RMPF	IN SERVICE		
PSL-6738A	HEADER PRESS LO	RMPF	IN SERVICE		
PSL-6738B	HEADER PRESS LO	RMPF	IN SERVICE		

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EXCEPTIONS

DEVICE NUMBER	COMPONENT NOUN DESCRIPTION	REMARKS

Personnel participating  
in device manipulation:

_____	_____
Name	Initials
_____	_____
_____	_____
_____	_____

Device lineup completed by:

_____	_____	_____
Operator	Date	Time

Lineup 3 Reviewed:

_____	_____
Unit Supervisor	Date

This form, when completed, SHALL be retained until superseded.

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DEVICE NUMBER	COMPONENT NOUN DESCRIPTION	LOCATION	POSITION REQUIRED	ALIGNED BY	NEW TAG NEEDED
NONE	LM-MOV-0001	RMPF ZLP 500	NORM AFTER CLOSED		
NONE	LM-MOV-0002	RMPF ZLP 500	NORM AFTER CLOSED		
NONE	LM-MOV-0003	RMPF ZLP 500	NORM AFTER CLOSED		
NONE	LM-MOV-0004	RMPF ZLP 500	NORM AFTER CLOSED		
NONE	MAKE-UP PUMP NO-1	RMPF ZLP 500	PULL FOR E. STOP		
NONE	MAKE-UP PUMP NO-2	RMPF ZLP 500	PULL FOR E. STOP		
NONE	MAKE-UP PUMP NO-3	RMPF ZLP 500	PULL FOR E. STOP		
NONE	MAKE-UP PUMP NO-4	RMPF ZLP 500	PULL FOR E. STOP		
NONE	REMOTE/LOCAL M/U STA/SPILLWAY TRANSFER SWITCH	RMPF ZLP 500	LOCAL		
NORL-HS-6717	RSVR SCR N WASH NO 11	Locally at Pump	OFF		
NORL-HS-6720	RSVR SCR N WASH NO 12	Locally at Pump	OFF		
NORL-HS-6723	RSVR SCR N WASH NO 13	Locally at Pump	OFF		
NOLM-HS-6739A	RMPF SEAL WATER BOOSTER PUMP 1	Locally at Pump	OFF		
NOLM-HS-6739B	RMPF SEAL WATER BOOSTER PUMP 2	Locally at Pump	OFF		

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DEVICE NUMBER	COMPONENT NOUN DESCRIPTION	LOCATION	POSITION REQUIRED	ALIGNED BY	NEW TAG NEEDED
NOLM-HS-0047 ("RL047")	SCREEN WASH SLUICE VALVE CONTROL SWITCH	RMPF, Between traveling screens 12 & 13	AUTO		
NOLM-HS-0048 ("RL048")	SCREEN WASH SLUICE VALVE CONTROL SWITCH	RMPF, Between traveling screens 12 & 13	AUTO		
HS-24	RMPF SCREEN 2	RMPF	AUTO		
HS-25	RMPF SCREEN 3	RMPF	AUTO		
HS-26	RMPF SCREEN 4	RMPF	AUTO		
HS-27	RMPF SCREEN 5	RMPF	AUTO		
HS-28	RMPF SCREEN 6	RMPF	AUTO		
HS-29	RMPF SCREEN 7	RMPF	AUTO		
HS-30	RMPF SCREEN 8	RMPF	AUTO		
HS-31	RMPF SCREEN 9	RMPF	AUTO		
HS-32	RMPF SCREEN 10	RMPF	AUTO		
HS-33	RMPF SCREEN 11	RMPF	AUTO		
HS-34	RMPF SCREEN 12	RMPF	AUTO		
HS-35	RMPF SCREEN 13	RMPF	AUTO		





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DEVICE NUMBER	COMPONENT NOUN DESCRIPTION	LOCATION	POSITION REQUIRED	ALIGNED BY	NEW TAG NEEDED
DCDP 20A BKR 1	1M CHARGER TO BUS DCDP 20A	DCDP 20A	ON/OFF(1)		
DCDP 20A BKR 2	125 VDC BATTERY AND 2M CHARGER TO BUS DCDP20A	DCDP 20A	ON		
DCDP 20A BKR 3	ZLP-501 ANNUNCIATORS	DCDP 20A	ON		
DCDP 20A BKR 4	138 KV CKT SWITCHER 9Y500ESG114A	DCDP 20A	ON		
DCDP 20A BKR 5	ZLP-500 ANNUNCIATORS	DCDP 20A	ON		
DCDP 20A BKR 6	HIGH SPEED GND SWITCH 9Y500ESG115A	DCDP 20A	ON		
DCDP 20A BKR 7	BREAKER TEST CAB	DCDP 20A	ON		
DCDP 20A BKR 8	4160 V SWGR 1M	DCDP 20A	ON		
DCDP 20A BKR 9	SPARE	DCDP 20A	OFF		
DCDP 20A BKR 10	480 V SWGR 1M (LC 1M)	DCDP 20A	ON		
DCDP 20A BKR 11	SPARE	DCDP 20A	OFF		
DCDP 20A BKR 12	2M CHARGER TO BUS DCDP 20A	On the outside front of DCDP 20A	ON/OFF(1)		

(1) ON for charger in Service. OFF when Charger is secured to limit current drain through meter when RMPF is de-energized.

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DEVICE NUMBER	COMPONENT NOUN DESCRIPTION	LOCATION	POSITION REQUIRED	ALIGNED BY	NEW TAG NEEDED
1M/1	4160V SWGR 1M TO 480V LC 1M XFMR	RMPF 4.16 KV SWGR 1M	RACKED IN		
1M/2	RMPF MAKEUP PUMP NO 8	RMPF 4.16 KV SWGR 1M	REMOVED		
1M/3	RMPF MAKEUP PUMP NO 7	RMPF 4.16 KV SWGR 1M	REMOVED		
1M/4	RMPF MAKEUP PUMP NO 6	RMPF 4.16 KV SWGR 1M	REMOVED		
1M/5	RMPF MAKEUP PUMP NO 5	RMPF 4.16 KV SWGR 1M	REMOVED		
1M/8	RMPF MAKEUP PUMP NO 4	RMPF 4.16 KV SWGR 1M	RACKED IN		
1M/9	RMPF MAKEUP PUMP NO 3	RMPF 4.16 KV SWGR 1M	RACKED IN		
1M/10	RMPF MAKEUP PUMP NO 2	RMPF 4.16 KV SWGR 1M	RACKED IN		
1M/11	RMPF MAKEUP PUMP NO 1	RMPF 4.16 KV SWGR 1M	RACKED IN		
1M/12	SPARE	RMPF 4.16 KV SWGR 1M	RACKED OUT		
1M/13	SPARE	RMPF 4.16 KV SWGR 1M	RACKED OUT		
1M/1C	4160V SWGR 1M TO 480V LC 1M	RMPF 480V LC 1M	RACKED IN		
1M/2B	SPACE	RMPF 480V LC 1M	RACKED OUT/REMOVED		
1M/2C	TO 480V MCC 1M3	RMPF 480V LC 1M	RACKED IN		
1M/1D	TO 480V MCC 1M1	RMPF 480V LC 1M	RACKED IN		
1M/2D	TO 480V MCC 1M2	RMPF 480V LC 1M	RACKED IN		

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DEVICE NUMBER	COMPONENT NOUN DESCRIPTION	LOCATION	POSITION REQUIRED	ALIGNED BY	NEW TAG NEEDED
1M1/A2	RMPF MAKEUP PUMP 1 DISCH MOV OPERATOR 0-LM-MOV-001	RMPF 480V MCC 1M1	ON		
1M1/A3	RMPF MAKEUP PUMP 2 DISCH MOV OPERATOR 0-LM-MOV-002	RMPF 480V MCC 1M1	ON		
1M1/A4	RMPF MAKEUP PUMP 3 DISCH MOV OPERATOR 0-LM-MOV-003	RMPF 480V MCC 1M1	ON		
1M1/B1	SPARE	RMPF 480V MCC 1M1	OFF		
1M1/B2	RMPF MAKEUP PUMP 4 DISCH MOV OPERATOR 0-LM-MOV-004	RMPF 480V MCC 1M1	ON		
1M1/B3	RMPF MAKEUP PUMP 5 DISCH MOV OPERATOR 0-LM-MOV-005	RMPF 480V MCC 1M1	LOCKED OFF		
1M1/B4	RMPF MAKEUP PUMP 6 DISCH MOV OPERATOR 0-LM-MOV-006	RMPF 480V MCC 1M1	LOCKED OFF		
1M1/C2	RMPF MAKEUP PUMP 7 DISCH MOV OPERATOR 0-LM-MOV-007	RMPF 480V MCC 1M1	LOCKED OFF		
1M1/C3	RMPF MAKEUP PUMP 8 DISCH MOV OPERATOR 0-LM-MOV-008	RMPF 480V MCC 1M1	LOCKED OFF		
1M1/D1	RMPF MAKEUP PUMP 3 SPACE HEATER	RMPF 480V MCC 1M1	ON		
1M1/D2	RMPF MAKEUP PUMP 4 SPACE HEATER	RMPF 480V MCC 1M1	ON		
1M1/D3	RMPF MAKEUP PUMP 5 SPACE HEATER	RMPF 480V MCC 1M1	LOCKED OFF		
1M1/D4	RMPF MAKEUP PUMP 6 SPACE HEATER	RMPF 480V MCC 1M1	LOCKED OFF		
1M2/A1U	CATHODICE PROTECTIONS RECTIFIER CP54-01	RMPF 480V MCC 1M2	ON		
1M2/A1L	SPARE	RMPF 480V MCC 1M2	OFF		
1M2/A2U	POWER OUTLETS RP54-001 & RP54-002	RMPF 480V MCC 1M2	ON		

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DEVICE NUMBER	COMPONENT NOUN DESCRIPTION	LOCATION	POSITION REQUIRED	ALIGNED BY	NEW TAG NEEDED
1M2/A2L	M/U PIPELINE CATHODIC PROT. RECT. CP54-13 THRU CP54-22	RMPF 480V MCC 1M2	ON		
1M2/A3U	SPARE	RMPF 480V MCC 1M2	LOCKED OFF		
1M2/A3L	TO 480V LIGHTING PANEL LP20A	RMPF 480V MCC 1M2	ON		
1M2/A4U	SPARE	RMPF 480V MCC 1M2	OFF		
1M2/A4L	SPARE	RMPF 480V MCC 1M2	OFF		
1M2/A5	CABLE BASEMENT SUMP PUMP 1	RMPF 480V MCC 1M2	ON		
1M2/A6	CABLE BASEMENT SUMP PUMP 2	RMPF 480V MCC 1M2	ON		
1M2/B1U	SPARE	RMPF 480V MCC 1M2	OFF		
1M2/B1L	SPARE	RMPF 480V MCC 1M2	OFF		
1M2/B2U	TO 480V DIST PNL DP20A	RMPF 480V MCC 1M2	ON		
1M2/B2L	SPARE	RMPF 480V MCC 1M2	OFF		
1M2/B3	ELECT EQUIP ROOM SUPPLY FAN 1	RMPF 480V MCC 1M2	ON		
1M2/B4	ELECT EQUIP ROOM SUPPLY FAN 3	RMPF 480V MCC 1M2	ON		
1M2/B5	SPARE	RMPF 480V MCC 1M2	OFF		
1M2/B6	RMPF SEAL WATER BOOSTER PUMP 1	RMPF 480V MCC 1M2	ON		
1M2/C1U	BATTERY CHARGER 1M	RMPF 480V MCC 1M2	ON		
1M2/C1L	BATTERY CHARGER 2M	RMPF 480V MCC 1M2	ON		
1M2/C2U	TO LIGHTING PNL LP20B XFMR LT20B	RMPF 480V MCC 1M2	ON		

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DEVICE NUMBER	COMPONENT NOUN DESCRIPTION	LOCATION	POSITION REQUIRED	ALIGNED BY	NEW TAG NEEDED
1M2/C2L	TO DIST PNL DP1M1 XFMR DT-20B	RMPF 480V MCC 1M2	ON		
1M2/C3	ELECT EQUIP ROOM SUPPLY FAN 2	RMPF 480V MCC 1M2	ON		
1M2/C4	ELECT EQUIP ROOM SUPPLY FAN 4	RMPF 480V MCC 1M2	ON		
1M2/C5	SPARE	RMPF 480V MCC 1M2	OFF		
1M2/C6	RMPF SEAL WATER BOOSTER PUMP 2	RMPF 480V MCC 1M2	ON		
1M2/D2	ELECT EQUIP ROOM ROOF EXHAUSTER 1	RMPF 480V MCC 1M2	ON		
1M2/D3	ELECT EQUIP ROOM ROOF EXHAUSTER 2	RMPF 480V MCC 1M2	ON		
1M2/D4	ELECT EQUIP ROOM ROOF EXHAUSTER 3	RMPF 480V MCC 1M2	ON		
1M3/A1	MCC 1M3 ELECT BLDG SUPPLY FAN	RMPF 480V MCC 1M3	ON		
1M3/A2U	SPARE	RMPF 480V MCC 1M3	OFF		
1M3/A2L	SPARE	RMPF 480V MCC 1M3	OFF		
1M3/A3	SPARE	RMPF 480V MCC 1M3	OFF		
1M3/A4	TRAVELING SCREEN #2	RMPF 480V MCC 1M3	ON		
1M3/B1	TRAVELING SCREEN #3	RMPF 480V MCC 1M3	ON		
1M3/B2	TRAVELING SCREEN #4	RMPF 480V MCC 1M3	ON		
1M3/B3	TRAVELING SCREEN #5	RMPF 480V MCC 1M3	ON		
1M3/C1U	CATHODIC PROTECTION RECTIFIER CP54-003	RMPF 480V MCC 1M3	ON		

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DEVICE NUMBER	COMPONENT NOUN DESCRIPTION	LOCATION	POSITION REQUIRED	ALIGNED BY	NEW TAG NEEDED
1M3/C1L	POWER OUTLETS RP54-003 & RP54-004	RMPF 480V MCC 1M3	ON		
1M3/C2U	CATHODIC PROTECTION RECTIFIER CP54-004	RMPF 480V MCC 1M3	ON		
1M3/C2L	CATHODIC PROTECTION RECTIFIER CP54-005	RMPF 480V MCC 1M3	ON		
1M3/C3	TRAVELING SCREEN #6	RMPF 480V MCC 1M3	ON		
1M3/C4	TRAVELING SCREEN #7	RMPF 480V MCC 1M3	ON		
1M3/D1U	SCREEN INTAKE TRASH RAKE 1	RMPF 480V MCC 1M3	ON		
1M3/D1L	MCC 1M3 ELECT BLDG UNIT HEATER #1	RMPF 480V MCC 1M3	ON		
1M3/D2U	TO 480V LIGHTING CONTACTOR LC21A	RMPF 480V MCC 1M3	ON		
1M3/D2L	TO DIST PNL DP1M3 XFMR LT-21B	RMPF 480V MCC 1M3	ON		
1M3/D3	TRAVELING SCREEN #8	RMPF 480V MCC 1M3	ON		
1M3/D4	TRAVELING SCREEN #9	RMPF 480V MCC 1M3	ON		
1M3/E1	TRAVELING SCREEN #10	RMPF 480V MCC 1M3	ON		
1M3/E2	TRAVELING SCREEN #11	RMPF 480V MCC 1M3	ON		
1M3/E3	TRAVELING SCREEN #12	RMPF 480V MCC 1M3	ON		
1M3/F1U	COFFER DAM CATHODIC PROT RECTIFIER 9 & 10	RMPF 480V MCC 1M3	ON		
1M3/F1L	COFFER DAM CATHODIC PROT RECTIFIER 11 & 12	RMPF 480V MCC 1M3	ON		
1M3/F3	SPARE	RMPF 480V MCC 1M3	OFF		
1M3/F4	SCREEN WASH PUMP 1	RMPF 480V MCC 1M3	ON		

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DEVICE NUMBER	COMPONENT NOUN DESCRIPTION	LOCATION	POSITION REQUIRED	ALIGNED BY	NEW TAG NEEDED
1M3/G3	SPARE	RMPF 480V MCC 1M3	OFF		
1M3/G4	SCREEN WASH PUMP 2	RMPF 480V MCC 1M3	ON		
1M3/H1	TRAVELING SCREEN #13	RMPF 480V MCC 1M3	ON		
1M3/H2	SPARE	RMPF 480V MCC 1M3	OFF		
1M3/H3	SPARE	RMPF 480V MCC 1M3	LOCKED OFF		
1M3/J1U	SCREEN INTAKE TRASH RAKE 2	RMPF 480V MCC 1M3	ON		
1M3/J1L	SPARE	RMPF 480V MCC 1M3	OFF		
1M3/J2U	SPARE	RMPF 480V MCC 1M3	OFF		
1M3/J2L	MCC 1M3 ELECT BLDG UNIT HEATER #2	RMPF 480V MCC 1M3	ON		
1M3/J3	SPARE	RMPF 480V MCC 1M3	OFF		
1M3/J4	SPARE	RMPF 480V MCC 1M3	OFF		
1M3/K1U	CATHODIC PROTECTION RECTIFIER CP54-006	RMPF 480V MCC 1M3	ON		
1M3/K1L	SPARE	RMPF 480V MCC 1M3	OFF		
1M3/K2U	SPARE	RMPF 480V MCC 1M3	OFF		
1M3/K2L	POWER OUTLETS RP54-005 & RP54-006	RMPF 480V MCC 1M3	ON		
1M3/K3	SPARE	RMPF 480V MCC 1M3	OFF		
1M3/K4	SPARE	RMPF 480V MCC 1M3	OFF		
1M3/L1	SPARE	RMPF 480V MCC 1M3	OFF		



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DEVICE NUMBER	COMPONENT NOUN DESCRIPTION	LOCATION	POSITION REQUIRED	ALIGNED BY	NEW TAG NEEDED
1M3/L2	SPARE	RMPF 480V MCC 1M3	OFF		
1M3/L3	SPARE	RMPF 480V MCC 1M3	OFF		
1M3/M1	SPARE	RMPF 480V MCC 1M3	OFF		
1M3/M2	SPARE	RMPF 480V MCC 1M3	OFF		
1M3/M3	SPARE	RMPF 480V MCC 1M3	OFF		
DP 1M1 BKR 1	RMPF MAKEUP PMP 1 DISCH VLV (LM-MOV-001) SPC HTR	RMPF 480V MCC 1M1/C1	ON		
DP 1M1 BKR 2	RMPF MAKEUP PMP 2 DISCH VLV (LM-MOV-002) SPC HTR	RMPF 480V MCC 1M2/C1	ON		
DP 1M1 BKR 3	RMPF MAKEUP PMP 3 DISCH VLV (LM-MOV-003) SPC HTR	RMPF 480V MCC 1M2/C1	ON		
DP 1M1 BKR 4	RMPF MAKEUP PMP 4 DISCH VLV (LM-MOV-004) SPC HTR	RMPF 480V MCC 1M2/C1	ON		
DP 1M1 BKR 5	RMPF MAKEUP PMP 5 DISCH VLV (LM-MOV-005) SPC HTR	RMPF 480V MCC 1M2/C1	OFF		
DP 1M1 BKR 6	RMPF MAKEUP PMP 6 DISCH VLV (LM-MOV-006) SPC HTR	RMPF 480V MCC 1M2/C1	OFF		
DP 1M1 BKR 7	RMPF MAKEUP PMP 7 DISCH VLV (LM-MOV-007) SPC HTR	RMPF 480V MCC 1M2/C1	OFF		
DP 1M1 BKR 8	RMPF MAKEUP PMP 8 DISCH VLV (LM-MOV-008) SPC HTR	RMPF 480V MCC 1M2/C1	OFF		
DP 1M1 BKR 9	MCC 1M1 UNIT SPC HTR	RMPF 480V MCC 1M2/C1	ON		
DP 1M1 BKR 10	SPARE	RMPF 480V MCC 1M2/C1	OFF		
DP 1M1 BKR 11	SPARE	RMPF 480V MCC 1M2/C1	OFF		
DP 1M1 BKR 12	SPARE	RMPF 480V MCC 1M2/C1	OFF		

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DEVICE NUMBER	COMPONENT NOUN DESCRIPTION	LOCATION	POSITION REQUIRED	ALIGNED BY	NEW TAG NEEDED
DP 20A BKR 1	ELECTRICAL UNIT HEATER EQUIP RM8V350VHT122	DIST PNL DP 20-A	ON		
DP 20A BKR 2	ELECTRICAL UNIT HEATER EQUIP RM8V350VHT123	DIST PNL DP 20-A	ON		
DP 20A BKR 3	ELECTRICAL UNIT HEATER EQUIP RM8V350VHT124	DIST PNL DP 20-A	ON		
DP 20A BKR 4	ELECTRICAL UNIT HEATER EQUIP RM8V350VHT125	DIST PNL DP 20-A	ON		
DP 20A BKR 5	ELECTRICAL UNIT HEATER EQUIP RM8V350VHT126	DIST PNL DP 20-A	ON		
DP 20A BKR 6	ELECTRICAL UNIT HEATER EQUIP RM8V350VHT127	DIST PNL DP 20-A	ON		
DP 20A BKR 7	SPARE	DIST PNL DP 20-A	OFF		
DP 20A BKR 8	ELECTRICAL UNIT HEATER EQUIP RM8V350VHT152	DIST PNL DP 20-A	ON		
DP 20A BKR 9	RIVER SERVICE XFMR COOLING FANS	DIST PNL DP 20-A	ON		
DP 20A BKR 10	SAPRE	DIST PNL DP 20-A	OFF		
DP 20B BKR 3	T/C BOX MAKEUP PMP #3	RMPF DIST PNL DP20-B	ON		
DP 20B BKR 4	T/C BOX MAKEUP PMP #4	RMPF DIST PNL DP20-B	ON		
DP 20B BKR 5	T/C BOX MAKEUP PMP #5	RMPF DIST PNL DP20-B	ON		
DP 20B BKR 6	T/C BOX MAKEUP PMP #6	RMPF DIST PNL DP20-B	ON		

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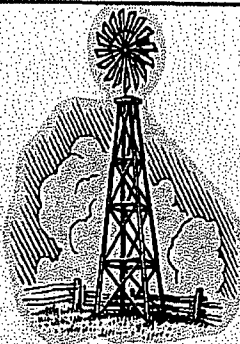
DEVICE NUMBER	COMPONENT NOUN DESCRIPTION	LOCATION	POSITION REQUIRED	ALIGNED BY	NEW TAG NEEDED
DP 1M3 BKR 1	SLUICE WASH VLV 1 & SCREEN WASH VALVS 1 THROUGH 12	RMPF Screen Structure Elec. Building, MCC 1M3/N2	ON		
DP 1M3 BKR 2	SLUICE WASH VLV 2 & SCREEN WASH VALVS 13 THROUGH 24	RMPF Screen Structure Elec. Building, MCC 1M3/N2	ON		
DP 1M3 BKR 3	SCREEN WASH PUMP 1 LUBE OIL SOL VLV (VS-6214A)	RMPF Screen Structure Elec. Building, MCC 1M3/N2	OFF		
DP 1M3 BKR 4	SCREEN WASH PUMP 2 LUBE OIL SOL VLV (VS-6215A)	RMPF Screen Structure Elec. Building, MCC 1M3/N2	OFF		
DP 1M3 BKR 5	SCREEN WASH PUMP 3 LUBE OIL SOLENOID VLV	RMPF Screen Structure Elec. Building, MCC 1M3/N2	OFF		
DP 1M3 BKR 6	TRAVELLING WATER SCREEN WASH CYCLE SEQUENCER	RMPF Screen Structure Elec. Building, MCC 1M3/N2	ON		
DP 1M3 BKR 7	SPARE	RMPF Screen Structure Elec. Building, MCC 1M3/N2	OFF		
DP 1M3 BKR 8	DAMPERS 8V340VDA008 & 8V340VDA009	RMPF Screen Structure Elec. Building, MCC 1M3/N2	ON		
DP 1M3 BKR 9	SCREEN WASH PUMP 1 SPC HEATER	RMPF Screen Structure Elec. Building, MCC 1M3/N2	ON		
DP 1M3 BKR 10	SCREEN WASH PUMP 2 SPC HEATER	RMPF Screen Structure Elec. Building, MCC 1M3/N2	ON		
DP 1M3 BKR 11	SCREEN WASH PUMP 3 SPC HEATER	RMPF Screen Structure Elec. Building, MCC 1M3/N2	OFF		
DP 1M3 BKR 12	MCC 1M3 UNIT SPC HTR	RMPF Screen Structure Elec. Building, MCC 1M3/N2	ON		

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<b>Reservoir Makeup Pumping Facility</b>			
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DEVICE NUMBER	COMPONENT NOUN DESCRIPTION	LOCATION	POSITION REQUIRED	ALIGNED BY	NEW TAG NEEDED
LP 21B BKR 3	INST ENCL SP HTRS 0-ECL-450 THRU 453	RMPF Screen Structure Elec. Building	ON		
LP 21B BKR 4	INST ENCL SP HTRS 0-ECL-462 THRU 465	RMPF Screen Structure Elec. Building	ON		
LP 21B BKR 5	INST ENCL SP HTRS 0-ECL-454 THRU 457	RMPF Screen Structure Elec. Building	ON		
LP 21B BKR 6	INST ENCL SP HTRS 0-ECL-466 THRU 469	RMPF Screen Structure Elec. Building	OFF		
LP 21B BKR 7	INST ENCL SP HTRS 0-ECL-458 THRU 461	RMPF Screen Structure Elec. Building	ON		
LP 21B BKR 8	INST ENCL SP HTRS 0-ECL-470 THRU 473	RMPF Screen Structure Elec. Building	OFF		
DISCONNECT	SPILLWAY STRUCTURE MAIN DISCONNECT	CP&L Pole SE of Spillway Building Structure	ON		
DP 22A/12	MAIN INCOMING FEED	Spillway Structure DP 22A	ON		
DP-22A BKR 1	SPILLWAY GATE HOIST #1	Spillway Structure DP 22A	OFF		
DP-22A BKR 2	SPILLWAY GATE HOIST #2	Spillway Structure DP 22A	OFF		
DP-22A BKR 3	SPILLWAY GATE HOIST #3	Spillway Structure DP 22A	OFF		
DP-22A BKR 4	SPILLWAY GATE HOIST #4	Spillway Structure DP 22A	OFF		
DP 22A BKR 5	WELDING RECEPTACLE	Spillway Structure DP 22A	ON		
DP-22A BKR 6	HEATER	Spillway Structure DP 22A	ON		
DP-22A BKR 7	LIGHTING TRANSFORMER	Spillway Structure DP 22A	ON		
DP-22A BKR 8	AREA FLOOD LIGHTING	Spillway Structure DP 22A	ON		
DP-22A BKR 9	ALERT/EVACUATION CIVIL DEFENSE SIREN	Spillway Structure DP 22A	ON		
DP-22A BKR 10	MAIN	Spillway Structure DP 22A	ON		

WR-9    Current groundwater operating permit issued by the Coastal Plains  
Groundwater Conservation District. [STPLR-468]

WR-9



## Coastal Plains Groundwater Conservation District

2200 7<sup>th</sup> Street, #303

Bay City, TX 77414

Phone: (979) 323-9170 Fax: (979) 245-5661

Email: [cpgcd@co.matagorda.tx.us](mailto:cpgcd@co.matagorda.tx.us) Web Site: [www.coastalplainsgcd.com](http://www.coastalplainsgcd.com)

### OPERATING PERMIT

PERMIT NO.: OP-04122805

**I. PERMITTEE:**

STP Nuclear Operating Company  
PO Box 289  
Wadsworth, TX 77483

**II. REGISTRANT:**

**III. NUMBER OF WELLS COVERED BY PERMIT: 5**

**IV. LOCATION OF WELL:**

Latitude: 28 degrees 48 minutes 21 seconds  
Longitude: 96 degrees 1 minutes 55 seconds

**V. WELL REGISTRATION NUMBER:**

2004122802, 2004122804, 2004122805, 2004122806, 2005010409

**VI. PERMIT TERM:**

Date of Issue: February 24<sup>th</sup>, 2011  
Expiration Date: February 28, 2014

**VII. PURPOSE OF USE:**

Industrial

**VIII. AUTHORIZED WITHDRAWAL:**

Only that which is required without being wasteful during the permit term, but not to exceed 9000 Acre Feet.

Any pumpage and excess of the amount authorized in this permit is a violation of the District's Rules. Applications for an amendment to increase authorized withdrawal must be submitted prior to exceeding the permitted amount.

**IX. SPECIAL PROVISIONS:**

DATED, ISSUED, AND EXECUTED THIS 24th day of February, 2011; TO BE EFFECTIVE ON  
THE 24<sup>th</sup> day of February, 2011

BY: \_\_\_\_\_

Neil Hudgins  
General Manager

WR-10. Conceptual Site Model for Units 1 and 2, Groundwater Protection Initiative, South Texas Project, Electric Generating Station, Wadsworth, Texas, Prepared by MACTEC Engineering and Consulting, Inc., Prepared for STP Nuclear Operating Company, Revision 1, May 20, 2009. [STPLR-375]

STPLR-375

WR-10

STI No. 32524840  
CSM-GWPI-0001/1

# CONCEPTUAL SITE MODEL FOR UNITS 1 AND 2 GROUNDWATER PROTECTION INITIATIVE

**South Texas Project  
Electric Generating Station  
Wadsworth, Texas**

**Prepared by:**

**MACTEC Engineering and Consulting, Inc.  
511 Congress Street  
Portland, Maine 04101**

**Prepared for:**

**STP Nuclear Operating Company  
P. O. Box 289  
Wadsworth, Texas 77483**

**Approved by:**

*J. H. Samuels*

**Revision 1**

**Effective Date: May 20, 2009**



**CONCEPTUAL SITE MODEL FOR UNITS 1 AND 2  
GROUNDWATER PROTECTION INITIATIVE**

**SOUTH TEXAS PROJECT  
ELECTRIC GENERATING STATION  
WADSWORTH, TEXAS**

**Prepared by:**

**MACTEC Engineering and Consulting, Inc.  
511 Congress Street  
Portland, Maine 04101**

**Prepared for:**

**STP Nuclear Operating Company  
P.O. Box 289  
Wadsworth, Texas 77483**

**Project Number 6234084613.05**

**Revision 1  
May 2009**



engineering and constructing a better tomorrow

May 20, 2009

Ms. Sandra Dannhardt  
STPEGS Nuclear Company  
PO Box 289  
Wadsworth, TX 77483

**Subject: Revised Conceptual Site Model for Units 1 and 2  
Groundwater Protection Initiative  
South Texas Project Electric Generating Station**

Dear Ms. Dannhardt:


Enclosed please find five hard copies and five compact discs of the revised Conceptual Site Model (CSM) for Units 1 and 2, completed in support of South Texas Project Electric Generating Station's (STPEGS') Groundwater Protection Initiative.

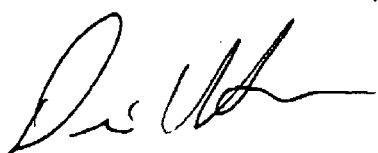
This revision includes the following updates:

- Section 11.0 - Status Update, May 2009
- Revised Table 6-1 - Evaluation of Potential Subsurface Releases
- Revised Figure 6-1 - Documented Releases of Tritium
- Appendix C-2 - ERPI Priority Index Matrix
- Appendix F - Monitoring Well Documentation

The additional data continues to show that historic and current tritium concentrations in groundwater are well below the US. Environmental Protection Agency (USEPA) Maximum Contaminant Level (MCLs) and well below the reporting criteria published in the Off Site Dose Calculation Manual (ODCM). If you have questions, please feel free to call Nadia Glucksberg at (207) 828-3535 or Mike Sufnarski at (704) 357 5633.

Sincerely,  
**MACTEC Engineering and Consulting, Inc.**

  
Nadia Glucksberg, CG  
Principal Hydrogeologist

  
For Michael Sufnarski, PE with permission  
Project Manager

CONCEPTUAL SITE MODEL FOR UNITS 1 AND 2  
GROUNDWATER PROTECTION INITIATIVE

SOUTH TEXAS PROJECT  
ELECTRIC GENERATING STATION  
WADSWORTH, TEXAS

Prepared by:



MACTEC Engineering and Consulting, Inc.  
511 Congress Street  
Portland, Maine 04101

Prepared for:

STP Nuclear Operating Company  
P.O. Box 289  
Wadsworth, Texas 77483

Project Number 6234084613.05

Revision  
May 2009

  
\_\_\_\_\_  
For Michael Sufnarski, PE with permission  
Project Manager  
\_\_\_\_\_  
Nadia Glucksberg, CG  
Principal Hydrogeologist

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## **EXECUTIVE SUMMARY**

STP Nuclear Operating Company has contracted MACTEC Engineering and Consulting Inc, (MACTEC) to develop a Conceptual Site Model (CSM) for Units 1 and 2 at the South Texas Project Electric Generating Station (STPEGS) located in Wadsworth, Texas (Figure 1-1). The purpose of the CSM is to document the geology and hydrogeology as well as to characterize known and potential releases of radionuclides to the environment. This information will then be used to assess impacts of radionuclides on groundwater quality and to design a groundwater monitoring network so that historic and future (potential) releases can be characterized, documented, and remediated, if warranted, before impacted groundwater can migrate off-site.

This work has been completed as part of STPEGS' ongoing commitment to environmental protection. STPEGS has entered into this Groundwater Protection Initiative as an active member of Electric Power Research Institute (EPRI) and is using this opportunity to voluntarily evaluate current and historic groundwater data to determine if the current monitoring network is appropriate for groundwater characterization. This work has been completed by an independent contractor and was performed in compliance with the Groundwater Protection Initiative established by the National Energy Institute (NEI) (NEI 07-07) and the EPRI Groundwater Protection Guidelines for Nuclear Power Plants (EPRI, 2007).

The NEI 07-07 guideline provides methods and approaches to characterizing, monitoring, and reporting the presence of radioactive isotopes in groundwater at nuclear power stations. To better characterize site conditions and develop the CSM, the following tasks were completed:

- Assessment of available maps, construction drawings, and aerial photographs;
- File review to identify historic releases of radioactive liquids to the environment;
- Interviews with plant personnel;
- Evaluation of systems that contain radioactive liquids;
- Site walk downs;
- Review of Condition Reports to assess historic releases and corrective actions;
- Evaluation of drilling methods, well installation and groundwater sampling techniques;
- Inspection of existing wells;
- Evaluation of existing analytical data; and



- Evaluation of data management.

The following summarizes the current CSM for STPEGS.

The geology below Units 1 and 2 consists of stratified interbedded sands and silts. The shallow groundwater is encountered at approximately 20 feet below ground surface (bgs) and groundwater generally flows towards the southeast, towards the Colorado River. Within the shallow aquifer, there is a downward gradient that may carry impacted water released near the surface to deeper zones. Below the shallow aquifer, there is an aquitard approximately 150 feet thick. This is underlain by a deeper aquifer that provides potable water to the plant and surrounding properties (STPNOC, 2008a).

Groundwater flow velocity for the shallow aquifer is dependent on the gradient. Although the sandy layers in the aquifer generally have higher hydraulic conductivity, the gradient is very low resulting in a very slow groundwater velocity. The deeper aquifer is actively pumped for supply water, this increases the hydraulic gradient (and flow direction) and therefore also increases flow velocity. However, as noted above, there is a significant sand and clay aquitard in-between the shallow and deep aquifers that prevent hydraulic communication between the two water bearing zones.

There are two general ways that radionuclides can enter or be released to the environment: 1) from the Main Cooling Reservoir (MCR) infiltrating through the overburden soils to the underlying groundwater; and 2) from releases or leaks from plant systems that carry radioactive materials.

The MCR contributes tritium to the aquifer as part of the plant's design. The MCR has had measurable levels of tritium at concentrations up to 17,000 pCi/L since commercial operation. Tritium first began to appear in relief wells about 2 years after detection in the MCR. Extensive monitoring around the MCR completed in 2006 found tritium had migrated to a well about 700 feet west of the MCR as measured from the Dike road. Wells within about 150 feet of the MCR also typically contained detectable tritium. This suggests that the groundwater may migrate about 700 feet per 18 years or about 40 feet per year (ft/year). This is consistent with the Updated Final Safety Analysis Report (UFSAR), Section 2.4.13.3.1.2 where the migration rate in the shallow aquifer was conservatively assumed to be about 77 ft/year (Bechtel, 2007).

Based on an evaluation of the systems, the most likely source of radioactivity (i.e. tritium) in groundwater within the protected area is from releases associated with the Total Dissolved Solids (TDS) piping and from the secondary system steam condensate. The TDS lines have had documented releases that were subsequently repaired, however limited volumes of radioactive water were released to the environment. The secondary system steam and condensate also carries radioactive fluids that are drained via steam traps in small quantities to the ground surface. For both of these lines, the concentrations of tritium within the systems may be present at concentrations up to 80,000 picoCuries per liter (pCi/L). These leaks and releases are most likely responsible for very localized presence of tritium in groundwater that have been detected at concentrations above background but well below the Environmental Protection Agency (EPA) Maximum Concentration Level (MCL) of 20,000 pCi/L. Please note that all of the systems within the Protected area are located approximately one mile from the property boundary and more than 2.5 miles from the nearest private residence.

The current groundwater monitoring network at STPEGS further supports this CSM. Slightly elevated levels of tritium (with respect to background) have been detected in groundwater samples collected from wells around the MCR, with only one location exhibiting slightly higher concentrations. Geologic boring logs from this location are not available, but this localized occurrence is most likely due to heterogeneities within the formation and the well most likely intersecting a more transmissive zone. Furthermore, the maximum concentration that could be detected in groundwater would be equal to the concentrations in the MCR. As these levels are below the EPA MCLs, there continues to be no significant risk to human health or the environment from impacted groundwater associated with the MCR.

Similarly, although tritium activities in groundwater do not exceed the EPA MCL of 20,000 pCi/L within the protected area, elevated activity has been detected at wells MW-221C and MW-221E, near a historic release from the Unit 2 TDS pipeline. Tritium was detected above background first in the shallow well (MW-221C, screened at approximately 40 feet bgs), and later at the deeper zone (MW-221E screened at approximately 80 feet bgs). Due to the slow velocity of groundwater in this area, it is not expected that detectable concentrations of tritium will migrate past the protected area boundary or past the property boundary as the concentrations will naturally disperse within the aquifer and the tritium will decay. There is no significant risk to human health or the environment from impacted groundwater associated with the TDS pipelines.

Based on the plant design, site conditions, historic releases, and current data sets, there are areas where small releases of radioactive liquids may have occurred and where residual or current source areas could be impacting groundwater that are not currently monitored. These potential data gaps include:

- Areas east of the Unit 1 TDS pipeline (including areas downgradient from historic releases);
- Areas downgradient from the condensate release areas; and
- The deeper aquifer, below Units 1 and 2.

By plant design, tritium has also been detected above background at wells located on the west side of the MCR. Although these data are expected, this does present a data gap when defining the lateral extent of tritium detected in groundwater.

With the exception of these specific groundwater monitoring locations, the current well network is adequate for screening level data. However, as noted below, additional care should be taken to prevent further degradation of the wells and to protect the groundwater from potential storm water runoff.

The CSM is an iterative process. The following conclusions may be drawn on the data presented in this report:

- Geology below the site is generally uniform, consisting of stratified, interbedded silts and sands.
- Shallow groundwater contours indicated that groundwater generally flows slowly to the southeast, towards the Colorado River, with localized impacts from subsurface structures and groundwater mounding from the MCR.
- Deep groundwater flow is impacted by on-site pumping wells, however regionally groundwater will flow toward the south, southeast, towards Matagorda Bay.
- There are approximately 520 piezometers and 35 monitoring wells around the MCR and 25 monitoring wells within the protected area of Units 1 and 2.
- Seven monitoring wells are sampled quarterly to evaluate groundwater quality.

- The existing groundwater monitoring wells near Units 1 and 2 provide adequate screening level data, but are not protected in accordance with industry (EPA and Texas Commission on Environmental Quality [TCEQ]) standards.
- With the exception of tritium, no other radionuclides have been detected in groundwater.
- Low concentrations of tritium have been detected in the shallow aquifer, but at levels well below the EPA MCL of 20,000 pCi/L. These values are also well below the Offsite Dose Calculation Manual (ODCM) limit of 30,000 pCi/L.
- Slightly elevated concentrations of tritium have been identified in the shallow aquifer west of the MCR and in the shallow aquifer adjacent to the Unit 2 TDS pipeline (as a result of a documented leak).
- No radionuclides have been detected in the deeper aquifer or in samples collected from supply wells.
- Based on a review of available data, it appears unlikely that radionuclides in groundwater (i.e. tritium) migrate past the facility property boundary in excess of regulatory standards. Based on a review of available data, there are no significant or unacceptable risks to human health or the environment from site-related radionuclides in groundwater.

In addition to these conclusions, the CSM has also identified the following data gaps:

- The low concentrations of tritium have been detected at MW-258, west of the MCR. To better define the lateral extent of detectable tritium in the shallow aquifer, additional groundwater monitoring should be conducted to understand the horizontal boundary of detectable tritium.
- Several releases have been documented from the TDS pipelines and associated tanks. Groundwater downgradient from the Unit 2 TDS pipeline has been evaluated, however there are no groundwater monitoring wells downgradient of the Unit 1 TDS pipeline.
- Small quantities of steam condensate are vented to the ground surface via steam traps. There are no groundwater monitoring wells downgradient of the steam traps.
- Samples collected from the deeper aquifer have not detected radionuclides. However, these samples were collected from the supply wells that are not only screened across large areas, but are also are pumped at high rates. By design, if any radionuclides did migrate to the deeper aquifer, samples collected from the supply wells would be diluted. With the current understanding of the geology and the very low concentrations of radionuclides (tritium) in the shallow aquifer, it is not likely that radionuclides would migrate through the

aquitard to the deep aquifer for the following reasons: 1) all tritium would decay by the time the groundwater migrated through the aquitard; and 2) any dilution by advection or dispersion would further decrease the concentrations. Should conditions in the shallow aquifer changed significantly, additional investigations within the deep aquifer may be warranted.

Based on the conclusions and data gaps presented above, the following recommendations are proposed to further refine the CSM and to better assess groundwater quality east of Unit 1 and west of the MCR. Additional recommendations are also provided to further support groundwater characterization.

#### Groundwater Monitoring Network Recommendations:

- Install six additional groundwater monitoring wells to supplement characterization of tritium impacted groundwater. These explorations are summarized in Table 10-1 and are shown on Figures 10-1 and 10-2.
  - Monitoring wells MW-801 through MW-803 should be installed to better characterize groundwater quality in the upper parts of the shallow aquifer immediately downgradient of the TDS pipeline and tanks for Unit 1. These wells should be installed with screens intersecting the watertable. Monitoring well MW-803 can also be used to monitor groundwater quality down gradient from the condensate steam traps.
  - Monitoring well MW-804 will be installed within the deep aquifer, but only if radionuclide concentrations in the lower portion of the shallow aquifer exceed the ODCM criteria of 30,000 pCi/L.
  - Monitoring wells MW-805L/U will be advanced to monitor the upper and lower portions of shallow aquifer groundwater quality west of the MCR. The upper well will be installed to intersect the watertable; the lower well will be installed at approximately 35 to 45 feet bgs, at a similar elevation as the existing well MW-258.
- Wells to be installed in the shallow aquifer may be installed using either hollow stem auger or casing drilling techniques.
- The well to be installed within the deep aquifer (MW-804) will only be installed when data suggest that there may be a plume migrating downward within the shallow aquifer. Because there is always a slight risk of cross contamination between aquifers, this deep well should only be installed when the radionuclide concentration in the lower portion of the shallow aquifer

exceeds 30,000 pCi/L. This value is 1.5 times the EPA MCL, and is also equal to the NRC reporting criteria as documented in the ODCM.

- Monitor existing groundwater wells within the protected area annually and monitor new wells semiannually. If data indicate that a release has occurred then the frequency should be increased as warranted.

#### **Groundwater Sampling Recommendations:**

- Install dedicated tubing within wells that are sampled regularly to minimize the potential for cross-contamination.
- Install compression caps to wells completed with flush-mounted protective casing wells to minimize the potential for storm water runoff and other releases that may enter the well and impact the shallow aquifer.
- Groundwater sampling techniques are adequate for collecting tritium samples however, should any other radionuclides or chemicals be included in the analytical suite, then additional samples should be collected using Low-Flow/Low Stress Groundwater Sampling (EPA, 1996) techniques.
- Collect groundwater samples from newly installed wells at a semiannual frequency for the first year, then if data do not indicate a release, annual sampling will be appropriate.

Should initial results indicate that releases have occurred or that groundwater is impacted by tritium at concentrations exceeding background values, additional wells may be installed to better delineate the plume and to identify potential sources.

Because the current understanding of groundwater indicates that there are no immediate receptors downgradient, or a history of any groundwater samples exceeding the EPA MCLs, the schedule for installing these wells or modifying sampling techniques is not critical and can be prioritized as needed with ongoing groundwater investigations currently underway for Units 3 and 4.

## **1.0 INTRODUCTION**

STP Nuclear Operating Company has contracted MACTEC Engineering and Consulting Inc, (MACTEC) to develop a Conceptual Site Model (CSM) for the Units 1 and 2 at the South Texas Project Electric Generating Station (STPEGS) located in Wadsworth, Texas (Figure 1-1). The purpose of the CSM is to document the geology and hydrogeology of the Site, identify known and potential releases of radioactive liquids, and assess groundwater quality with respect to radionuclides in the environment. The CSM will be used to design a groundwater monitoring network so that historic and future (potential) releases of radionuclides can be characterized, documented, and remediated (if necessary) before impacted groundwater can migrate off-site. As tritium is found in all radioactive liquids at nuclear plants, and because it is the most mobile radionuclide in groundwater, tritium data is used as a 'tracer' compound to identify if releases occurred. Should elevated concentrations of tritium indicate a significant release, then other radionuclides will also be evaluated.

The development of this CSM has been completed as part of STPEGS' ongoing commitment to protect public health and the environment. STPEGS has entered into this Groundwater Protection Initiative as an active member of Electric Power Research Institute (EPRI) and is using this opportunity to voluntarily evaluate current and historic groundwater data and to determine if the current monitoring network is appropriate for ongoing groundwater characterization. This work has been completed by an independent contractor and was performed in compliance with the groundwater protection initiative established by National Energy Institute (NEI) (NEI 07-07), and the EPRI Groundwater Protection Guidelines for Nuclear Power Plants (EPRI, 2007).

### **1.1 BACKGROUND**

In 2006, as the nuclear industry started focusing on groundwater protection, STPEGS drafted an action plan to better understand situations involving inadvertent radiological releases that had the potential to reach groundwater. This action plan was also developed to support communications with the stakeholders such as the local communities, State Regulators, and the Nuclear Regulatory Commission (NRC).

In July, 2006, STPEGS' initiated several actions to support the NEI Groundwater Protection Initiative. These include the following:

- Developed a site specific plan of action to assure timely detection and effective response to situations involving inadvertent radiological releases to groundwater.
- Revised procedures to include the notification of Environmental Personnel of spills that involve radioactive material (including secondary water that may contain tritium).
- Revised procedures to include formal and informal reporting to appropriate state and local officials, with follow-up to the NRC for significant onsite leaks/spills to groundwater used as a source of drinking water as well as for any groundwater sample results that exceed the Criteria of 30,000 picoCuries per liter (pCi/L), established in the Offsite Dose Calculation Manual (ODCM).
- Established guidelines for calculating reportable quantities associated with leaks or spills.
- Revised the Reporting Manual to include: 1) informal notification to appropriate state and local officials; 2) submittal of a 30-day report for any water sample that exceeded ODCM criteria; and 3) reporting of spills and leaks that exceed the Reportable Quantity (if appropriate) for a substance that cannot be remediated to specified limits.
- Added an event code to the Corrective Action Program for 10CRF50.75g Decommissioning Items to capture spills and leaks that could impact groundwater.
- Completed an evaluation of underground pipes, tanks, and the Spent Fuel Pool.
- Discussed tritium data with local officials to build trust and to better understand local concerns.
- Worked with the Environmental Department at Comanche Peak to ensure consistency for informal reporting to the Texas Department of State Health Services.
- Verified that historic groundwater data collected from wells around the Main Cooling Reservoir (MCR) are consistent with expected results.
- Completed the Industry Groundwater Protection Initiative Voluntary Data Collection Questionnaires.

This CSM continues STPEGS' ongoing commitment to protect groundwater and the environment.



## **1.2 SCOPE OF WORK**

The NEI 07-07 guideline provides methods and approaches to characterizing, monitoring, and reporting the presence of radioactive isotopes in groundwater at nuclear power stations. To better characterize site conditions and develop the CSM, the following tasks were completed:

- Assessment of available maps, construction drawings, and aerial photographs;
- File review to identify historic releases of radioactive liquids to the environment;
- Interviews with plant personnel;
- Evaluation of systems that contain radioactive liquids;
- Site walk downs;
- Review of Condition Reports to assess historic releases and the results of corrective actions;
- Evaluation of drilling methods, well installation and groundwater sampling techniques;
- Inspection of existing wells;
- Evaluation of existing tritium data; and
- Evaluation of data management.

Data collected were then used to develop this CSM that describes the physical setting, plant features, and describes the nature and extent of radionuclides detected in groundwater. The CSM will help establish an appropriate groundwater monitoring network to continue to monitor groundwater quality and to further document current environmental conditions.

The findings from this effort are presented in the following sections. Section 2 presents the site description including STPEGS history as well as the current site conditions. Section 3 presents the physical setting, including the geology, hydrogeology, surface water, and meteorology. Section 4 presents a description of the systems that carry or store radioactive liquids. Section 5 presents an overview and description of the plant systems that produce, transport, store, or release radioactive liquids. Section 6 discusses the historic releases of tritium to the environment. Section 7 describes the groundwater monitoring network as well as existing analytical data. Section 8 presents a summary of the CSM. Section 9 summarizes the conclusions, and Section 10 presents recommendations.

## **2.0 SITE DESCRIPTION**

The STPEGS Site encompasses 12,220 acres in Matagorda County, Texas, and is located approximately 15 miles southwest of Bay City and approximately 90 miles southwest of Houston. The industrial portion of the property includes the active power plant (Units 1 and 2) and the associated MCR. The plant buildings encompass approximately 65 acres. The MCR is 7,000 acres and there is a second man made pond, or the Essential Cooling Pond (ECP) that is approximately 47 acres (Figure 1-1). The remaining areas are bottomland, forested pastureland, mixed grass and shrub communities with some areas leased as farm and grazing lands. The elevation of the plant ranges from 15 to 50 feet above Mean Sea Level (MSL) with most of the protected area of the plant constructed at an elevation of 29 feet MSL. The land surface slopes towards the Colorado River, located three miles to the east (STPNOC, 2008b).

STPEGS has two 1,350 megawatt Westinghouse pressurized water reactors (PWRs) identified as Unit 1 and Unit 2 that produce up to 3,800 megawatts of thermal energy. Two steam turbine generators then use this energy to provide up to 1,350 megawatts of electrical power each. The protected area (plant buildings) is shown on Figure 2-1. The main surface feature at the Site is the MCR which is formed by a 12.4 mile long earth-filled embankment, constructed above the natural ground surface. The MCR encompasses approximately 7,000 acres, with a normal maximum operating water level at 47 feet above MSL (STPNOC, 2008b).

The reservoir contains plant related cooling water with tritium at a concentration of approximately 13,000 pCi/L and is monitored by approximately 520 piezometers and groundwater monitoring locations. Per design and per NRC license, low concentrations of tritium are allowable in groundwater as a result of the MCR water infiltrating through the soils, eventually reaching the watertable. Groundwater results from monitoring points have never exceeded the Environmental Protection Agency (EPA) Maximum Contaminant Level (MCL) of 20,000 pCi/L, and are not expected to (STPNOC 2008a).

## **2.1 SITE HISTORY**

In 1971 the Houston Lighting & Power Co., the City of Austin, the City of San Antonio, and the Central Power and Light Co. (CPL) initiated a study on the feasibility of constructing a jointly-

owned nuclear electric power plant in southern Texas. Three years later, application for plant construction permits was submitted to the Atomic Energy Commission (AEC) for two reactors located on farmland just north of Matagorda, Texas; construction began in 1976 following NRC approval (STPNOC, 2008b).

Unit 1 received a low-power testing license on August 21, 1987, obtained initial criticality on March 8, 1988, and was declared commercially operational on August 25, 1988. Unit 2 received a low-power testing license on December 16, 1987, obtained initial criticality on March 12, 1989, and was declared commercially operational on June 19, 1989. Combined, the two units produce enough electricity to serve approximately two million homes (STPNOC 2008b).

STPEGS is currently owned by NRG Energy, Inc, the City of Austin, and CPS Energy as Tenants in Common. STP Nuclear Operating Company (STPNOC) has operational control of STPEGS as well as the responsibility for implementation of associated environmental programs, including complying with NEI 07-07 (STPNOC 2008b).

In 2007 STPNOC applied for a license to build and operate two new units (Units 3 and 4) at the Site. As part of the application process, soil borings have been completed and groundwater monitoring wells have been installed to characterize the geology and hydrogeology of the new sites. Data collected to support Units 3 and 4 have also been used to develop this CSM.

### **3.0 REGIONAL LAND USE/DEMOGRAPHICS**

STPEGS is the largest employer and source of revenue for Matagorda County. This section describes the land use around the plant, as well as the demographic setting of the surrounding communities.

#### **3.1 REGIONAL LAND USE**

The areas around STPEGS are predominantly farm and grazing lands for beef cattle. Farm lands in the immediate vicinity include sod and rice farms as well as catfish aquafarming. Figure 3-1 shows land use around the plant. Based on a well survey conducted in support of the UFSAR for Units 3 and 4, there are several wells on site to supply potable water and the nearest residence with a private drinking water well is located about 2.5 miles from the plant. Wells identified in this search are shown on Figures 3-2 through 3-4 (Bechtel, 2007).

#### **3.2 DEMOGRAPHICS**

In 2006 Matagorda County had a population of 37,122, ranking 78th in Texas. The County also held a per capita personal income (PCPI) of \$24,962. This PCPI ranked 175th in the state and was 71 percent of the state average, \$35,166, and 68 percent of the national average, \$36,714. The 2006 PCPI reflected an increase of 6.7 percent from 2005. The 2005-2006 state change was 5.8 percent and the national change was 5.6 percent. In 1996 the PCPI of Matagorda was \$17,619 and ranked 117th in the state. The 1996-2006 average annual growth rate of PCPI was 3.5 percent. The average annual growth rate for the state was 4.7 percent and for the nation was 4.3 percent (www.bea.gov, 2007).

The economic base for the area is primarily agricultural. The land surrounding STPEGS is used for the following products: beef, rice, grain, sorghum, soybeans, and cotton. There is also a commercial fishing industry along the lower Colorado River, East and West Matagorda Bay, The Intracoastal Waterway, and in the Gulf of Mexico. Aquaculture farms are also being developed to harvest catfish for consumer use (STPNOC, 2008a).

## **4.0 PHYSICAL SETTING**

This section presents the physical setting of the plant, including the regional and local topography, geology, hydrogeology, surface waters, and meteorology. Information is summarized from previous investigations as well as the current geophysical investigation that is underway in support of Units 3 and 4.

### **4.1 TOPOGRAPHY**

The regional topography is relatively flat with a gentle dip towards the southeast and other shallow areas around natural wetlands, streams, and Little Robbins Slough. Closer to STPEGS, the topography has been influenced by construction; the area around Units 1 and 2 has an elevation of approximately 29 feet above MSL with highest elevation being the berm around the MCR, at an elevation of approximately 65 feet MSL. The local topography is shown on Figure 1-1.

### **4.2 GEOLOGY**

The regional geology of Matagorda County includes the Gulf Coastal Plains physiographic province within the Coastal Prairies sub-province, which extends as a broad band parallel to the Texas Gulf Coast. Geology underlying the STPEGS includes deltaic sands and clays. Specifically, there is a thick wedge of southeasterly dipping sedimentary deposits ranging in age from Holocene through Oligocene. The regional geology of the area is shown in Figure 4-1 (Bechtel, 2007).

The geology of STPEGS has been classified as part of the Beaumont Formation which extends from the ground surface to approximately 14,000 feet below ground surface (bgs). The formation includes sands, silts, and clays deposited in an alluvial and deltaic deposition zone. The soils and groundwater directly below the STPEGS have been referred to as the "Coastal Lowland Aquifer System" and include deposits from: alluvial plains; delta, lagoon and beaches; and the continental shelf. Typically each of the stratigraphic units range from several inches to tens of feet thick and are uniformly encountered across the site, with the exception of impacts from construction (Bechtel, 2007).

During the construction of Units 1 and 2, large excavations were completed and backfilled with homogeneous fill materials. The filled area extends around both Units 1 and 2 reactor buildings and the Cooling Water Circulation lines, and extends up to 50 feet bgs. The area of excavation is shown on Figure 4-2. Cross sections depicting the geology are shown on Figure 4-3. Cross sections developed to support the Updated Final Safety Analysis Report (UFSAR) for Units 1 and 2 are shown in Appendix B (STPNOC, 2008b).

#### **4.3 HYDROGEOLOGY**

This hydrogeologic system near STPEGS contains numerous local aquifers in a thick sequence of unconsolidated clays, silts, sands, and gravels. These series extend to thicknesses greater than 1,000 feet and contain groundwater that ranges from fresh, young waters to saline brines (Figure 4-4). The aquifers are pumped locally for municipal, industrial, and irrigation needs. The specific aquifers near the STPEGS include:

- Chicot Aquifer;
- Evangeline Aquifer;
- Burkeville Confining Unit;
- Jasper Aquifer;
- Catahoula Confining Unit; and
- Vicksburg-Jackson Confining Unit.

As noted above, the Beaumont Formation has been identified below STPEGS. This formation is associated with the Chicot Aquifer and, to a lesser extent, the Colorado River Flood Plain. The aquifer within this formation supports most groundwater wells in the area. The aquifer consists of two zones; shallow and deep, separated by a stiff clay layer that is approximately 150 feet thick (Bechtel, 2007). This sequence is also depicted in Figure 4-4.

For the purposes of evaluating radionuclides in groundwater, the shallow geologic environment is the most important to understand in assessing the migration of potentially contaminated groundwater and would most likely contain the highest concentration of radionuclides. However, as the deeper aquifer is used for potable consumption, this zone was evaluated as part of this effort.

The shallow aquifer located below STPEGS is encountered at approximately 20 feet bgs and generally flows towards the southeast. Near the industrialized portion of the site, the localized mounding from the MCR (that has static water level at approximately 40 to 45 feet above MSL) slightly deflects groundwater flow directions, radially away from the MCR. Additional localized impacts are also likely due to the deep foundations of the building within the protected area. The locations of existing wells at STPEGS are shown on Figure 4-5.

Groundwater contours in the shallow aquifer below Units 1 and 2 are presented in Figures 4-6 and 4-7 (however the current monitoring well and piezometer network does not allow for a detailed interpretation to show the specific influences from subsurface structures). In the shallow or upper zone, the specific yield for the sandy deposits generally ranges from 10 to 30 percent, with the clay having a much lower storage coefficient, estimated in the confining layers (ranging from  $1 \times 10^{-4}$  to  $1 \times 10^{-3}$ ). The horizontal hydraulic gradient of the shallow water table is very low, as expected with the horizontally bedded soils and regionally flat topography. Groundwater velocity in the shallow aquifer is estimated at approximately 40 feet per year (STPNOC, 2008b).

Groundwater elevations indicate there is a downward vertical gradient between the upper portions of the shallow aquifer (encountered at approximately 20 feet bgs), and the lower water bearing zones within the same unit (encountered at approximately 80 feet bgs). This is most likely a localized occurrence due to the mounding caused by groundwater recharge from the MCR. Within the native soils, groundwater velocity in the vertical direction is likely to be much less than the horizontal velocity, however, areas of fill are expected to be more isotropic.

The deeper aquifer, located 250 to 300 feet bgs, flows on a regional scale toward the southeast. However, flow direction is locally influenced by the STPEGS' water supply wells. Groundwater from the deeper aquifer is currently used at STPEGS Units 1 and 2 in plant operations for fire suppression, sanitary, potable drinking water, and demineralized water production, and makeup water to the ECP. Groundwater is pumped from the deep aquifer using five production wells that range in depth from 600 to 700 feet bgs. These wells pump at capacities, or flow rates, of 200 to 500 gallons per minute (gpm) and create a cone of depression in the potentiometric surface that extends across the northern portion of the MCR. Groundwater contours for this zone are shown on Figure 4-8.

#### **4.4 SURFACE WATER**

There are several surface water and wetland features on the STP property. The most obvious water body is the MCR. The ECP, Kelly Lake, Little Robbins Slough, the toe drainage systems, the MCR Reservoir Makeup Pump Facility (RMPF) and spillway, wetland and estuaries, and the Colorado River also provide aquatic habits for wildlife. The delineated wetlands are shown on Figure 4-9. Each feature is discussed briefly below:

- **Main Cooling Reservoir.** As noted above, the MCR is a large unlined man made structure designed to circulate cooling water for Units 1 and 2. The static elevation of the reservoir is at approximately 47 feet MSL or 42 feet above the water table. By design, reservoir water infiltrates through the soils column to recharge groundwater below. There are approximately 520 piezometers and 35 groundwater monitoring wells installed around the MCR. Most of these are used to evaluate the integrity of the reservoir, however six wells are sampled quarterly for radionuclides as part of the plants Radiological Environmental Monitoring Program (REMP).
- **Essential Cooling Pond.** This is also a man-made structure designed to hold sufficient water that if needed would support Units 1 and 2 in providing additional cooling water. This reservoir is much smaller than the MCR, but is not lined and water is likely to infiltrate into the underlying soils eventually reaching the water table. Note that the tritium levels within the ECP are currently non-detectable because the makeup source is from groundwater from the deep aquifer.
- **Kelly Lake.** Kelly Lake is a small shallow lake located to the east of Units 1 and 2. It is approximately 4 to 6 feet deep and is most likely not recharged by groundwater that is encountered at approximately 15 to 20 feet bgs.
- **Little Robbins Slough.** Little Robbins Slough is a natural channel that formerly ran north-south across the present location of the MCR. During construction, the channel was relocated around the west side of the MCR. This slough receives water from the toe/drainage system as well as water from nearby and upstream drainage ditches.
- **Toe/Drainage Systems.** The toe system runs around the MCR and captures surface water runoff and seepage from the MCR, ultimately discharging into the Colorado River and Little Robbins Slough. This is a shallow system that may lose some water to groundwater below, but most likely is not in direct hydraulic communication with the underlying groundwater. Tritium



concentrations within the toe system are expected to range from non detectable levels up to 13,000 pCi/L (equal to the tritium concentrations of the MCR).

- Reservoir Makeup Pumping Facility (RMPF). The RMPF is used to divert water from the Colorado River to the Main Cooling Reservoir. The RMPF is located north and upstream of the permitted discharge point.
- MCR Spillway and Blowdown. The spillway is used for the emergency release of water from the MCR. The blowdown pipeline is the permitted discharge (TPDES) from the MCR to the Colorado River.
- Low Lying Wetlands. With the construction of Units 1 and 2 and the MCR, there are several large low lying unnamed wetlands that support ecological habitat. These areas are generally located to the east of the MCR and adjacent to the Colorado River.
- Colorado River. With the exception of the MCR, the Colorado River is the second most notable surface water in the area. It is the largest river within Texas with a total drainage area of 42,300 square miles, 11,400 square miles of which do not contribute to the river water supply. Groundwater within the shallow aquifer near STPEGS discharges to the Colorado River, East and South of the plant.

#### **4.5 METEROLOGY**

STPEGS is located within a sub-tropical maritime climate region that is also influenced by more continental climate patterns associated with areas to the north. The seasons are characterized by short, mild winters and long, hot and humid summers. Rainfall is common throughout the year with an annual average of approximately 42 inches per year. The prevailing wind direction is from the south-southeast, shifting to north, and northeast for short periods during the winter (STPNOC, 2008a).

## **5.0 SYSTEMS**

As part of the NEI Initiative, an evaluation of all systems that contain radioactive liquids was completed to determine if there are potential areas that warrant investigations and/or future groundwater monitoring. These systems include sumps, storage tanks, spent fuel pools, and piping. For assessing the potential impact of radioactivity on groundwater, the systems that are located outside of structures, or within the yard area, are evaluated in this CSM, as these systems have a greater potential to impact groundwater quality, should a release or leak occur. These systems are described below and are shown on Figures 5-1 and 5-2.

### **5.1 COLLECTION SUMPS**

At many plants, sumps are located outdoors where they may leak or overflow and impact the underlying groundwater. At others, they are specifically designed to capture shallow groundwater to prevent water from impacting operations. At STPEGS, collection sumps are present throughout the Mechanical Electrical Auxiliary Building (MEAB) to collect liquids for appropriate treatment prior to discharge. These coated sumps are located inside the building as are the associated pipes. Leaks from this type of system, should they occur, would be observed visually and corrected. STPNOC personnel also conduct sump run-time trends; should there be a significant change in flow, the systems would be investigated and any leaks repaired.

Additionally, because the buildings with deeper foundations were constructed at elevations below the water table, any releases of tritiated water from internal systems to the sumps would not impact the soils and groundwater outside the structures. At the deeper elevations, the groundwater gradient would push groundwater into the building. Therefore, releases to the sumps or to floors would not leak out, but would require active pumping to remove the accumulated water. Water could then be sampled and routed to the appropriate treatment system, if necessary.

Based on a walk down of sumps within the buildings, as well as facility knowledge, there is little potential for liquids within the sumps or associated piping to release tritium to the environment. Please note that there are several sumps used for liquid collection that are located outside the buildings; however, those associated with storage tanks and berms are discussed further below.

## **5.2 STORAGE TANKS**

There are several storage tanks at Units 1 and 2 that store radioactive water, as well as wastewater. These include: the Waste Monitor Tanks, Total Dissolved Solids (TDS) tanks, Liquid Waste Storage Tanks, Refueling Water Storage Tanks, Oily Waste Treatment System Tanks, and Service Water Tanks. Although each storage tank area is bermed, or inside a building, and inspected regularly should a leak occur, tritium could be released to the environment. For the purpose of this report, only tanks that store radioactive liquids are addressed below.

### **5.2.1 Yard Area Waste Monitor Tanks**

Yard Area Waste Monitor Tanks are associated with the Liquid Waste Lines and are constructed of stainless steel with welded seams and welded nozzle connections. The waste line system piping is mostly located within the MEAB with a few sections in the Fuel Handling Building (FHB), Reactor Containment Building (RCB) and Turbine Generator Building (TGB). The piping crosses the yard area, within a guard pipe, leading to the Waste Monitoring Tanks (WMT), D, E, and F. These tanks are located on the southern side of the MEAB (See Figure 2-1).

The concentration of gamma emitting radionuclides in the water in the outdoor WMT is maintained below 10,000 pCi/L. The tritium concentration could be as high as the Reactor Coolant System (1 to 5 billion pCi/L). Should leaks occur, the system is designed to capture the radioactive liquids within the WMT Sump and the associated Emptying Pump, which would then discharge the liquid back to the WMT.

By design, the potential for significant releases of radioactive water from these tanks is low. Regardless, plant operators log the WMT levels daily as part of their rounds and would observe a decline in liquid level if significant leakage were to occur. On a less frequent basis, they are also monitored by the waste system engineer as part of normal system monitoring and freeze protection walk-downs. The berms around the tanks are also inspected and cleaned every six months. The maintenance history of the outdoor WMTs has not recorded any leakage from the tanks, and has noted only a few leaks associated with the pump seals. With over 20 years of documentation, there have only been six work orders recorded for external leaks associated with these tanks.

### **5.2.2 TDS Tanks**

The TDS tanks are part of the Condensate Polishing System, and each unit includes the following tanks:

- 50,000 gallon Cation LTDS
- 60,000 gallon Mixed Bed LTDS
- 16,900 gallon Cation HTDS
- 16,900 gallon Mixed bed HTDS #1
- 16,900 gallon Mixed bed HTDS #2

These tanks are located to the east of each of the Turbine Generator Buildings (TGBs) within concrete berms. Tritium concentrations associated with these tanks are typically in the 2,000 to 80,000 pCi/L range and several reported leaks are associated with piping around the tanks. These locations are discussed further in Section 6.0.

### **5.2.3 Liquid Waste Storage Tanks**

The Liquid Waste Storage Tanks (LWSTs) also referred to as the Waste Holdup Tanks, typically contain concentrations of tritium in the 1 to 5 billion pCi/L. However, at STPEGS, both LWSTs are located within the MEAB. Should they leak, the releases would be captured by sumps within the MEAB and the water contained. Furthermore, should a release go undetected, the hydraulic gradient at the lower elevation levels within the buildings is into the structure, so releases would not be expected to seep out into the surrounding aquifer. At STPEGS, the LWSTs are not a likely source of radioactivity in groundwater.

### **5.2.4 Refueling Water Storage Tanks**

Similar to the LWSTs, the Refueling Water Storage Tanks (RWSTs) are located within the MEAB. Should they leak, the releases would be captured by sumps within the MEAB and the water contained. Furthermore, should a release go undetected, the hydraulic gradient at the lower elevation levels within the buildings is into the structure, so releases would not be expected to seep out into the surrounding aquifer.

### **5.3 SPENT FUEL POOL**

At many nuclear power plants, spent fuel pools are typically areas that are of particular interest with respect to potential releases of radionuclides to the environment and more specifically to groundwater. At STPEGS, the bottom of the spent fuel pools is located on the first floor (elevation 21 feet, 11 inches) in the FHB. The basement floor, or next level down, was constructed at elevation -29 feet MSL, so there is approximately 50 feet between the bottom of the pools and the next floor level.

The area under the spent fuel pool is periodically entered by plant personal. Should a leak occur, not only would it trip alarms, but it could also be visually observed and repaired. Additionally, the spent fuel pools have a leak chase channel on the back side of the pool line welds, within the concrete. These leak chase channels discharge to telltale drains that are also monitored regularly. Furthermore, any weld defect would first leak into the chase channel, then to the telltale drains and would not impact the concrete or be released to the environment.

As noted with the building sumps, the lower floors of the building are at elevations below the static water level, and therefore the hydraulic gradient of groundwater would be to enter the building so releases would not be expected to seep out into the surrounding aquifer. Releases of radioactive water would be contained within the building, and pumped/treated as radiologically impacted liquid waste. At STPEGS, the Spent Fuel Pools are not a likely source for introducing radionuclides to groundwater.

### **5.4 SYSTEM PIPING**

Most of the systems that carry radioactive liquids are within the buildings, where the liquids are piped directly into tanks (also located inside). Should leaks occur within these structures, not only would the leaks be visually observed, but they would be captured by floor drains and sumps (discussed above in Subsections 5.1 and 5.2). However, there are several systems that are located within the yard area where a release would not be captured by a floor drain and sump system. Leaks from these piping systems would be the most likely sources of releases of radioactivity to the environment, and if a leak occurred, groundwater quality could be impacted.

Potential systems within the immediate vicinity of Units 1 and 2 include the following:

- Liquid Waste Discharge Piping;
- Total Dissolved Solids Tank Discharge Piping;
- Auxiliary Cooling Open Loop Piping and Circulating Water Piping;
- Reservoir Blowdown Piping; and
- Oily Waste Treatment System Piping.

In addition to these systems, the Auxiliary Steam and Condensate Storage and Transfer Piping discharge tritiated water directly to the ground surface. Although the discharge is part of the system design, it still has the potential to introduce tritium to the underlying groundwater prior to surface discharge.

These systems are the primary locations where tritium could be introduced to the environment. As part of a voluntary self assessment, STPEGS also participated in the EPRI Groundwater Protection Initiative: Materials Degradation Master Matrix (MDMM) and under this initiative documented all piping details with respect to how likely systems could degrade and leak tritiated water into the environment. The results of this effort are provided in Appendix C.

A brief description of each of the piping systems that have been identified as potential tritium sources is provided below. The location of each of these systems is shown on Figures 5-1 and 5-2 and additional details are provided in Appendix D.

#### **5.4.1 Liquid Waste Discharge Piping**

The liquid waste system is designed to process radioactive liquids for eventual discharge into the MCR under the NRC License. The system collects radioactive water from various sources within the plant including the equipment drains, floor drains, laundry and regenerated wastes. The liquids are processed through a collection of demineralizers, filters, ALPS and holding tanks (to allow for decay of the various nuclides present in the water) to reduce the concentration of radioactive nuclides in the water below the limits for release into the environment.

The majority of the liquid waste system piping is located within the MEAB with smaller sections in the FHB, RCB, TGB, and yard area. The portions of the liquid waste system that are in the yard area are associated with WMT D, E and F on the south side of the MEAB. There is one section of

buried pipe that runs from the yard area down to a penetration in the MEAB. Otherwise, all of the yard area liquid waste piping is above-ground.

Most of the liquid waste piping is made of Schedule 40S stainless steel. However, one section of buried piping in the waste line has a 6-inch guard pipe made of class 7 seamless carbon steel. There are also limited portions of the system made to the other specifications, however, with a few exceptions most of this piping is no longer used (i.e. waste evaporator package, auxiliary steam supply, etc.).

Given the low operating pressures/flow-rates in the liquid waste system, and the materials used for the process piping and the process fluid (such as very dilute boric acid and tritiated water), a leak from this system is unlikely. However, the locations with the highest potential for leakage are mechanical joints such as flanges and valve packing. Because most of the liquid waste process piping is located indoors, the only area where leaks would present a realistic groundwater contamination issue is on the piping around the WMTs in the yard area and the WMTs themselves. Given the materials of construction used for these components and the methods of construction (almost every joint is welded and the one section of buried pipe has a guard pipe surrounding it), leakage or releases to the environment is unlikely.

The liquid waste piping that is in the yard area and the WMT is monitored daily during operator rounds. They are also monitored by the liquid waste System Engineer as part of normal system monitoring and freeze protection walk-downs. If a release did occur in the yard area, it would quickly be detected. Additionally, as noted above, plant operators log the WMT levels daily as part of their rounds and would observe a decline in level if significant leakage were to occur downstream of the WMTs.

#### **5.4.2 Total Dissolved Solids Discharge Piping**

The TDS pipelines run from the east side of the TGB of each Unit, traveling underground South and then East, entering the North side of the NC Basin. The lines are constructed of filament wound, glass fiber reinforced, thermosetting epoxy resin pipe with threaded, mechanical adhesive or combination type joints.

The TDS tanks and lines carry waste water from resin regeneration that contain up to 80,000 pCi/L of tritium. Prior to 2002 steam generator replacement, this concentration could have been higher due to primary to secondary leakage. Leaks have been documented in this piping and historically identified when water is observed at the ground surface. Since 1994, Unit 1 piping has had 18 underground leaks and one above ground leak. Unit 2 piping has had seven underground leaks. Underground leaks were repaired by excavating the piping and making repairs in accordance with plant procedures. Documentation for the releases and repairs are provided in Appendix E. This condition has since been addressed by modifying the timing sequence on the inlet valves to the neutralization basins. Currently, the TDS pipelines are monitored as a routine part of operational rounds and if leaks are identified, they are immediately repaired.

#### **5.4.3 Auxiliary Cooling Open Loop Piping and Circulating Water Piping**

Because they run in parallel from the MCR across STPEGS, the Open Loop Auxiliary Cooling Water Piping and Circulating Water Piping follow similar routes and are discussed as one system. These piping systems are shown together on Figure 5-1.

The Open Loop System provides cooling water from the MCR to several systems at the plant, including:

- Auxiliary Cooling Water and Circulating Water/Closed Loop Heat Exchangers;
- Non-Essential Heating Ventilation and Air Conditioning (HVAC) Chillers;
- Steam Generator Feedwater Pump/Turbine Lube Oil Coolers;
- Main Turbine Lube Oil Coolers; and
- Generator Hydrogen Coolers.

There are two pumps per unit that each operate at approximately 11,900 gpm. The Open Loop piping runs underground through 10- to 30-inch diameter pre-stressed concrete cylinder and pre-tensioned concrete cylinder (bar wrapped) pipe. In addition to piping water from the MCR, this system also receives liquid radiological waste from the Non-Essential HVAC Chillers OC Return Line. All Open Loop water is returned to the MCR through the Circulating Water piping.



The normal failure of this type of pipe is a complete rupture (or fish mouth) and such a failure would be visually observed by plant personnel and immediately repaired. Additionally, if a failure occurs, the Control Room will also get an alarm indicating a loss of discharge pressure.

The Circulating Water System provides cooling water to the Main Condensers for removal of heat to the MCR. Three to four pumps are in service (per Unit) with each rated at approximately 225,000 gpm. The piping is made up of 84-inch (located in the Turbine Building), 96-inch and 138-inch (located above and below ground level) pre-stressed concrete cylinder pipe.

Similar to the Open Loop piping, the normal failure of this type of pipe is a complete rupture (fish mouth) and such a failure would be visually observed by plant personnel. However, if the failure occurs on the supply side to the condensers, the Control Room will also get an indication of a plant anomaly due to a change in condenser vacuum or a change in pump discharge pressure.

A Life Cycle Management Study was conducted for the system's buried pipe in 2002/2003. This system has nine failure mechanisms that are categorized into seven categories: corrosion; soil composition (sulfate, chloride and acidic); atmospheric exposure; stray current corrosion; galvanic corrosion cell; differential aeration cell; and hydrogen induced cracking (cathodic overprotection). Each category has been assessed and with the exception of the hydrogen induced cracking, all have been addressed and resolved. The hydrogen induced cracking assessment is ongoing. Additional details for each failure mechanism are provided in Appendix D.

In addition to assessing the potential failure mechanisms, this system is monitored regularly. Should there be a leak, it would result in catastrophic failure, not only releasing tritium to the environment, but disrupting plant operations, resulting in a shutdown of power generation. As noted above, a failure of this type would not only be visually observed, but sensors within the control room would also alarm, indicating a rupture. In addition to the assessment noted above, the pipe material that is exposed to the atmosphere is sampled every 12 years. Every 2.4 years, or every third cycle, the pipes are also drained to perform material condition inspection to assure that the repairs and deficiencies are corrected and documented. Every outage (or 1.5 years) a visual inspection is also completed of the 96-inch above ground pipe and the buried 138-inch pipe.

#### **5.4.4 Reservoir Blowdown Piping**

The Reservoir Blowdown system runs underground adjacent to the spillway and is the permitted discharge from the MCR to the Colorado River. Although there is potential for this line to leak, a release would follow the discharge path via the spillway and discharge to the River. Furthermore, because the approximate concentration of tritium within the reservoir is 13,000 pCi/L, any leak would: 1) not exceed the MCLs of 20,000 pCi/L; and 2) would only migrate further downstream/gradient, discharging to the Colorado River (below allowable limits). This line has been tested in 1997, however this line is not commonly used. There are several monitoring points already along this line and to date, none have had elevated concentrations of tritium.

#### **5.4.5 Oily Waste Treatment System Piping**

The Oily Waste Treatment System Piping receives oily waste water, in part, from the TGB sumps in both Units 1 and 2. The lines run underground in between Units 1 and 2, from the Oily Waste Surge Tank to the Treatment System. The piping continues underground and discharges to the MCR. The Oily Waste Treatment System discharge piping is made of ductile iron pipe and cement line.

This piping is monitored as a routine part of operational rounds. Plant procedures direct operations personnel to check for process piping leakage in the course of their normal operator rounds. There have been no reported underground pipe leaks and five above ground leaks from pipe or hose breaks, which were repaired as soon as the leaks were identified. A slow underground leak from this system may not be detected immediately; however the typical tritium levels within this system range from 1000 to 50,000 pCi/L.

#### **5.4.6 Auxiliary Steam System**

The Auxiliary Steam System pipes were not initially identified as potential systems that could release tritium to the environment. However, by design, these lines discharge tritiated water to the ground surface. As this is condensate, the actual tritium concentrations may be detected up to approximately 80,000 pCi/L.

The Auxiliary Steam Header is used to transfer steam between Units 1 and 2. Steam travels between the two units and Auxiliary Boiler both above ground and via below ground tunnels. The steam then travels from the Auxiliary Boiler to the TGB and then to the Liquid Waste stations in above ground from the south side of the TGBs to the Fuel Handling Building. The lines are constructed of seamless carbon steel and are monitored as a routine part of operational rounds.

There have been no reported leaks, however as noted above, condensate is released to the ground surface. In addition, due north of the Auxiliary Feed Water Storage Tank and along the south of the TGB on both units, two drain lines continuously leak a mixture of steam and water to the ground surface.

#### **5.4.7 Condensate Storage and Transfer Piping**

The Condensate Storage and Transfers system runs underground between the secondary Makeup Tank and the TGB for each Unit. This system stores and transfers makeup water to the condensers in each unit. These lines are also composed of carbon steel and have had no reported leaks.

## **6.0 POTENTIAL AND KNOWN RELEASES**

Known and potential releases are assessed under the NEI initiative to identify the current areas where elevated radionuclides could be present in groundwater; to better understand where the likely source areas are; and to better design the groundwater monitoring network.

By design, the MCR releases tritium to groundwater. The MCR is a man-made 7,000 acre reservoir. With the water elevation of 47 feet MCL, or approximately 42 feet above the static groundwater elevation, the MCR water percolates through the overburden soils causing a local mounding of groundwater, influencing groundwater flow directions in the shallow aquifer. Tritium concentrations within the MCR are approximately 13,000 pCi/L, well below the EPA MCL of 20,000 pCi/L.

The infiltration of MCR water to groundwater also introduces low levels of tritium to the shallow aquifer. This impact is part of the plant's design and therefore low concentrations of tritium in groundwater are expected. For the purpose of the NEI Initiative, it is important to monitor the extent of impacted water so that the plume boundaries are defined. As long as concentrations are below the acceptable level, no further action will be warranted.

Similarly, the venting of steam and condensate through steam traps to the air and ground surface does introduce tritium to the environment, however at concentrations that should not significantly impact groundwater quality. Releases from the secondary systems are quantified and reported in accordance with the Offsite Dose Calculation Manual.

The intent of the Groundwater Protection Initiative is to understand historic practices and current systems to understand where radioactive liquids could be released to the environment and to ensure that these areas are being monitored, should groundwater become impacted. Because of the potential for impacts to the environment, releases should be documented in a Condition Report coded for decommissioning (as required under Code of Federal Regulations 10CFR50.75[g]). Because the operating levels and allowable discharge of tritium are typically above the EPA MCL, many lesser historic releases may not have been documented. To better assess historic releases, a thorough review of all available files was conducted, followed by interviews with STPEGS.

employees and plant walk downs. The documented releases are summarized on Table 6-1 and the locations of these releases are shown on Figure 6-1.

Historic releases occurred across the plant, and upon review, most of the significant releases have been in association with the TDS pipelines. These lines are constructed of fiberglass and have a history of leaking, although all leaks were immediately identified and repaired (Appendix E). These leaks, along with other historically documented releases do not pose a dose-based risk to workers, but they have introduced tritium at concentrations above background levels to the underlying aquifer. This condition has since been addressed by modifying the timing sequence on the inlet valves to the neutralization basins. Releases have also been documented from other systems and storage tanks, however, most of them were of insufficient volume to impact groundwater, or were captured by the storm water collection system and eventually discharge to the plant area drainage ditch (PADD) (see Figure 5-2).

## **7.0 CURRENT MONITORING NETWORK**

Groundwater has been monitored regularly at STPEGS since plant construction. Twenty-five groundwater monitoring wells were installed to support construction within the protected area and approximately 520 piezometers and 35 wells were also installed around the MCR to continuously monitor the integrity of the berm. Although these wells were not installed to specifically assess tritium in groundwater, they may be used as data points to understand current conditions and to evaluate groundwater quality. Groundwater samples have been collected from various locations site wide as needed, however seven required monitoring well locations are monitored quarterly to specifically monitoring tritium concentrations in groundwater. Two of these quarterly monitoring locations are located within the protected area. Groundwater samples are also collected from the water supply wells that draw potable water from the deeper aquifer. The locations of the wells and piezometer stations are shown on Figure 4-5.

### **7.1 GROUNDWATER MONITORING WELLS AND PIEZOMETERS**

In addition to reviewing groundwater data, the EPRI Guidelines for complying with the NEI Initiative also recommend reviewing well installation and groundwater sampling methodologies. The following actions were completed to better assess the appropriateness of existing sampling points:

- Conducted a review of the well/piezometer installation procedures;
- Completed a visual assessment of all wells within the yard area and selected wells around the MCR; and
- Observed groundwater sampling techniques.

The following subsections describe the findings from each assessment.

#### **7.1.1 Well and Piezometer Installation**

Groundwater monitoring wells and piezometers have been installed following industry standards, with an appropriate sandpack around the screened interval, bentonite seal above the screen, and the remaining annulus backfilled with cement grout. The procedures for well installation are provided

in Appendix A. It should be noted that for most, if not all wells, wells screens were installed based on a predetermined depth interval and may not be monitoring the most appropriate interval. However, these data may be used to assess overall conditions of the underlying aquifer and used as a screening tool to better understand the distribution of radionuclides within the water bearing zones.

In addition to the existing wells network, concurrent to this evaluation, additional groundwater monitoring wells are also being installed in support of the licensing and planned construction of Units 3 and 4. These locations are also shown as proposed locations on Figure 10-2. However, unlike the historic wells, these wells are being installed with the intent of intersecting specific water bearing zones to provide data for the overall groundwater model. As data is available they will also be incorporated into this CSM.

#### **7.1.2 Condition Assessment**

Most historic wells within the yard area have been completed as flush mounted road boxes. Some have also been completed with the protective casing extending above ground surface. Based on a walk-down of these wells, several of them were damaged and many did not have compression caps or seals. Should a significant rain fall occur, storm water could enter the well, possibly impacting the geochemistry within the well. A summary of the well conditions is provided in Table 7-1.

Existing wells and piezometers installed around the MCR were generally completed with above ground (or stick-up) protective casings. With these, there is less of a potential for storm water to enter the wells. These wells are also sampled and inspected at a higher frequency and appear to be in better condition.

The new wells currently being installed for Units 3 and 4 have been completed as stickups with locks and have been installed using techniques accepted by EPA, NRC, and Texas Commission of Environmental Quality (TCEQ).

#### **7.1.3 Sampling Techniques**

Groundwater samples are collected on a quarterly basis from nine monitoring wells at STPEGS as well as from the drinking water supply wells. Other wells have been sampled as warranted to

provide additional data points used to assess groundwater quality. Groundwater samples are collected by evacuating three to five well volumes to ensure that the samples represent formation water, and not the stagnant water within the well. Typically the same tubing is used for all wells, unless it is worn or visually dirty, in which case it is replaced.

Because the water table is located at approximately 15 to 20 feet bgs, a peristaltic pump (or Isco™ pump) is used to pull the water to the surface at a maximum rate of approximately 0.5 gallons per minute. During the observation, only one sampling event at well MW-256 was observed, however, based on interviews with the technician, the rate of pumping for this well is typical of others at STPEGS.

After sufficient purge time/volume, the appropriate volume was dispensed in the sampling container, and marked with the sampling time and date. Samples were then brought to the on-site laboratory for on-site analysis.

## **7.2 ANATLYICAL DATA**

Radiological data has been collected from groundwater wells and piezometers since the construction of Units 1 and 2 and of the MCR. Data are managed by the Chemistry and Health Physics Department and furnished to all stakeholders in the Annual Environmental Operating Report. Available tritium data are provided in Tables 7-2 and 7-3 and are summarized on Figure 7-1. Groundwater samples are also routinely collected for other plant-related radionuclides. These data are presented in Table 7-4. Data are also published annually under the Annual Environmental Operating Report that is available to local and federal stakeholders as well as the public.

### **7.2.1 Results**

No tritium concentrations in groundwater collected from wells and piezometers at STPEGS exceed the EPA MCL of 20,000 pCi/L. No other radionuclides have been detected in groundwater.

Tritium results show that in general there are low concentrations (i.e. less than 5,000 pCi/L) of tritium in shallow groundwater as a result of: 1) the water in the MCR infiltrating the shallow soils and reaching the water table; 2) from releases from the TDS pipeline and potentially from condensate that is released to the ground surface.



Most wells around the MCR show low concentrations of tritium. The most recent tritium data for wells MW-258 and MW-259 near the western boundary indicated just detectable concentrations, 260 pCi/L and 400 pCi/L respectively. Both wells are within feet of the property boundary and are separated from each other by about 20 feet. Tritium detected in these wells indicates that the plume may extend slightly beyond the site boundary. These wells were installed with a screened interval at approximately 45 to 50 feet bgs. There is no data from groundwater encountered at the water table or from deeper depths. However, as the MCR is the source of tritium, concentrations will not increase above the MCR concentration, and with radiological decay and dispersion/advection, groundwater concentrations will likely be much lower.

Two other monitoring locations around the MCR also reported elevated concentrations of tritium. Increasing trends were noted at MW-235 during 2007 with reported concentrations of tritium at concentrations up to 740 pCi/L (with more recent data from 2008 reporting tritium concentrations at 1,000 pCi/L). However, trend analyses show that MW-251 tritium concentrations have been relatively stable over time, with the highest concentration reported at approximately 5,000 pCi/L for samples collected in 2006. Even though these locations contain elevated tritium, there are additional wells in the area that delineate the plume and no additional investigations are warranted.

Increasing trends were noted at MW-235 during 2007 with reported concentrations of tritium at levels up to 7,400 pCi/L (more recent data from 2008 show tritium concentrations at 1,000 pCi/L). MW-251 concentrations have been more stable, but are also reported at approximately 5,000 pCi/L for samples collected since 2006. Even though these locations contain elevated tritium, there are additional wells in the area that delineate the plume and no additional investigations are warranted.

Within the protected area, there are some slightly elevated tritium data that are associated with two specific releases from the Unit 2 TDS pipelines. The Condition Reports associated with these leaks are provided in Appendix E. Groundwater data collected from monitoring wells 221C and 221E show tritium concentrations ranging from 15,300 pCi/L to 5,140 pCi/L in the upper portion of the shallow aquifer and from 571 pCi/L to 1870 pCi/L in the lower portion of the shallow aquifer. Based on the trends over time, the higher detections were first reported from samples collected from the well screened closer to the water table in the upper portion of the shallow aquifer. With time, these tritium concentrations declined and the concentrations from the well screened in a deeper zone increased. As noted in Section 4.0, there is downward vertical gradient in areas

around the MCR and more specifically across the protected area (Units 1 and 2). It could also be hypothesized that the groundwater sampling techniques of purging three to five well volumes may have pulled the shallow, impacted water, already with a downward gradient, further downward. However, as the concentrations are now declining it does support the theory that the elevated tritium was due to a specific release and with the source terminated, the groundwater concentrations are decreasing both via radioactive decay and more likely via dispersion within the shallow aquifer.

The other potential source of radionuclides to groundwater would be the areas where small volumes of condensate are vented to through steam traps to the ground surface. With the current monitoring well network, there is no indication that the small volume released to the ground surface has impacted groundwater quality.

Groundwater data from the deeper aquifer show that there is no detectable tritium within the deeper aquifer.

#### **7.2.2 Database Management**

The analytical data are stored as both hard copy and electronically. The master database is only accessible to select personnel and selected entries are manually entered into Excel Spreadsheets for reporting. Spreadsheets are used to manipulate and display the data.

It was noted that data are linked to each well via the sample identification, but that the exact coordinates for all wells were not available in an electronic format. As part of this effort, wells have been imported into a Geographic Information System (GIS) to support data evaluation.

## **8.0 CONCEPTUAL SITE MODEL SUMMARY**

This section provides a summary of the CSM for STPEGS. The geology below Units 1 and 2 consists of stratified interbedded sands and silts. The shallow groundwater is encountered at approximately 20 feet bgs and generally flows towards the southeast, towards the Colorado River. Within the shallow aquifer, there is a downward gradient between the upper and lower zone that could carry radionuclides released near the surface to deeper zones. Below the shallow aquifer, there is an aquitard of approximately 150 feet thick. This is underlain by a deeper aquifer that provides potable water to the plant.

Groundwater flow velocity for the shallow aquifer is dependant on the gradient. The sandier layers generally have a high horizontal hydraulic conductivity; however the gradient is very low, resulting in a very slow velocity. Within the deeper aquifer, groundwater is actively pumped to supply water for STPEGS. This pumping increases the horizontal gradient within the deep aquifer and therefore increases flow velocity and flow direction. However, because there is approximately 150 feet of a clay and silt aquitard between the two water bearing zones, there is no measurable hydraulic communication between the shallow and deep aquifers. Therefore, pumping of the deep aquifer does not appear to influence groundwater flow in the shallow aquifer below Units 1 and 2.

Tritium is the only radionuclide detected in groundwater at STPEGS. There are two general sources for tritium to enter or be released to groundwater from the plant: 1) the MCR water infiltrating into the soils and underlying aquifer, and 2) releases from systems located within the protected area.

By design, the MCR contributes low concentrations of tritiated water to the aquifer below. The MCR has had measurable levels of tritium for about 20 years, and first began to appear in relief wells about two years later. Extensive monitoring around the MCR completed in 2006 indicated that tritium migrated to a well about 700 feet west of the MCR as measured from the dike road. Wells about 750 feet north of the reservoir did not contain detectable tritium (<300 pCi/liter). Wells within about 150 feet of the reservoir typically contained detectable tritium. This suggests that tritium may migrate about 700 feet per 18 years or about 40 ft/year. This is consistent with the UFSAR, Section 2.4.13.3.1.2, where the migration rate is conservatively assumed to be about 77 ft/year (STPNOC, 2008b). Since the tritium concentrations in the MCR water are generally around

13,000 pCi/L, water from the MCR that recharges the aquifer cannot cause tritium levels in the aquifer to be higher than levels in the MCR, or to exceed the EPA MCL.

Elevated levels of tritium (with respect to background) have been detected around the MCR, with only one location reported at slightly higher concentrations. Geologic boring logs from this location are not available, but this localized occurrence is most likely due to heterogeneities within the area where the well intersects a more transmissive zone.

The second way radionuclides can be introduced to groundwater is from releases or leaks. Based on an evaluation of the systems, as well as a review of historic releases, the most likely source of tritium in groundwater is from releases from the TDS pipelines and from the steam and condensate that is discharged to the ground surface. For both of these lines, the initial source concentrations of tritium can range up to approximately 80,000 pCi/L and are most likely responsible for localized elevated concentrations in groundwater near MW-221C and E.

Groundwater data from the monitoring network further supports this CSM. No tritium concentrations in groundwater exceed the EPA MCL of 20,000 pCi/L, and tritium concentrations above background level have only been detected at well 221C and 221E, near a historic release from the Unit 2 TDS pipelines. At these wells, elevated levels were first detected in the upper zone of the shallow aquifer (at MW-221C) and later from the lower zone of the shallow aquifer (MW-221E).

Based on the site conditions, historic releases, and current data sets, there are a few areas where releases could have occurred and could be impacting groundwater that is not currently monitored. These data gaps include:

- Areas east of the Unit 1 TDS pipeline (including areas downgradient from historic releases);
- Areas downgradient from the condensate release areas; and
- The deeper aquifer, below Units 1 and 2.

By plant design, tritium has also been detected above background at wells located on the west side of MCR. Although these data are expected, this does present a data gap when defining the lateral extent of tritium detected in groundwater.

In addition to specific groundwater monitoring locations used to assess the integrity of the MCR, the current well network with the protected area for Units 1 and 2 is adequate for screening level data, but additional care should be taken to prevent further degradation of the wells and to protect the groundwater from potential storm water runoff. Specific recommendations for operating the existing wells and sampling techniques are presented in Section 10.

## **9.0 CONCLUSIONS**

This report has been completed to support NEI Initiative (NEI 07-07) and the implementation of the EPRI Guidelines for Groundwater Protection. As such, the CSM was developed to document historic releases of tritium within the context of the local geology and hydrogeology to enable an assessment of potential impact of site operations, with respect to tritium, on groundwater quality. Although the CSM is an iterative process, the following conclusions are based on the data presented in this report:

- Geology below the site is generally uniform, consisting of stratified, interbedded silts and sands.
- Shallow groundwater contours indicated that groundwater generally flows slowly to the southeast, towards the Colorado River, with localized impacts from subsurface structures and groundwater mounding from the MCR.
- Deep groundwater flow is impacted by on-site pumping wells, however regionally groundwater will flow toward the south, southeast, towards Matagorda Bay.
- There are approximately 520 piezometers and 35 monitoring wells around the MCR and 25 monitoring wells within the protected area of Units 1 and 2.
- Seven monitoring wells are sampled quarterly to evaluate groundwater quality.
- The existing groundwater monitoring wells near Units 1 and 2 provide adequate screening level data, but are not protected in accordance with industry (EPA and TCEQ) standards.
- With the exception of tritium, no other radionuclides have been detected in groundwater.
- Low concentrations of tritium have been detected in the shallow aquifer, but at levels well below the EPA MCL of 20,000 pCi/L. These values are also well below ODCM limit of 30,000 pCi/L.
- Slightly elevated concentrations of tritium have been identified in the shallow aquifer west of the MCR and in the shallow aquifer adjacent to the Unit 2 TDS pipeline (as a result of a documented leak).
- No radionuclides have been detected in the deeper aquifer or in samples collected from supply wells.
- Based on a review of available data, it appears unlikely that radionuclides in groundwater (i.e. tritium) migrate past the facility property boundary in excess of regulatory standards.

Based on a review of available data, there are no significant or unacceptable risks to human health or the environment from site-related radionuclides in groundwater.

In addition to these conclusions, the CSM has also identified the following data gaps:

- Low concentrations of tritium have been detected at MW-258, west of the MCR. To better define the lateral extent of detectable tritium in the shallow aquifer, additional groundwater monitoring should be conducted to understand the horizontal boundary of detectable tritium.
- Several releases have been documented from the TDS pipelines and associated tanks. Groundwater downgradient from the Unit 2 TDS pipeline has been evaluated, however there are no groundwater monitoring wells downgradient of the Unit 1 TDS pipeline.
- Small quantities of steam and condensate are vented to the ground surface via steam traps. There are no groundwater monitoring wells downgradient of the steam traps.
- Samples collected from the deeper aquifer have not detected radionuclides. However, these samples were collected from the supply wells that are not only screened across large areas, but are also are pumped at high rates. By design, if any radionuclides did migrate to the deeper aquifer, samples collected from the supply wells would be diluted. With the current understand of the geology and the very low concentrations of radionuclides (tritium) in the shallow aquifer, it is not likely that radionuclides would migrate through the aquitard to the deep aquifer for the following reasons: 1) all tritium would decay by the time the groundwater migrated through the aquitard; and 2) any dilution by advection or dispersion would further decrease the concentrations. Should condition in the shallow aquifer changed significantly, additional investigations within the deep aquifer may be warranted.

## **10.0 RECOMMENDATIONS**

Based on the conclusions and data gaps presented in Section 9.0, the following recommendations are provided to refine the CSM and to better assess groundwater quality east of Unit 1 and west of the MCR. Additional recommendations are also provided to support groundwater sampling techniques.

### **Groundwater Monitoring Network Recommendations:**

- Install six additional groundwater monitoring wells to supplement characterization of tritium impacted groundwater. These explorations are summarized in Table 10-1 and are shown on Figures 10-1 and 10-2.
  - Monitoring wells MW-801 through MW-803 should be installed to better characterize groundwater quality in the upper parts of the shallow aquifer immediately downgradient of the TDS pipeline and tanks for Unit 1. These wells should be installed with screens intersecting the water table. Monitoring well MW-803 can also be used to monitor groundwater quality down gradient from the condensate steam traps.
  - Monitoring well MW-804 will be installed within the deep aquifer, but only if radionuclide concentrations in the lower portion of the shallow aquifer exceed the ODCM criteria of 30,000 pCi/L.
  - Monitoring wells MW-805L/U will be advanced to monitor the upper and lower portions of shallow aquifer groundwater quality west of the MCR. The upper well will be installed to intersect the water table; the lower well will be installed at approximately 35 to 45 feet bgs, at a similar elevation as the existing well MW-258.
- Wells to be installed in the shallow aquifer may be installed using either hollow stem auger or casing drilling techniques.
- The well to be installed within the deep aquifer (MW-804) will only be installed when data suggest that there may be a plume migrating downward within the shallow aquifer. Because there is always a slight risk of cross contamination between aquifers, this deep well should only be installed when radioactivity measured in the lower portion of the shallow aquifer exceeds 30,000 pCi/L. This value is 1.5 times the EPA MCL, and is also equal to the NRC reporting criteria as documented in the ODCM.



- Monitor existing groundwater wells within the protected area annually and monitor new wells semiannually. If data indicate that a release has occurred then the frequency should be increased as warranted.

**Groundwater Sampling Recommendations:**

- Install dedicated tubing within wells that are sampled regularly to minimize the potential for cross-contamination.
- Install compression caps to wells completed with flush-mounted protective casing wells to minimize the potential for storm water runoff and other releases that may enter the well and impact the shallow aquifer.
- Groundwater sampling techniques are adequate for collecting tritium samples however, should any other radionuclides or chemicals be included in the analytical suite, then additional samples should be collected using Low-Flow/Low Stress Groundwater Sampling (EPA, 1996) techniques.
- Collect groundwater samples from newly installed wells at a semiannual frequency for the first year, then if data do not indicate a release, annual sampling will be appropriate.

Should initial results indicate that releases have occurred or that groundwater is impacted by tritium at concentrations exceeding background values, additional wells may be installed to better delineate the plume and to identify potential sources.

Because the current understanding of groundwater indicates that there are no immediate receptors downgradient, or a history of any groundwater samples exceeding the EPA MCLs, the schedule for installing these wells or modifying sampling techniques is not critical and can be prioritized as needed with ongoing groundwater investigations currently underway for Units 3 and 4.

## **11.0 STATUS UPDATE MAY 2009**

In response to the recommendations presented in Section 10.0 STP completed the suggested field effort and installed five groundwater monitoring wells (MW 801 through MW-803, and the well pair MW-805U and L, in Summer 2008). The documentation of the well installation is presented in Appendix F. Following the well installation and development, groundwater samples were collected and analyzed for tritium. These data are reported under separate cover, in the Annual Environmental Operating Report. As the data results further confirmed the CSM, no additional investigations are warranted at this time.

The five wells installed under the Groundwater Protection Initiative have been added to STP groundwater monitoring program.

## 12.0 ACRONYMS

AEC	Atomic Energy Commission
ALPS	Advanced Liquid Processing System
bgs	below ground surface
CPL	Central Power and Light Company
CSM	Conceptual Site Model
ECP	Essential Cooling Pond
EPA	Environmental Protection Agency
EPRI	Electric Power Research Institute
FHB	Fuel Handling Building
ft/year	feet per year
GIS	Geographic Information System
gpm	gallons per minute
HTDS	high total dissolved solids
HVAC	Heating Ventilation and Air Conditioning
LTDS	low total dissolved solids
LWST	Liquid Waste Storage Tank
MACTEC	MACTEC Engineering and Consulting, Inc.
MCL	Maximum Contaminant Level
MCR	Main Cooling Reservoir
MDMM	Materials Degradation Master Matrix
MEAB	Mechanical Electrical Auxiliary Building
MSL	Mean Sea Level
NC	Nonradioactive Chemical
NEI	National Energy Institute
NRC	Nuclear Regulatory Commission
OC	Open Loop Auxiliary Cooling Water System
ODCM	Offsite Dose Calculation Manual
PADD	plant area drainage ditch
pCi/L	picoCuries per liter
PCPI	per capita personal income
PWR	pressurized water reactor
RCB	Reactor Containment Building
REMP	Radiological Environmental Monitoring Program

RMPF	Reservoir Makeup Pumping Facility
RWST	Refueling Water Storage Tank
SDWIS	Safe Drinking Water Information System
STP	South Texas Project
STPEGS	South Texas Project Electric Generating Station
STPNOC	STP Nuclear Operating Company
TCEQ	Texas Commission on Environmental Quality
TDS	Total Dissolved Solids
TGB	Turbine Generator Buildings
TPDES	Texas Pollutant Discharge Elimination System
TWDB	Texas Water Development Board
UFSAR	Updated Final Safety Analysis Report
WMT	Waste Monitoring Tank

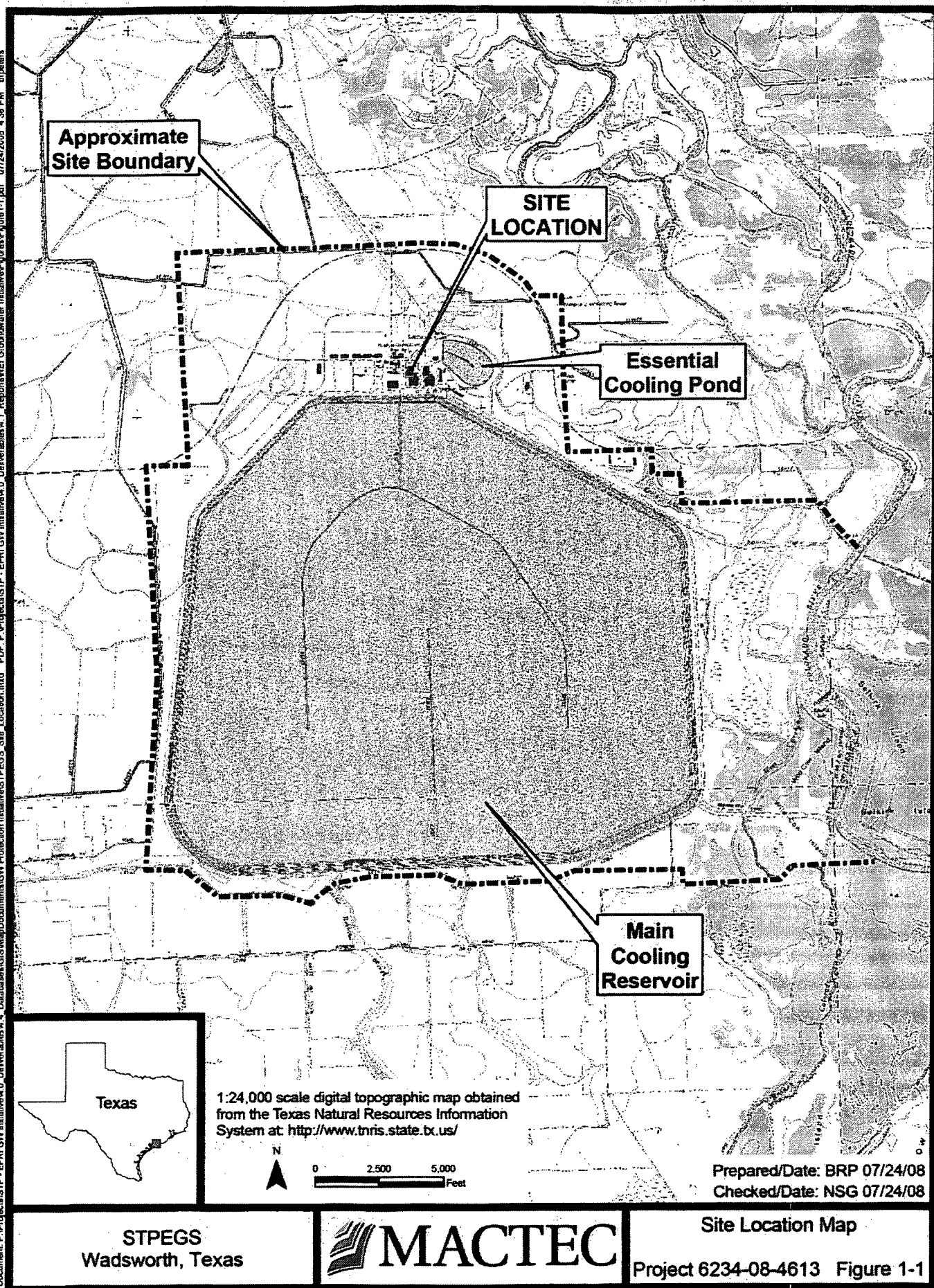
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- EPRI, 2007. Groundwater Protection Guidelines for Nuclear Power Plants, November 2007.
- NEI, 2007. Industry Ground Water Protection Initiative – Final Guidance Document. National Energy Institute, August 2007.
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- STPNOC, 2008b, Updated Final Safety Analysis Report for Units 1 and 2, South Texas Project Electric Generating Station, Wadsworth, Texas. Revision 14 May 7, 2008
- USEPA, 1996, *Low Stress (low flow) Purging and Sampling Procedure for the Collection of Ground Water Samples from Monitoring Wells*, July 30, 1996, Revision 2. USEPA, Region 1.

## FIGURES



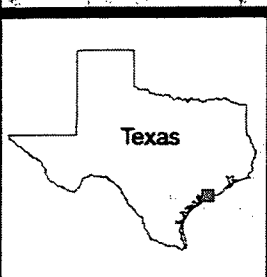
## FIGURES



## SITE LOCATION

## Essential Cooling Pond

**Main  
Cooling  
Reservoir**



1:24,000 scale digital topographic map obtained from the Texas Natural Resources Information System at: <http://www.tnris.state.tx.us/>



0 2,500 5,000 Feet

Prepared/Date: BRP 07/24/08  
Checked/Date: NSG 07/24/08

STPEGS  
Wadsworth, Texas



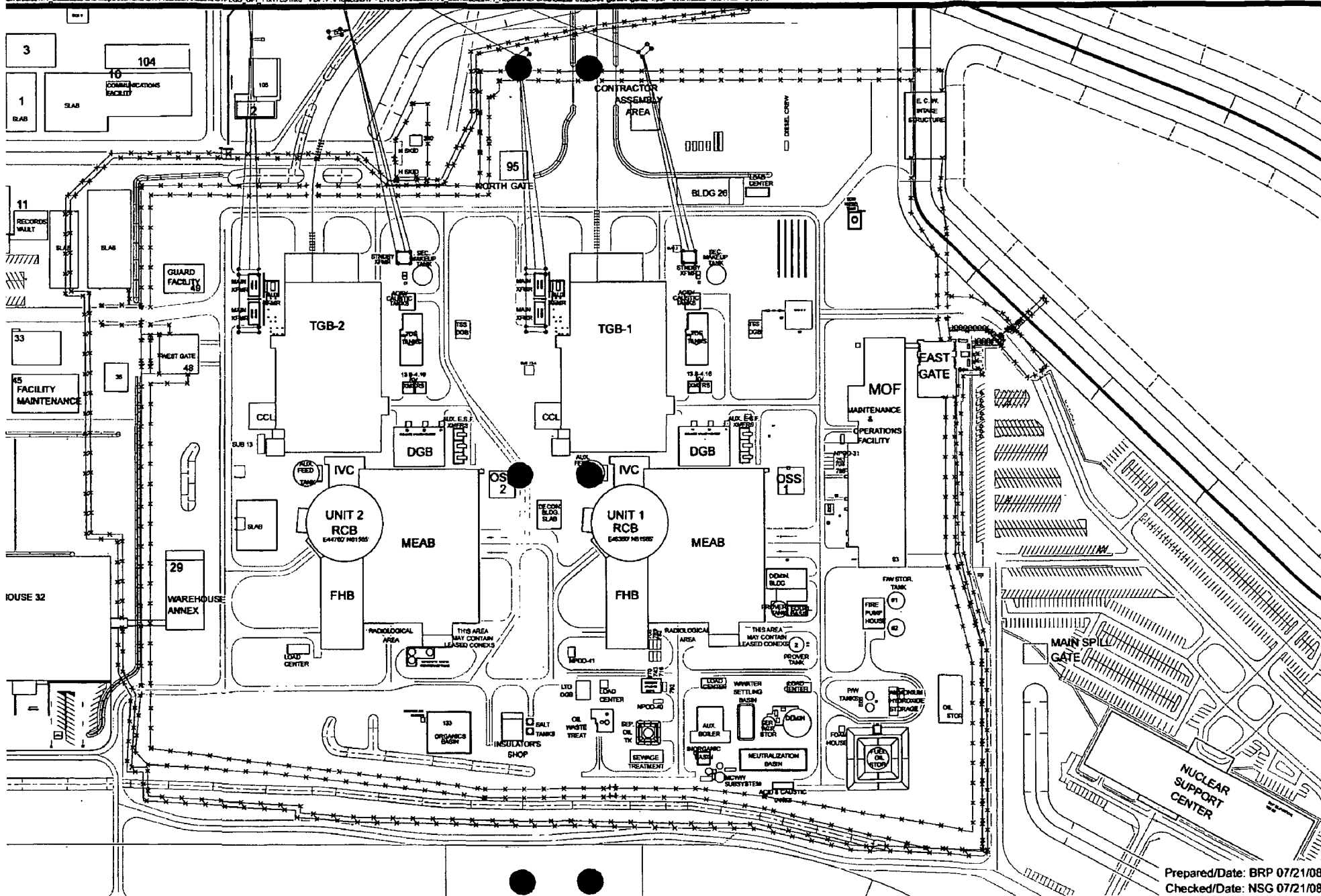
# MACTEC

### Site Location Map

Project 6234-08-4613 Figure 1-1



*Matagorda Regional Medical Center  
Radiological Emergency Area (REA) Setup*

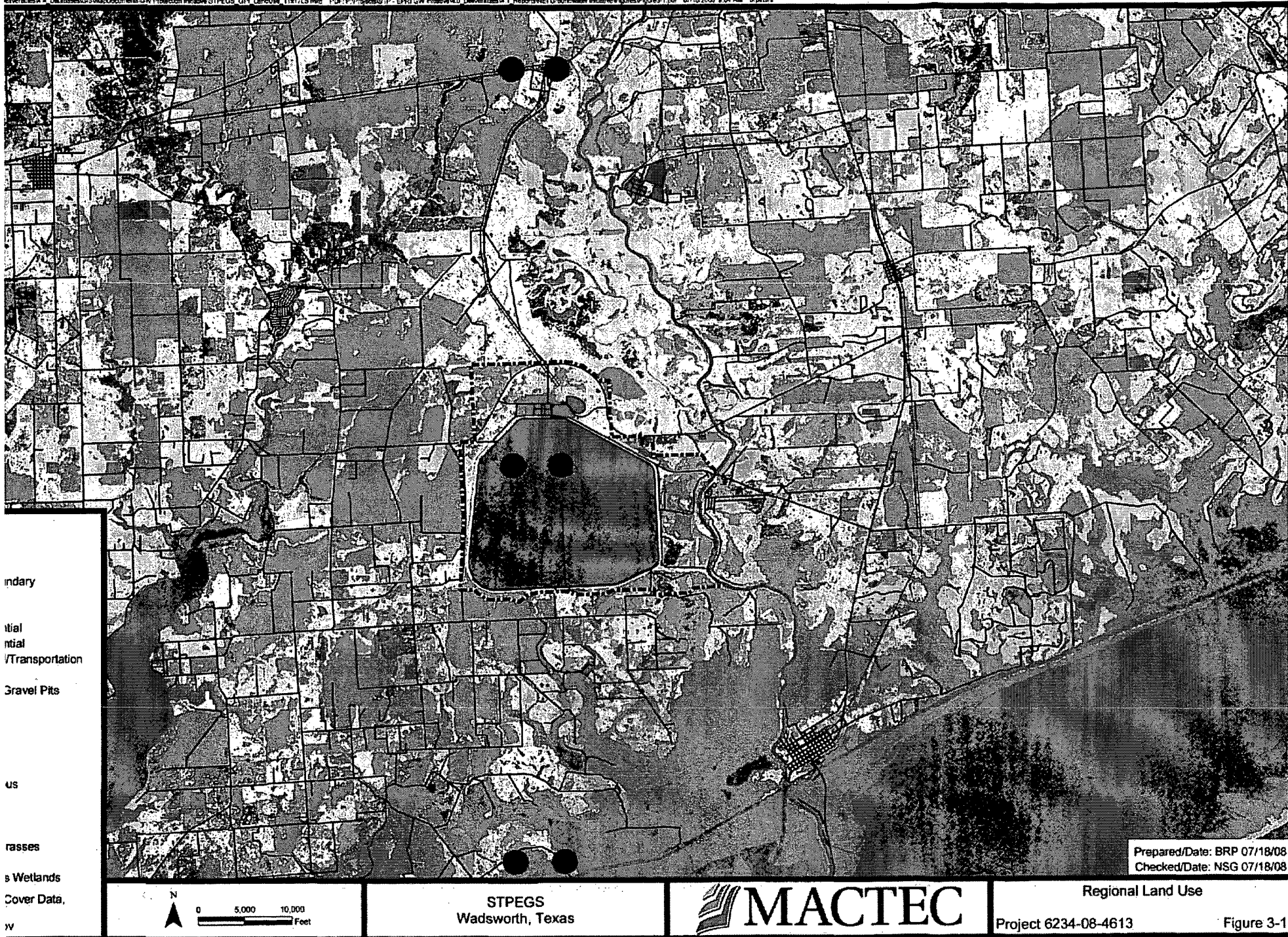


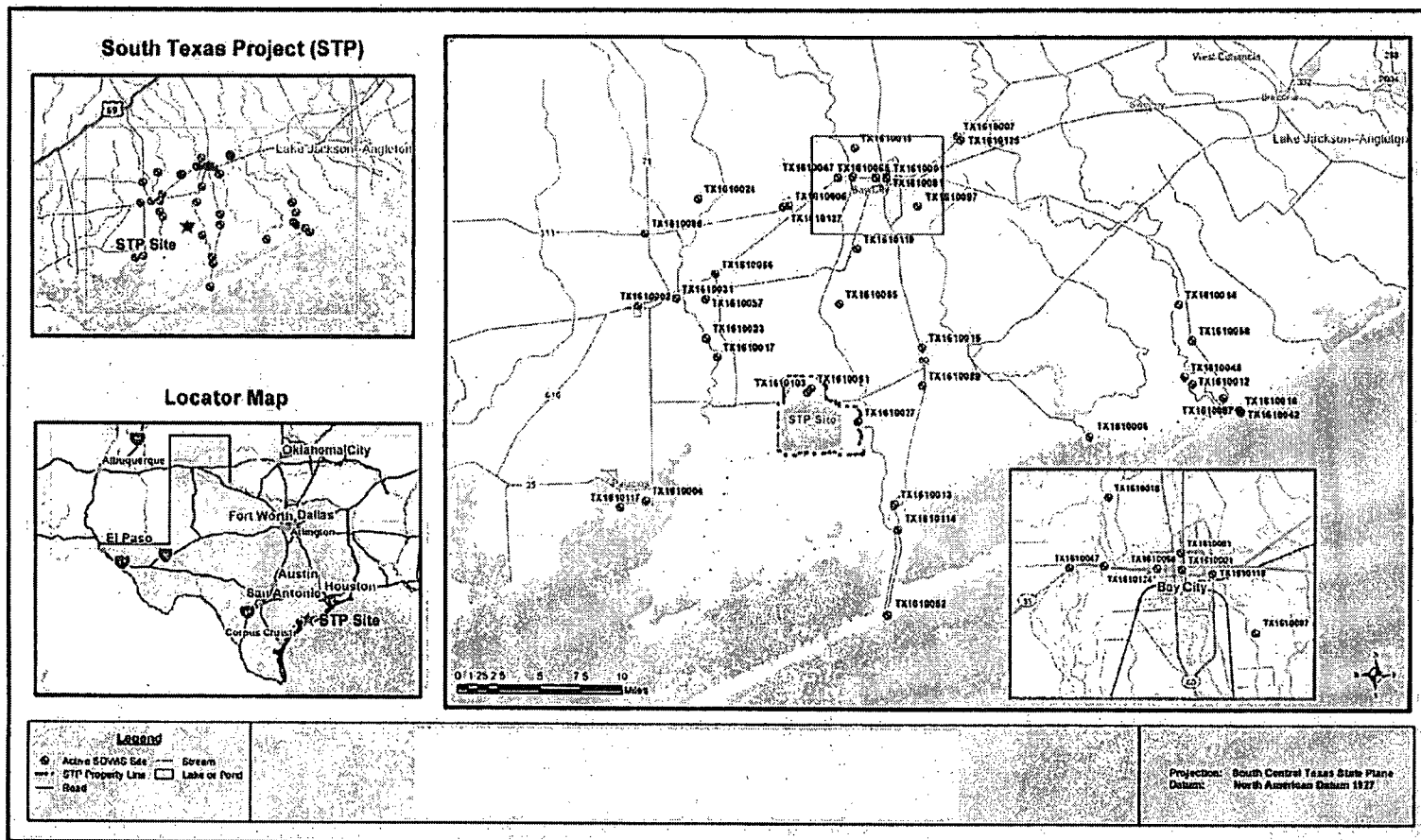
Prepared/Date: BRP 07/21/08  
Checked/Date: NSG 07/21/08

STPEGS  
Wadsworth, Texas

**MACTEC**

Current Site Conditions, Units 1 and 2  
Project 6234-08-4613  
Figure 2-1





Prepared/Date: JPH 8/13/08  
Checked/Date: NSG 8/13/08

Note: Data from Units 3 & 4 FSAR (Bechtel 2007)

STPEGS  
Wadsworth, Texas

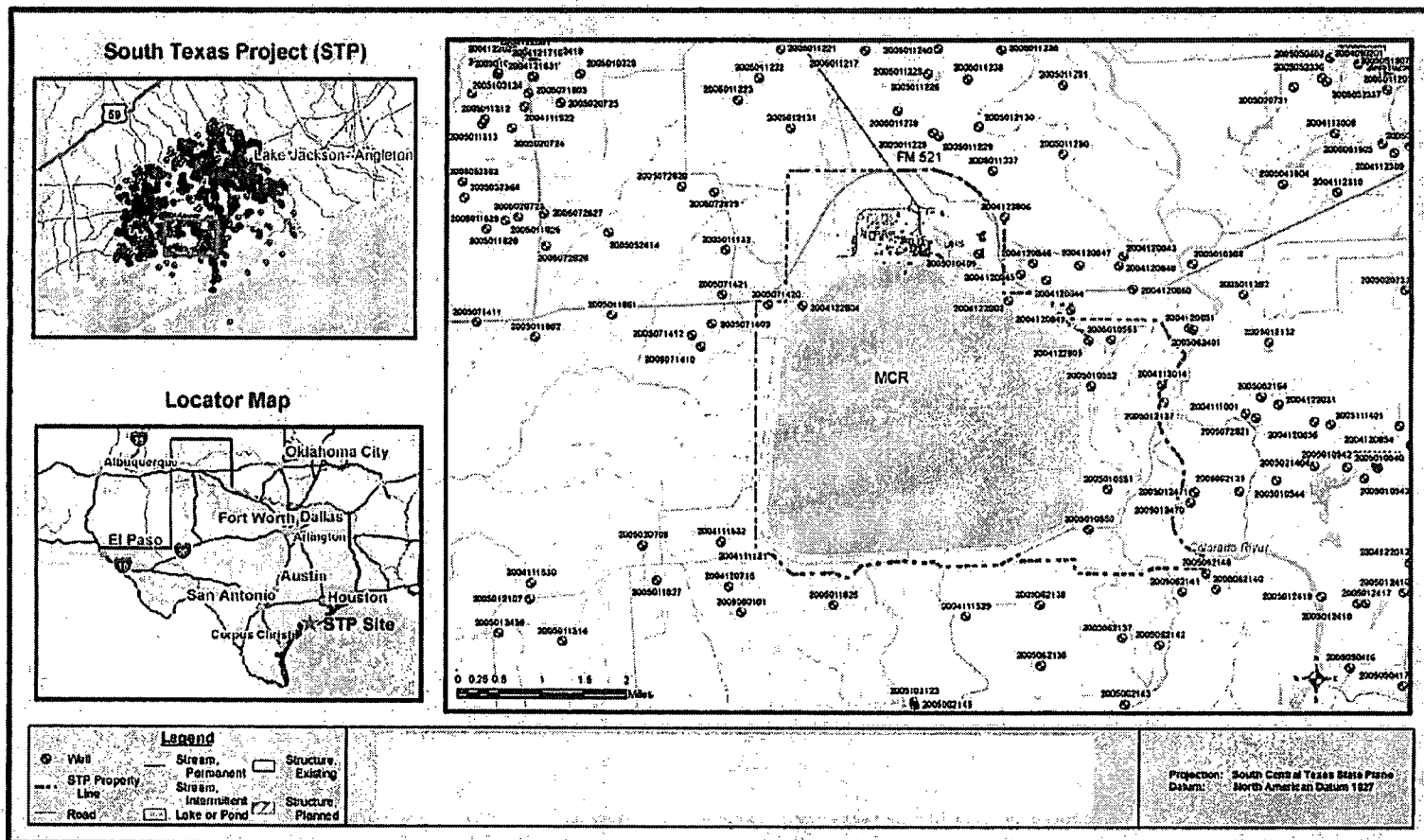
**MACTEC**

Safe Drinking Water Information System (SDWIS)  
Water Supply Systems in Matagorda County

Project 6234-08-4613

Figure 3-2





Prepared/Date: JPH 8/13/08  
Checked/Date: NSG 8/13/08

Note: Data from Units 3 & 4 FSAR (Bechtel 2007)

STPEGS  
Wadsworth, Texas

**MACTEC**

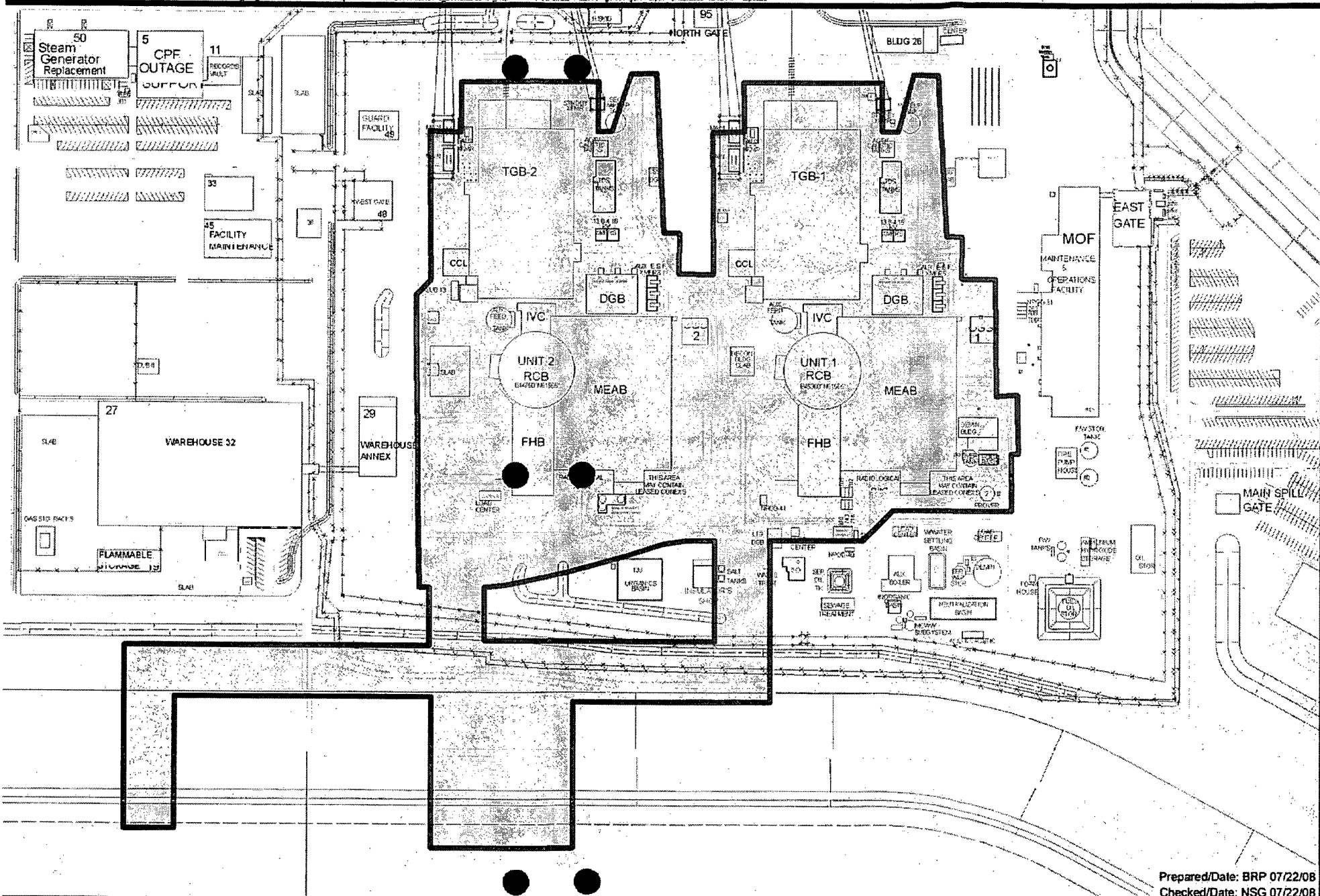
Coastal Plains Groundwater  
Conservation District Well Locations

Project 6234-08-4613

Figure 3-4







Prepared/Date: BRP 07/22/08  
Checked/Date: NSG 07/22/08

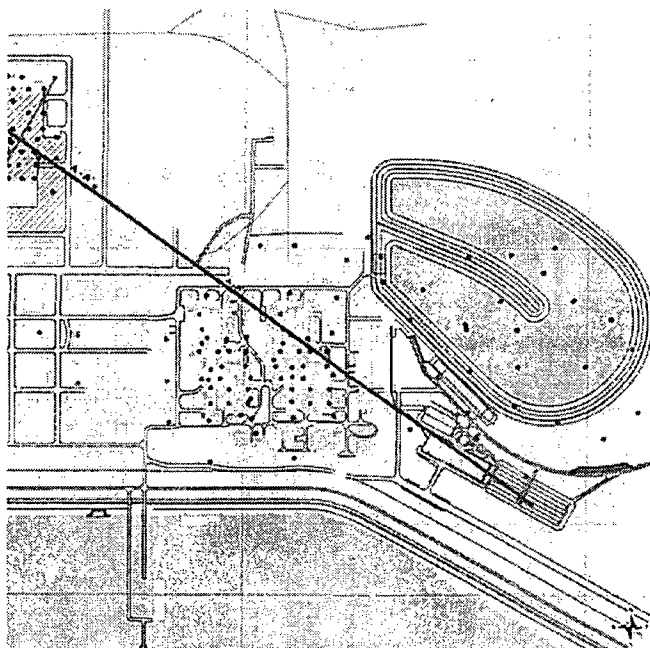
**Legend**  
 Approximate Construction Excavation Areas

**STPEGS**  
Wadsworth, Texas

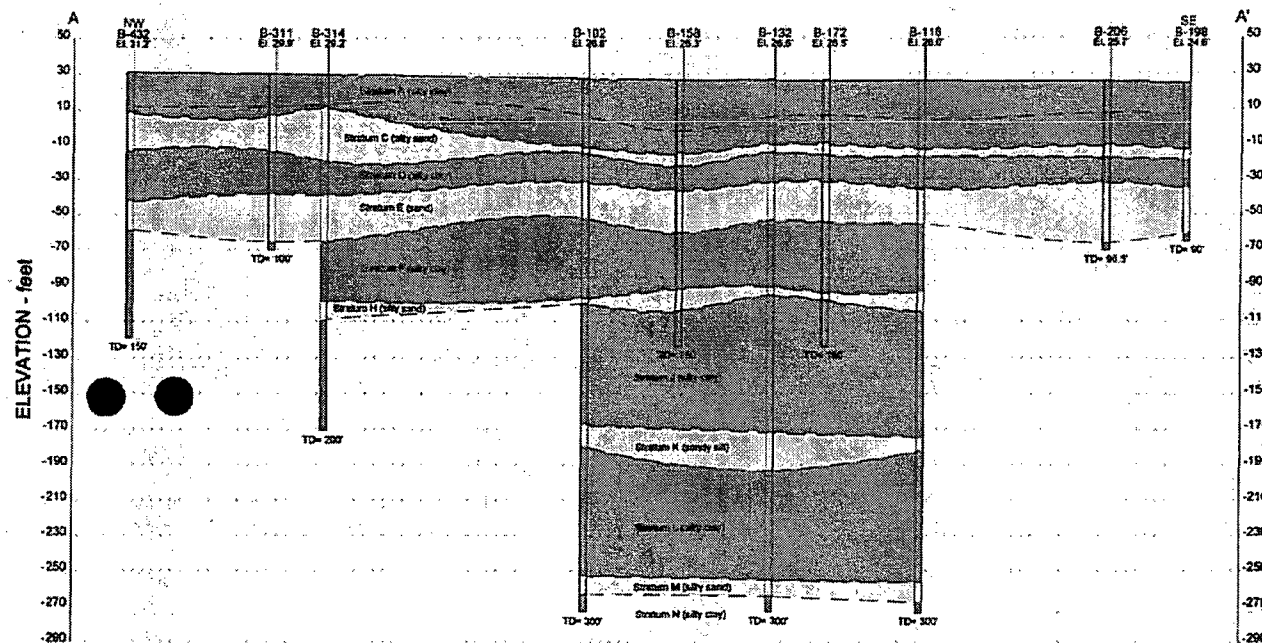
**MACTEC**




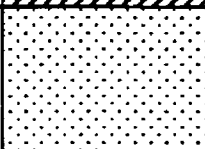
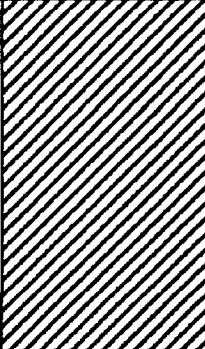
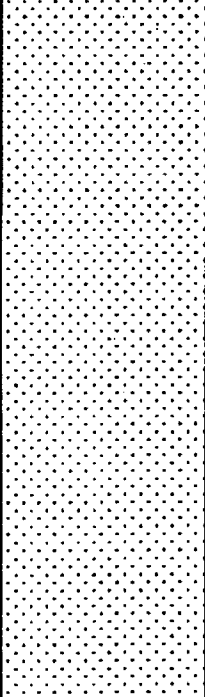
**Construction Excavation Areas**  
 Project 6234-08-4613  
 Figure 4-2





Cross Section Locations



Unit	Hydrogeologic Zone	Ground Surface	Thickness	Geologic Materials
Shallow Aquifer	Upper Shallow Aquifer		10 - 30 ft	Clay and Silt
	Upper Shallow Aquifer		20 - 30 ft	Silty Sand and Poorly Graded Sand
	Lower Shallow Aquifer		15 - 25 ft	Clay and Silt
	Lower Shallow Aquifer		25 - 50 ft	Silty Sand and Poorly Graded Sand with thin Clay and Silt Layers
Deep Aquifer Confining Layer			100 - 150 ft	Silty Clay and Silt with thin Sand Layers
Deep Aquifer			>500 ft	Sand with thin Clay and Silt Layers

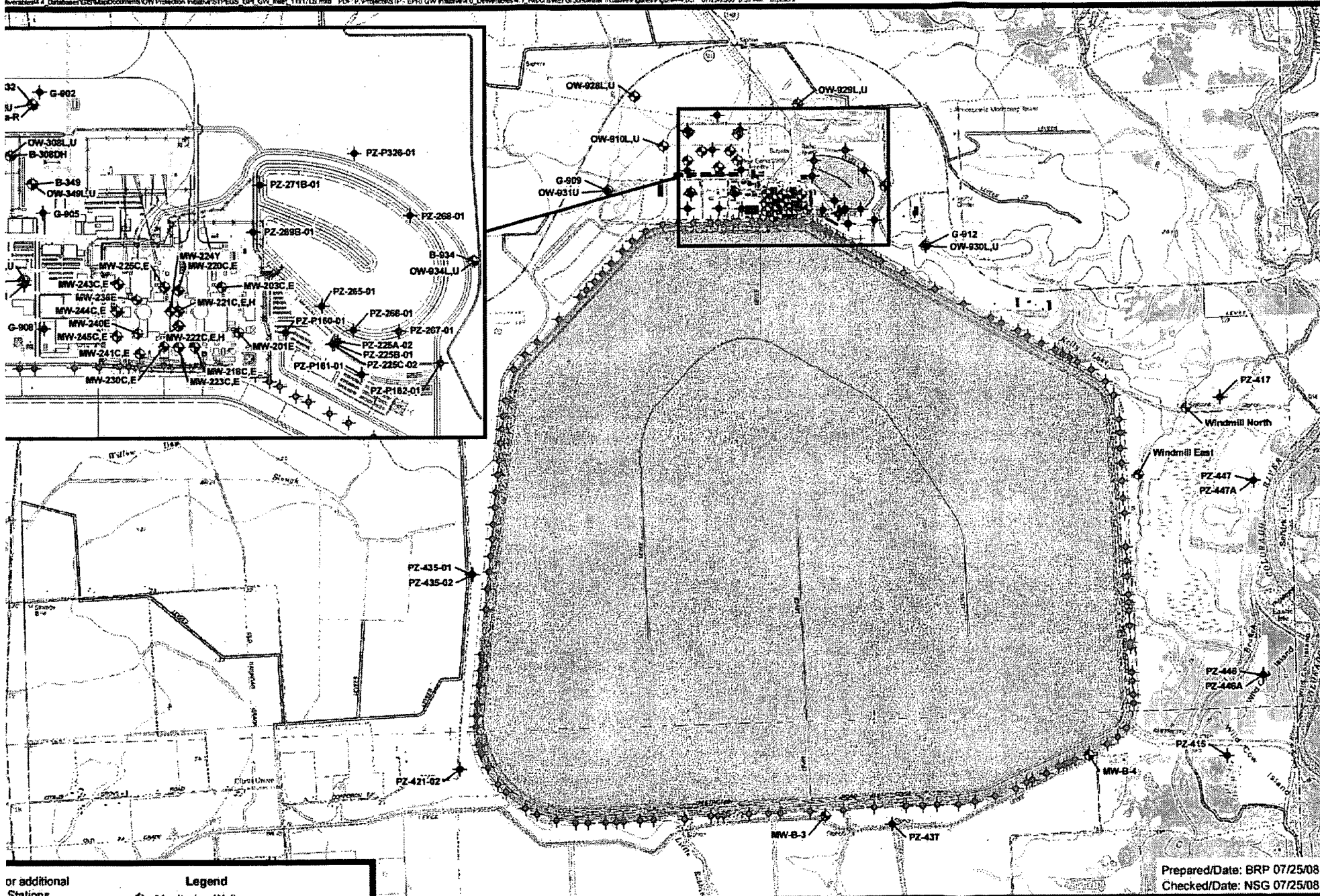
Prepared/Date: JPH 8/11/08  
Checked/Date: NSG 8/11/08

STPEGS  
Wadsworth, Texas



Aquifer Sequence Below STPEGS

Project 6234-08-4613 Figure 4-4



or additional  
Stations.

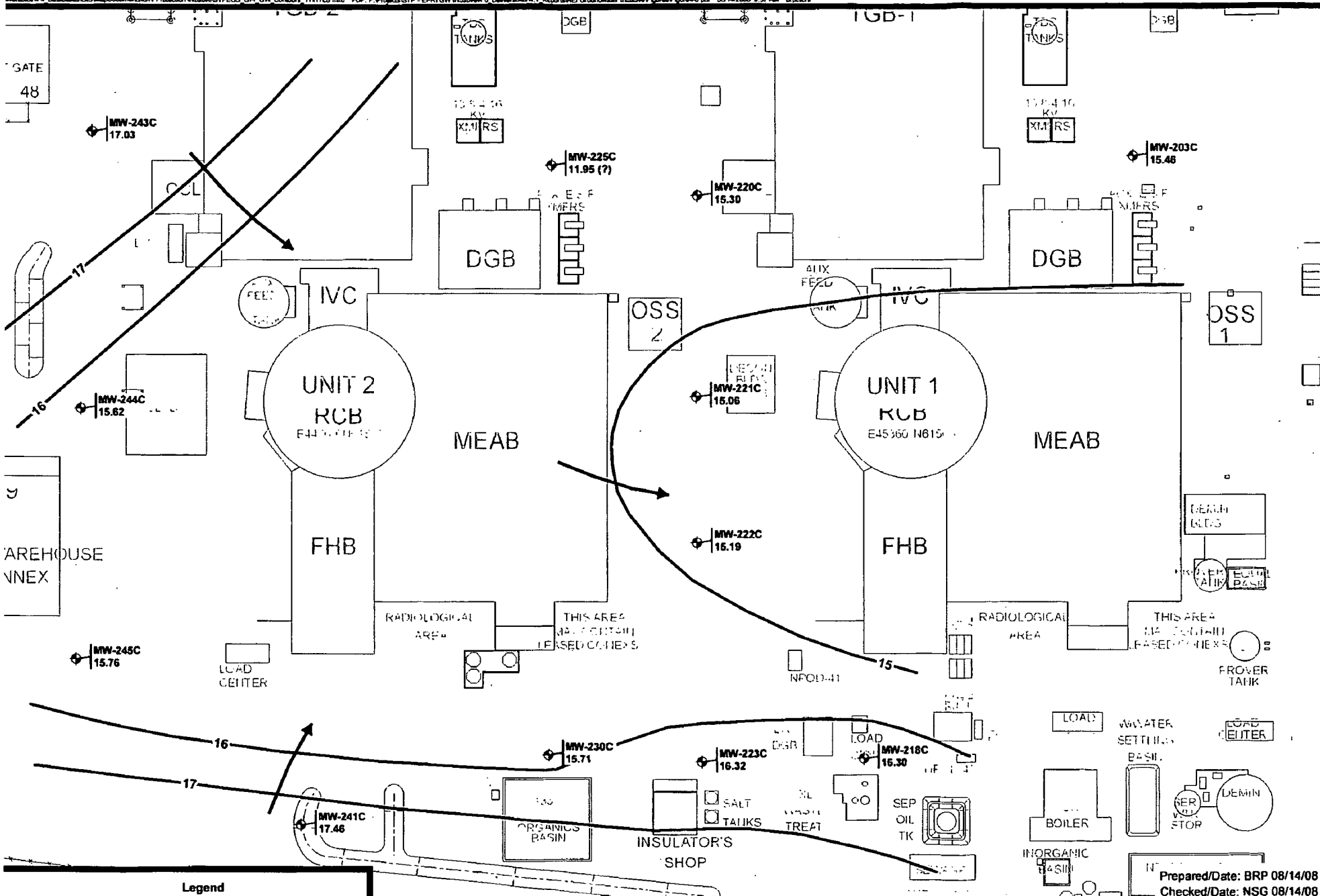
STEGS  
Wadsworth, Texas

**MACTEC**

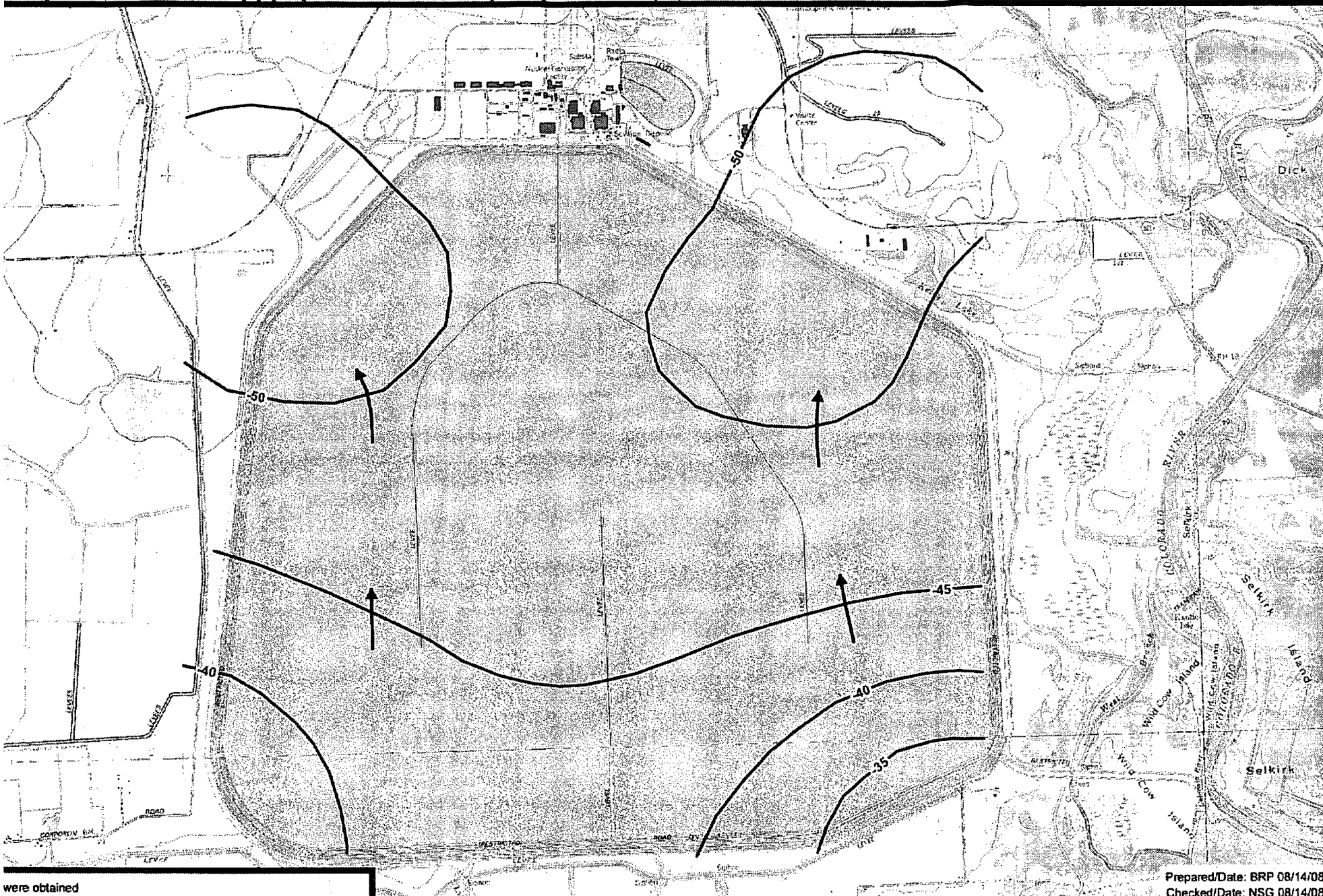
Existing Wells and Piezometers  
Project 6234-08-4613

Figure 4-5

Prepared/Date: BRP 07/25/08  
Checked/Date: NSG 07/25/08



Prepared/Date: BRP 08/14/08  
Checked/Date: NSG 08/14/08



were obtained  
(Bechtel, 2007)

**Legend**

- 40 — Groundwater Contour (Feet below MSL)
- ➔ Approximate Groundwater Flow Direction

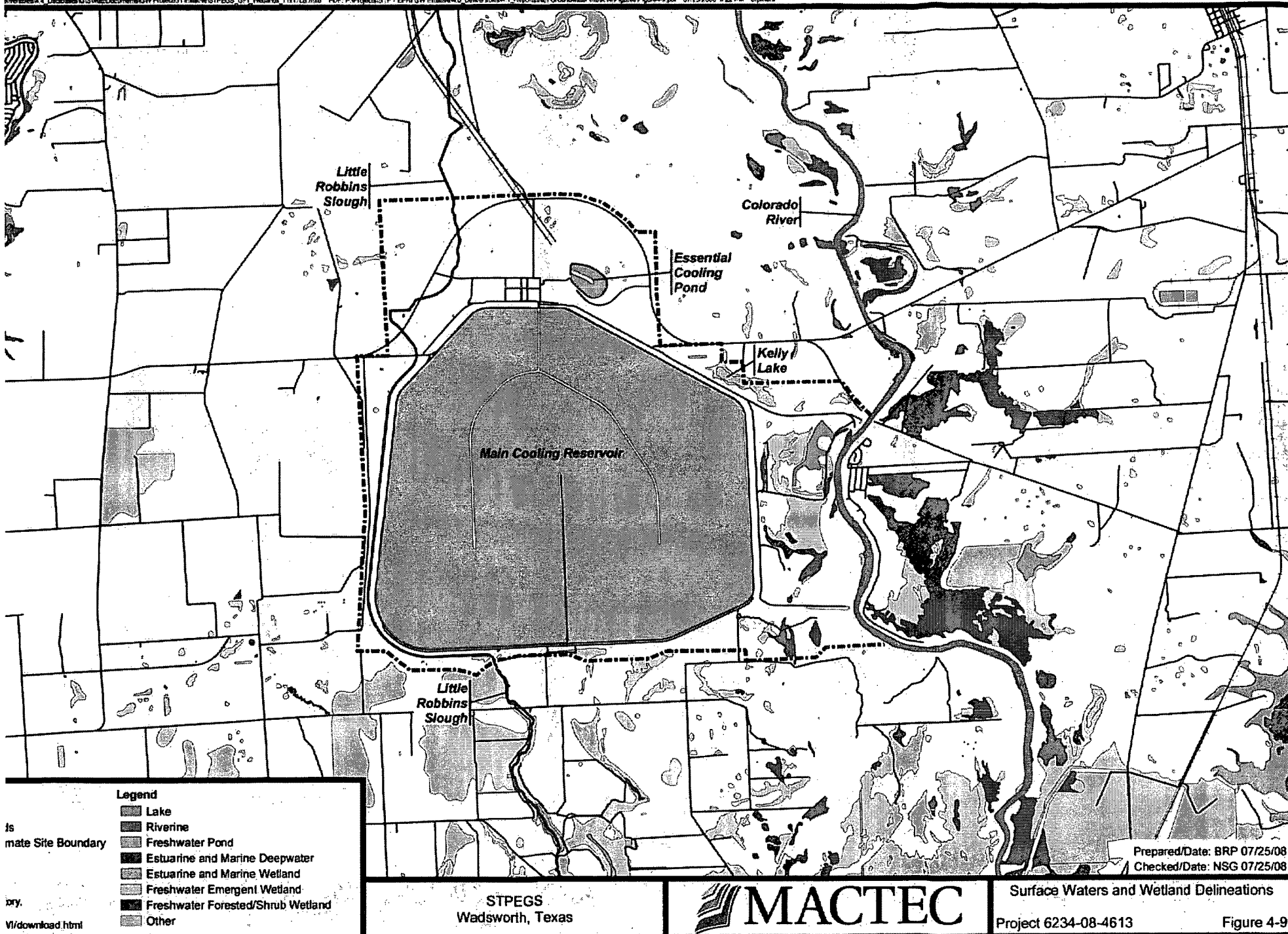
**STPEGS**  
Wadsworth, Texas

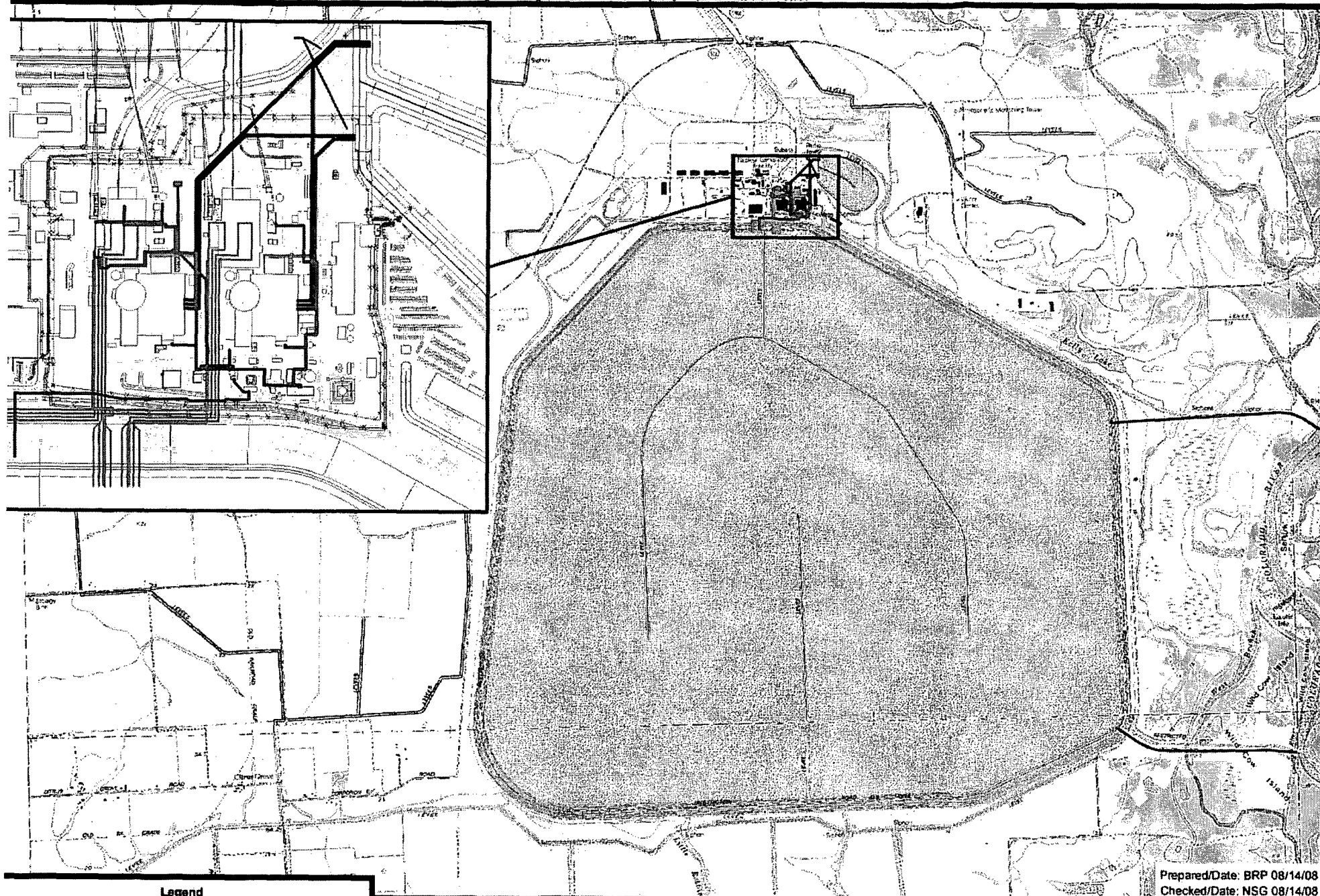


Groundwater Potentiometric Surface Contours  
Deep Aquifer - November 2005  
Project 6234-08-4613  
Figure 4-8

Prepared/Date: BRP 08/14/08  
Checked/Date: NSG 08/14/08







Prepared/Date: BRP 08/14/08  
Checked/Date: NSG 08/14/08

- Legend**
- TDS Lines
  - Oily Waste Lines
  - Essential Cooling Water Lines
  - Open-Loop Cooling Water System
  - Blowdown and Makeup Pipelines

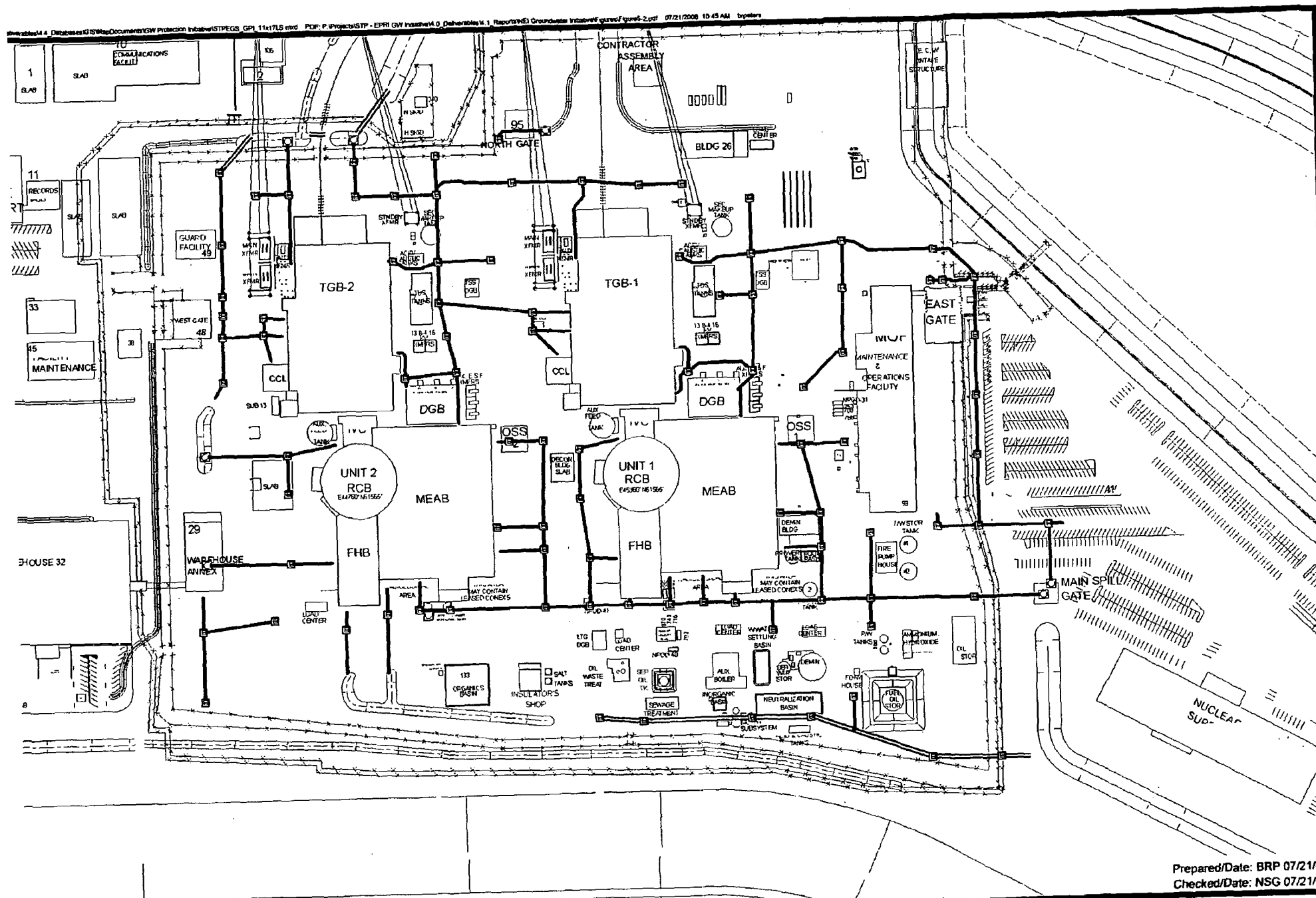
STPEGS  
Wadsworth, Texas

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Units 1 and 2 Systems  
Project 6234-08-4613

Figure 5-1





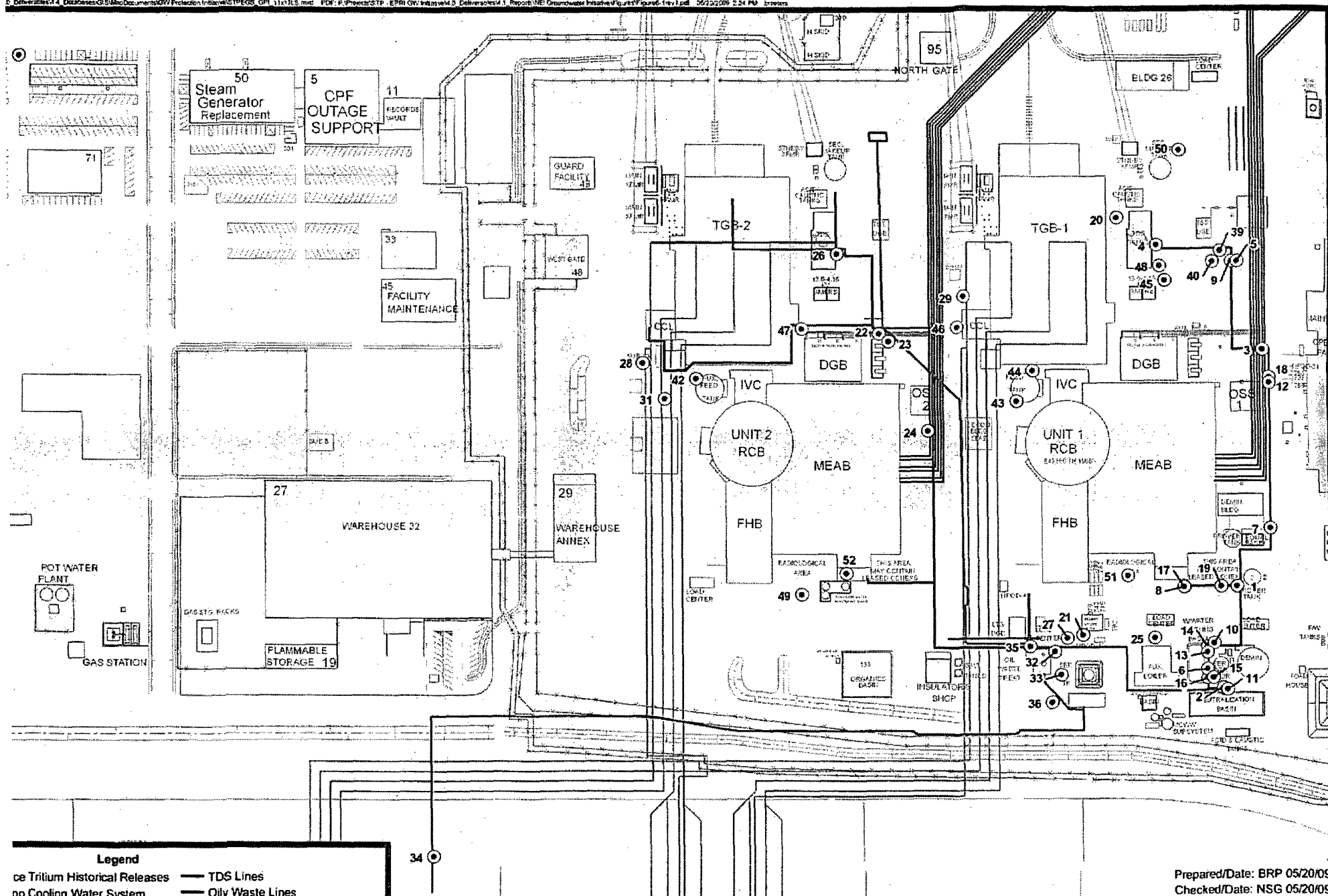
Prepared/Date: BRP 07/21/08  
 Checked/Date: NSG 07/21/08

- Legend**
- Catch Basin
  - Outfall
  - Pipe
  - Culvert

STPEGS  
 Wadsworth, Texas



Units 1 and 2 Storm Water System  
 Project 6234-08-4613  
 Figure 5-2



# Legend

ce Tritium Historical Releases  
op Cooling Water System  
Cooling Water Lines

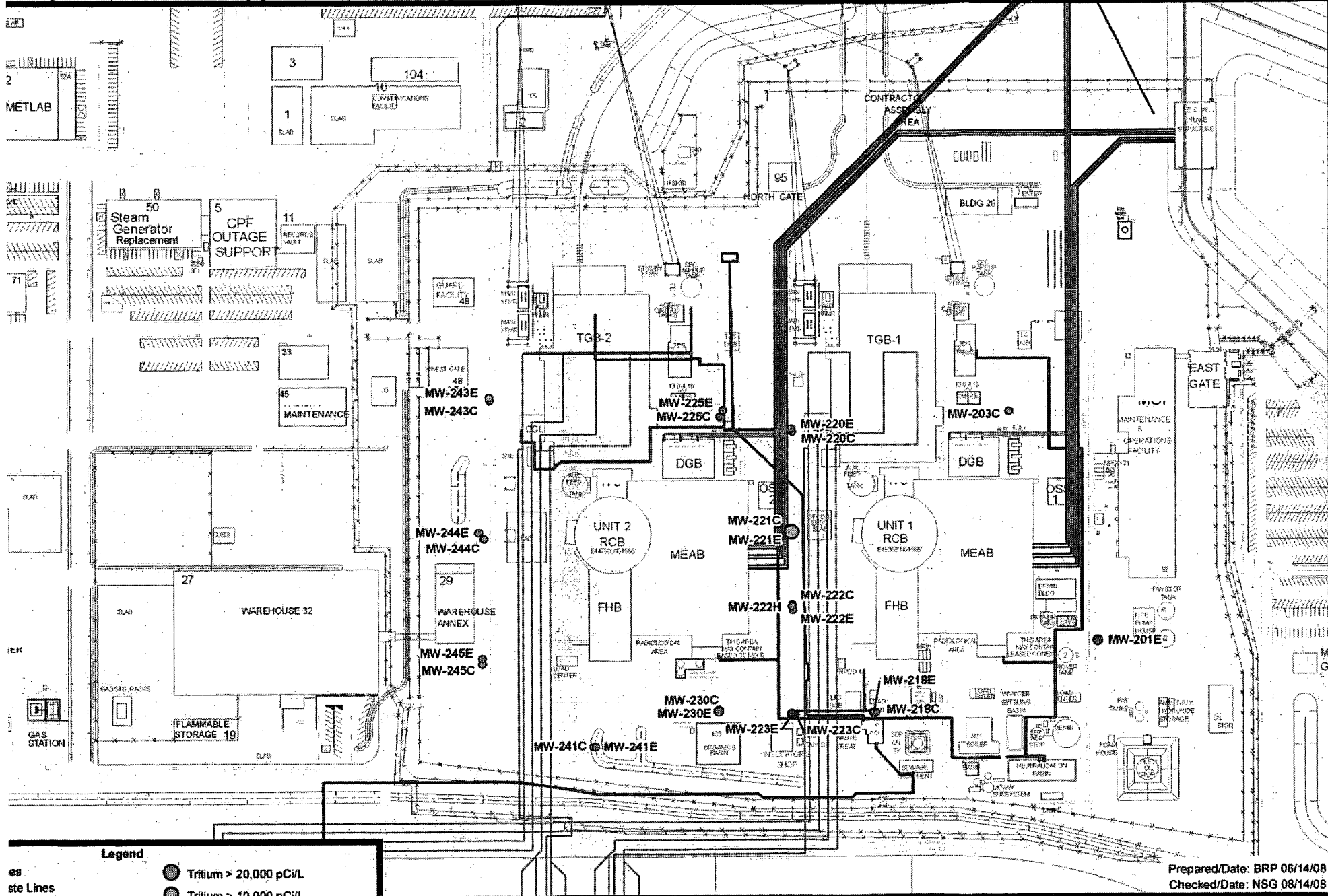
Please refer to Table 6-1 for additional details and cross referenced locations.

STPEGS  
Wadsworth, Texas

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Documented Releases of Tritium  
(Rev 1)  
Project 6234-08-4613  
Figure 6-1

Prepared/Date: BRP 05/20/09  
Checked/Date: NSG 05/20/09



Prepared/Date: BRP 08/14/08  
Checked/Date: NSG 08/14/08

### Summary of Tritium in Groundwater

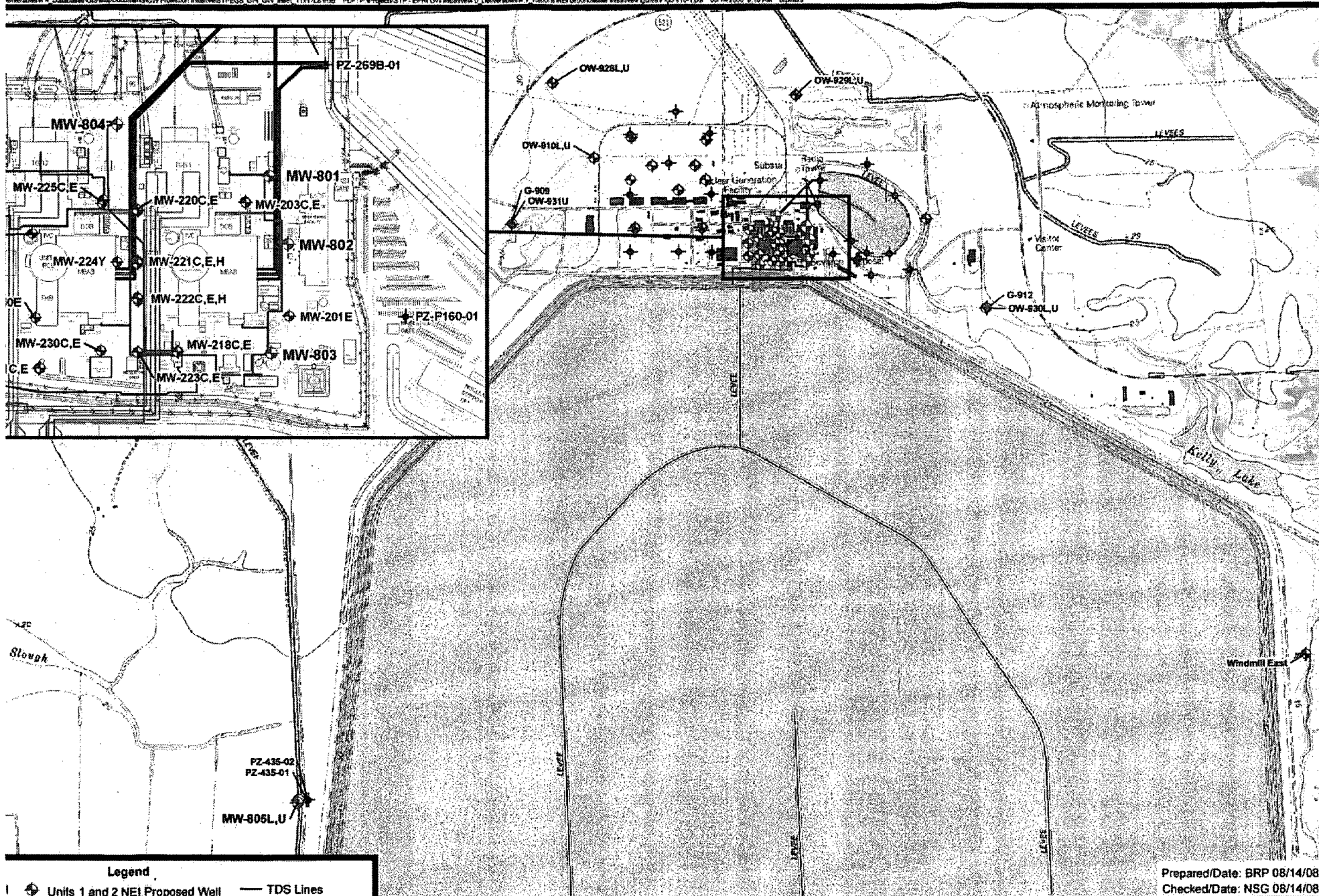
Project 6234-08-4613

Figure 7-1

**STPEGS**  
Wadsworth, Texas



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**Legend**

- ◆ Units 1 and 2 NEI Proposed Well
- Open-Loop Cooling Water System
- Essential Cooling Water Lines
- TDS Lines
- Oily Waste Lines

STPEGS  
Wadsworth, Texas

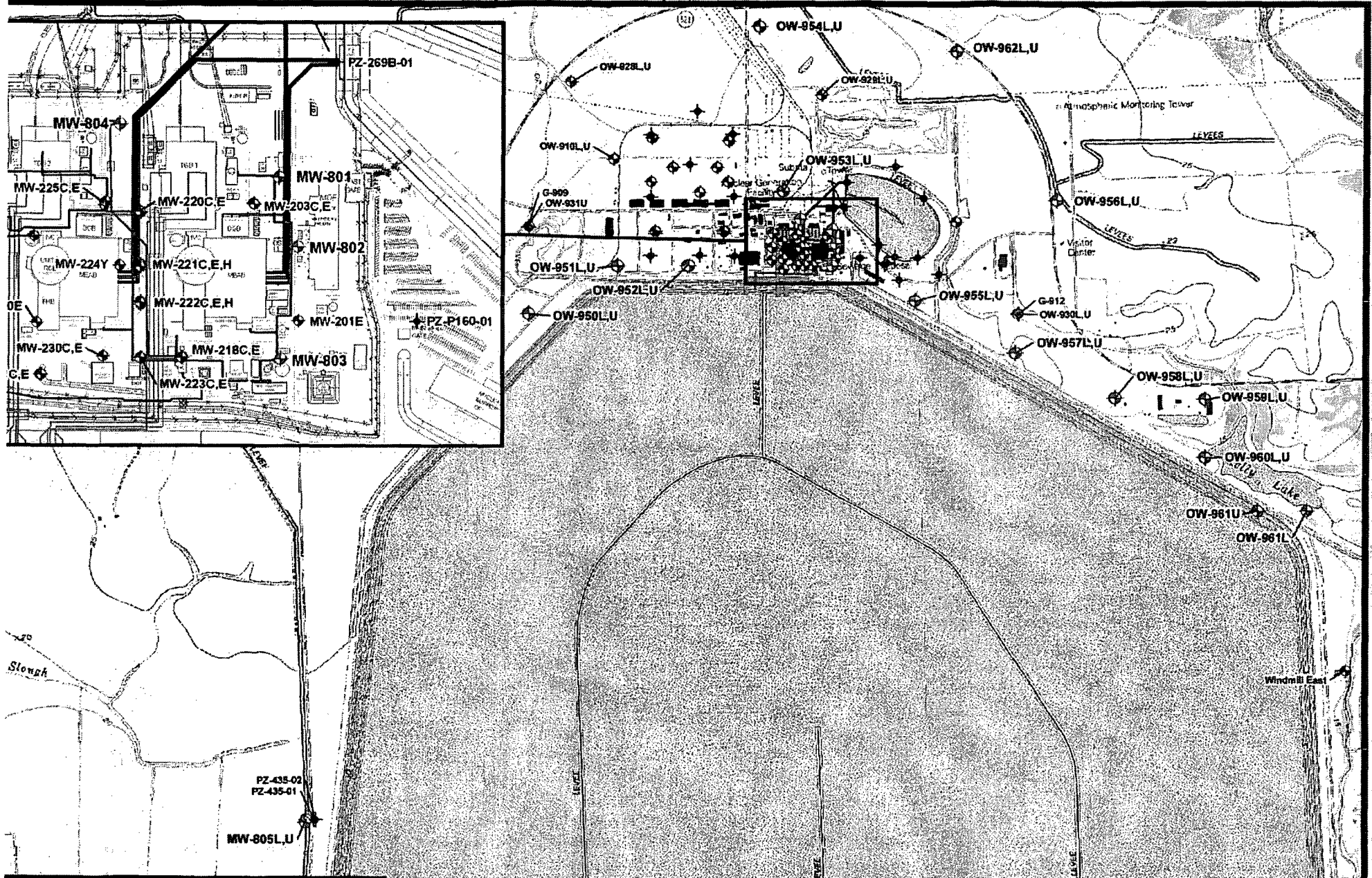
**MACTEC**

Proposed Groundwater Monitoring Wells  
for Units 1 and 2  
Project 6234-08-4613

Prepared/Date: BRP 08/14/08  
Checked/Date: NSG 08/14/08

Figure 10-1





- Legend**
- Units 1 and 2 NEI Proposed Well
  - Units 3 and 4 Proposed Well
  - Open-Loop Cooling Water System
  - Essential Cooling Water Lines
  - TDS Lines
  - Oily Waste Lines

STEGS  
Wadsworth, Texas

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All Proposed Groundwater Monitoring Wells  
Project 6234-08-4613  
Figure 10-2

Prepared/Date: BRP 08/14/08  
Checked/Date: NSG 08/14/08

## TABLES



## TABLES

SUMMARY OF HISTORIC RELEASES, LEAKS, AND SPILLS<sup>2,4</sup>CONCEPTUAL SITE MODEL FOR UNITS 1 AND 2  
GROUNDWATER PROTECTION INITIATIVE  
STPEGS, WADSWORTH, TEXAS

Line No.	Reference(s) <sup>3</sup>	System	Date(s)	Location	Description	Release Quantity (Gallons)	Recovered/ Remediated <sup>1</sup>	4QQ Code <sup>5</sup>	Comments.
1	SPR940926 CR 94-1051 CR 03-3951 Activity No. 305798	CP1	4/24/1994	SE of Prover Tank No. 2.	Underground U1 CP line breach.	Total quantity unknown. Min volume was 25 gallons. Leak rate approx. 5 gpm.	Y	N	Diagram in work pkg.
2	CR 03-3951 Activity No. 305411	CP1	6/25/1994	Approx. 5 ft. N of NC Basin	Underground CP discharge line leak.	Not documented	Y	N	Diagram in work pkg.
3	CR 03-3951 Activity No. 329701	CP1	8/12/1994	Unclear	Underground CP discharge line leak.	Not documented	Not documented	N	Diagram in work pkg.
4	OPGP03-ZH-0006 Form 1 (Spill Event Report) WAN94029399	CP1	9/15/1994	East of U1 LTDS Tank	Aboveground CP discharge line leak. TDS discharge line gasket blew out of flange.	200	Y	N	
5	CR 03-3951 Activity No. 321589	CP1	On or about 01/04/1995	Approx. 50 ft. SE of TSC1 Diesel Generator.	Underground CP discharge line leak.	Not documented	Not documented	N	
6	CR 03-3951 Activity No. 334529	CP1	On or about 02/11/1995	Approx. 4 ft. E of SW Basin near SE corner.	Underground CP discharge line leak.	Not documented	Not documented	N	
7	CR 03-3951 Activity No. 341326	CP1	On or about 01/18/1996	SW corner of MUD Bldg. approx. 14 ft. west of road.	Underground CP discharge line leak.	Not documented	Not documented	N	Diagram in work pkg. Work pkg. references a CNAQ CR. Unable to locate CR.



SUMMARY OF HISTORIC RELEASES, LEAKS, AND SPILLS<sup>2,4</sup>CONCEPTUAL SITE MODEL FOR UNITS 1 AND 2  
GROUNDWATER PROTECTION INITIATIVE  
STPEGS, WADSWORTH, TEXAS

Line No.	Reference(s) <sup>3</sup>	System	Date(s)	Location	Description	Release Quantity (Gallons)	Recovered/ Remediated <sup>1</sup>	4QQ Code <sup>5</sup>	Comments.
8	CR 96-3000 WAN79595 Activity No. 341921 Nonrad Spill Event Report (Not in RMS) Plant Operations Control Room Logbook	CP1	3/12/1996	SE corner inside U1 Truck Bay. N61,293.5 E45,581.96	Underground CP discharge line leak. HTDS transfer. Small quantity to nearby storm drain. Quantity too small to pump. Contaminated soil to be handled by HP.	Total quantity unknown. Min volume was 1 gallon.	Not documented. However, records indicate that storm drains were isolated to prevent offsite discharge; therefore, recovery of liquid was probable IAW standard protocol.	N	Diagram in work pkg. Isotopic analysis performed by Chemistry. Chemistry reported no activity in HTDS tank. Also no activity in discharged water in vicinity of leak. HP's unable to detect activity in adjacent soil; however, Chemistry analysis indicated some contamination.
9	0PGP03-ZH-0008 Form 1 (Spill Event Report) CR 96-4727 WAN82601	CP1	4/26/1996	Approx. 120 ft. E of TGB1; 40 ft. SE of TSC1. N61,907.00 E45,676.00	Underground CP discharge line leak. TDS discharge line perforated by earth anchor while securing temporary building during 1RE06 preps.	1200 - 1800	Y	N	
10	CR 97-10917 WAN114032	CP1	7/6/1997	NE of SW Settling Basin	Underground CP discharge line leak.	Not documented	Not documented	N	
11	CR 97-18761 CR 03-3951 Activity Nos. 360298 & 368439	CP1	11/21/1997	Approx. 3 ft. N of NC Basin B.	Underground CP discharge line leak.	Not documented	Not documented	N	

SUMMARY OF HISTORIC RELEASES, LEAKS, AND SPILLS<sup>2,4</sup>CONCEPTUAL SITE MODEL FOR UNITS 1 AND 2  
GROUNDWATER PROTECTION INITIATIVE  
STPEGS, WADSWORTH, TEXAS

Line No.	Reference(s) <sup>3</sup>	System	Date(s)	Location	Description	Release Quantity (Gallons)	Recovered/ Remediated <sup>1</sup>	4QQ Code <sup>5</sup>	Comments.
12	CR 98-5931 CR 03-3951 Activity No. 368409	CP1	4/14/1998	NE corner of OSS1.	Underground CP discharge line leak.	Not documented	Not documented	N	Diagram in work pkg. Reference 329701 for possible previous patch.
13	CR 02-17779 CR 03-3951 Activity No. 421736	CP1	11/26/2002	E of SW Basin.	Underground CP discharge line leak.	Not documented	Not documented	N	
14	CR 05-11783 WAN305098	CP1	9/25/2005	NE of SW Basin. N61,179.50 E45,625.25	Underground CP discharge line leak.	Not documented	Not documented	N	
15	CR 05-12634 WAN305878	CP1	10/9/2005	NE of SW Basin. N61,120.00 E45,625.25	Underground CP discharge line leak.	Not documented	Not documented	N	Diagram in work pkg.
16	CR 05-13563 WAN306658	CP1	10/20/2005	SE of SW Basin. N of NaOCl Tank. N61,120.00 E45,625.25	Underground CP discharge line leak.	Not documented	Not documented	N	
17	CR 05-13956 WAN307000	CP1	10/25/2005	S of U1 MAB inside RRA fence. N61,293.50 E45,580.96	Underground CP discharge line leak.	150	Y	N	Diagram in work pkg.
18	CR 06-7987 WAN320211	CP1	6/21/2006	NE corner of IWMC. N61,688.00 E45,745.00	U1 TDS discharge line breached by auger when setting fence posts.	5	Y	N	Diagram in work pkg. H3 = 2.81E-7 No gamma activity
19	CR 06-15250 WAN328448	CP1	11/4/2006	SE of U1 Truck Bay near fence line. N61,293.50 E45,652	U1 TDS discharge line.	2500	Y	N	Related CR 06-15555 is coded 4QQ. Photographs of affected area in CR 06- 15555. Diagram in work

SUMMARY OF HISTORIC RELEASES, LEAKS, AND SPILLS<sup>2,4</sup>CONCEPTUAL SITE MODEL FOR UNITS 1 AND 2  
GROUNDWATER PROTECTION INITIATIVE  
STPEGS, WADSWORTH, TEXAS

Line No.	Reference(s) <sup>1</sup>	System	Date(s)	Location	Description	Release Quantity (Gallons)	Recovered/ Remediated <sup>1</sup>	4QQ Code <sup>5</sup>	Comments.
20	CR 08-14366 CR 08-14864	CP1	9/30/2008	N of U1 CP Resin Box.	U1 Resin Box overflow.	4800	Y	Y	H-3 = 9.75E-6.
21	CR 99-8947 CR 03-3951 Activity No. 378299	CP2	6/12/1999	S of CUB. (S of FHB1)	Underground CP discharge line leak.	Not documented	Not documented	N	CR references completion of ZH-0006 Form 1, but unable to locate.
22	CR 00-8903 CR 03-3951 Activity No. 385645	CP2	5/12/2000	Between U2 ESF Xfms & U2 ESF DG Fuel Oil Filter Skid.	Underground CP discharge line leak.	Not documented	Not documented	N	
23	CR 01-4296	CP2	3/14/2001	Near U2 Fuel Oil Filtration Skid.	Underground U2 TDS line break. CLTDS discharge water.	200	Y	N	
24	CR 03-7595 CR 03-3951 Activity No. 430966	CP2	5/4/2003	S of OSS2. N61,589.00 E45,096.00 EL. 21 ft.	Underground CP discharge line leak.	Not documented	Not documented	N	Diagram in work pkg.
25	CR 04-12157 WAN282412	CP2	9/5/2004	Near Auxiliary Boiler.	Underground CP discharge line leak.	Not documented	Y	N	
26	CR 05-10556	CP2	8/21/2005	E of MBLTDS Tank.	Underground CP discharge line leak.	Not documented	Not documented	N	
27	CR 08-3030 STI: 32270196 WAN354663	CP2	2/18/2008	Approx. 50 ft. ENE of OWTS. South of Aux. Steam pipe.	TDS discharge through broken FHB1 HVAC Drain line elbow upstream of tie-in to U2 TDS discharge line.	200	Y	Y	H3 = 4.57E-6 µCi/mL No gamma activity
28	0PGP03-ZH-0006 Form 1 (Spill Event Report)	OC	9/15/1993	West of TGB2 near Lube Oil Purification.	OC line gasket blew out of flange and sprayed OC water to ground.	200	Y	N	

Rev. 1

SUMMARY OF HISTORIC RELEASES, LEAKS, AND SPILLS<sup>2,4</sup>CONCEPTUAL SITE MODEL FOR UNITS 1 AND 2  
GROUNDWATER PROTECTION INITIATIVE  
STPEGS, WADSWORTH, TEXAS

Line No.	Reference(s) <sup>3</sup>	System	Date(s)	Location	Description	Release Quantity (Gallons)	Recovered/ Remediated <sup>1</sup>	4QQ Code <sup>5</sup>	Comments.
29	SPR 933417 CR 93-3403	OC	12/8/1993	TGB1 & area immediately west.	Breach of temporary OC line subsequent to temp mod installation.	5	N	N	
30	OPGP03-ZH-0006 Form 1 (Spill Event Report)	OC	12/10/1993	Next to Cold Chemistry Lab. Unit not specified.	OC water to ground from breakdown of temporary OC piping.	200	Y	N	
31	CR 07-4505	OC	3/26/2007	West of U2 AFWST, south of the Turbine Lube Oil Reservoir & north of the decon slab. GPS coordinates listed in CR.	Discharge of OLACW when placing temp mod for ILRT Compressor Equipment in service. The spill originated from 4 hose couplings on a straight line between the Lube Oil Reservoir and the decon slab.	8	N	Y	H3 = 3.26E-7 No gamma activity
32	OPGP03-ZH-0006 Form 1 (Spill Event Report)	OW	9/8/1993	Temporary sludge dewatering skid near OWTS.	Unprocessed oil sludge discharge due to hose rupture.	200	Not documented	N	
33	OPGP03-ZH-0006 Form 1 (Spill Event Report)	OW	11/2/1993	West of SOST.	Oil and oily sludge from hose rupture.	6	Y	N	
34	WAN94006358 Activity No. 201772	OW	On or about 03/02/1994	N side of MCR dike, W of CWI.	Outfall 201 (OWTS) discharge line break.	Not documented	Not documented	N	
35	OPGP03-ZH-0006 Form 1 (Spill Event Report) CR 95-9020	OW	7/15/1995	Proximal to the OWTS Gross Oil Separator outside the curbed area.	Oil/water mixture.	30	Y	N	

TABLE 6-1  
SUMMARY OF HISTORIC RELEASES, LEAKS, AND SPILLS<sup>2,4</sup>

CONCEPTUAL SITE MODEL FOR UNITS 1 AND 2  
GROUNDWATER PROTECTION INITIATIVE  
STPEGS, WADSWORTH, TEXAS

Line No.	Reference(s) <sup>3</sup>	System	Date(s)	Location	Description	Release Quantity (Gallons)	Recovered/ Remediated <sup>1</sup>	4QQ Code <sup>5</sup>	Comments.
36	CR 96-4619	OW	4/23/1996	OW Flowmeter.	Oily waste effluent.	2 GPM	Not documented	N	
37	SPR 890888 CR 90-2	ST	12/22/1989 to 12/26/1989	Vicinity of the WSWTS effluent tank.	Effluent tank overflow to storm drain system due to frozen discharge line.	58,000	N	N	
38	SPR 900041 CR 90-75	ST	1/21/1990	Vicinity of the WSWTS effluent tank.	Effluent tank overflow to storm drain.	200	N	N	
39	CR 94-543 SPR 940062	ST	1/10/1994	S of U1 TSC Diesel Generator	Sanitary Lift Station overflow. Overflow consisted of grey water from Bldg. 26 laundry and showers.	Not documented	Not documented	N	
40	Activity No. 305448	ST	On or about 08/12/1994	Approx. 50 ft. S of U1 TSC Diesel Generator	Broken line on abandoned sanitary lift station. Effluent consisted of "soapy water."	Not documented	Not documented	N	
41	CR 97-11831 WAN110884	ST	7/21/1997	Vicinity of fire hydrant N of Bldg. 52.	Sewer line discharge (appeared to be mainly HVAC condensate) from section of pipe inadvertently removed during excavation for fire water line repair.	Not documented	Y	N	
42	Environmental/Radio active Waste Log Book, p. 99.		1/9/1990	Vicinity of U2 Auxiliary Feedwater Pump Seal Tank.	Aux Feedwater Pump Seal Tank overflow.	Not documented	Y	N	

**TABLE 8-1**  
**SUMMARY OF HISTORIC RELEASES, LEAKS, AND SPILLS<sup>2,4</sup>**

**CONCEPTUAL SITE MODEL FOR UNITS 1 AND 2**  
**GROUNDWATER PROTECTION INITIATIVE**  
**STPEGS, WADSWORTH, TEXAS**

Line No.	Reference(s) <sup>3</sup>	System	Date(s)	Location	Description	Release Quantity (Gallons)	Recovered/ Remediated <sup>1</sup>	4QQ Code <sup>5</sup>	Comments.
43	Environmental/Radio active Waste Log Book, p. 117. CR 92-236 CR 92-1068		4/11/1992	AFWST1 vicinity.	U1 AFWST overflow to storm drain.	<16,000	Y	N	Removal completed 4/13/92.
44	0PGP03-ZH-0006 Form 1 (Spill Event Report) CR 94-655 SPR 940232	CD	1/31/1994	Area between TGB1 & IVC1. Also to storm drain southwest of U1 AFWST.	LWPS Condensate Return Tank overflow.	1000	Not documented. Spill Gates closed.	N	
45	0PGP03-ZH-0006 Form 1 (Spill Event Report)		2/7/1994	East of U1 TGB Startup Feed Pump	Feedwater from seal on U1 Startup Feed Pump	140	Y	N	
46	0PGP03-ZH-0006 Form 1 (Spill Event Report)		5/15/1994	West of U1 Cold Chemistry Lab	Overflow of condensate/feedwater from U1 Cold Chemistry Lab Sump overflow.	15	Not documented	N	
47	CR 94-1297 SPR 941309		6/25/1994	Area between U2 Feedwater Heater No. 21 to Storm Drain N-7.	Feedwater from FWH21 Relief Valve.	5	Y	N	
48	0PGP03-ZH-0006 Form 1 (Spill Event Report)		1/3/1996	U1 Startup Feed Pump.	U1 Startup Feed Pump inboard seal leakoverflowed pump berm.	200	Y	N	
49	CR 98-16185		10/13/1998	Radwaste Yard south of U2 MAB on asphalt area.	Washwater leakage from temporary Health Physics Ozone Laundry Trailer.	5	Y	N	Cs-137 = 4.95E-8 µCi/mL Co-58 = 2.37E-6 µCi/mL Co-60 = 2.61E-7 µCi/mL Mn-54 = 7.72E-8 µCi/mL

Rev. 1

SUMMARY OF HISTORIC RELEASES, LEAKS, AND SPILLS<sup>2,4</sup>CONCEPTUAL SITE MODEL FOR UNITS 1 AND 2  
GROUNDWATER PROTECTION INITIATIVE  
STPEGS, WADSWORTH, TEXAS

Line No.	Reference(s) <sup>3</sup>	System	Date(s)	Location	Description	Release Quantity (Gallons)	Recovered/ Remediated <sup>1</sup>	4QQ Code <sup>5</sup>	Comments.
50	CR 03-5029	CT	3/30/2003	U1 SMUT storm drain to Main Spill Gate area.	U1 SMUT pumped to storm drain system.	6000	Y	N	
51	CR 07-14271		9/24/2007	U1 Radwaste Yard	Leakage of rainwater from metal box containing non-rapid head stand extension shield door when being re-located in Radwaste Yard	1	N	Y	Co-58 = 7.647E-5 (water from the box). No detectable contamination in spill area
52	CR 09-7831	SB	5/17/2009	Outside U2 Truck Bay doors on east side of MAB.	Feedwater from Steam Generator Blowdown System from leak on the flange of the SGBD 21A Resin Fill line that overflowed the Truck Bay sump.	100	Y	Y	H-3 = 7.29E-5. No licensed material detected. All but approx. $\leq 2$ gallons to soil recovered.

<sup>1</sup>Standard station protocol is, and has historically been, to recover any standing liquid for return to the appropriate wastewater treatment system.

<sup>2</sup>Criteria for listing:

1. Excludes non-radiological chemical and petroleum spills.
2. Excludes spills to engineered containment.
3. Includes spills to surface/subsurface soils of radioactive liquid waste effluents and secondary effluents.
4. For U1 secondary effluents, excludes spills prior to 1991. (No continuous release prior to that date w/ exception of A/B in 4<sup>th</sup> quarter of 1989).
5. For U2 secondary effluents, excludes spills prior to 4<sup>th</sup> quarter of 1989. (No continuous release prior to that date.)
6. Limited to sources listed in 06-3826-7 as follows (plus WSWTS sanitary waste [ST] and miscellaneous other secondary water sources(e.g. CT, CD, etc.)):
  - Total Dissolved Solids Tank Discharge [CP1, CP2]
  - LWPS (Liquid Radwaste Processing System) [WL]
  - OLACW (Open-Loop Cooling Water System) [OC]
  - CW (Circulating Water System) [CW]
  - Blowdown (Main Cooling Reservoir Blowdown) [MC]
  - OW (Oily Waste Treatment System) [OW]

<sup>3</sup>Documents reviewed:

1. Integrated Spill Contingency Plan for the South Texas Project Electric Generating Station; October 2006. STI: 32017883.
2. Oil and Hazardous Material Spill Contingency Plan for South Texas Project Electric Generating Station; February 1989. STI: 169110.
3. Industrial Storm Water Pollution Prevention Plan for the South Texas Project Electric Generating Station; Multi-Sector General Permit No. TXR05P472; November 2006.
4. Condition Report No. 03-3951: Evaluation of Life Cycle Management Study Recommendations for Buried Pipe Systems.
5. Correspondence ST-HL-FD-341; Administrative Order Docket No. VI-91-0212; October 1, 1991. STI: 1070839.
6. Condition Reports
7. Work Packages
8. Environmental Office Files

<sup>4</sup>Information included in this compilation represents a good faith effort to provide a comprehensive list from documented sources as of 04/30/2008. Rev. 1 updates this list through 5/17/2009. This list may be amended when necessary to incorporate additional information, if applicable, upon discovery or as otherwise identified.

<sup>5</sup>10 C.F.R. §50.75(g) decommissioning item. This column represents whether a condition report, where applicable, is so coded as of the date of this evaluation.

**TABLE 7-1  
SUMMARY OF MONITORING WELLS WITHIN THE PROTECTED AREA**

**CONCEPTUAL SITE MODEL FOR UNITS 1 AND 2  
GROUNDWATER PROTECTION INITIATIVE  
STPEGS, WADSWORTH, TEXAS**

Well ID	Protective Casing		Well Material		Completion	Notes
	Stand Pipe	Lid	Riser	Cap		
MW-204	See Notes	See Notes	See Notes	See Notes	See Notes	Could not find well in field
MW-205	See Notes	See Notes	See Notes	See Notes	See Notes	Could not find well in field
MW-206	See Notes	See Notes	See Notes	See Notes	See Notes	Could not find well in field
MW-201C	See Notes	See Notes	See Notes	See Notes	See Notes	Could not find well in field
MW-201E	6" Steel	yes	1.5" ID PVC	none	Flushmount Completion	Well annulus filled with spiders and debris
MW-203C	6" Steel	yes	1.5" ID PVC	yes	Flushmount Completion	PVC Cap with breathing slit, not water-tight
MW-203E	6" Steel	yes	1.5" ID PVC	yes	Flushmount Completion	PVC Cap with breathing slit, not water-tight
MW-218C	none	none	1.5" ID PVC	yes	Stickup (approx 1.5 ft above ground surface)	
MW-218E	none	none	1.5" ID PVC	yes	Stickup (approx 0.5 ft above ground surface)	
MW-220C	6" ID steel	none	1.5" ID PVC	yes	Flushmount Completion (extending approx 0.5 ft above ground surface)	PVC Cap with breathing slit, not water-tight
MW-220E	6" ID steel	yes	2" ID PVC	yes	Flushmount Completion (extending approx 0.5 ft above ground surface)	PVC Cap with breathing slit, not water-tight
MW-221C	6" ID steel	yes	1.5" ID PVC	yes	Flushmount Completion (extending approx. 0.25 ft above ground surface)	PVC Cap with breathing slit, not water-tight
MW-221E	6" ID steel	yes	1.5" ID PVC	yes	Flushmount Completion	PVC Cap with breathing slit, not water-tight
MW-221H	6" ID steel	yes	1.5" ID PVC	yes	Flushmount Completion	PVC Cap with breathing slit, not water-tight
MW-222C	6" ID steel	yes	1.5" ID PVC	none	Flushmount Completion (extending approx 0.5 ft above ground surface)	
MW-222E	6" ID steel	yes	1.5" ID PVC	none	Flushmount Completion	
MW-222H	6" ID steel	yes	1.5" ID PVC	none	Flushmount Completion	
MW-223C	none	none	2" ID PVC	yes	Stickup (approx 2.5 ft above ground surface)	
MW-223E	none	none	2" ID PVC	yes	Stickup (approx 0.5 ft above ground surface)	
MW-225C	6" ID steel	yes	1.5" ID PVC	yes	Stickup Completion (0.6 ft above ground surface)	PVC extends beyond protective casing
MW-225E	6" ID steel	yes	1.5" ID PVC	yes	Stickup Completion (1 ft above ground surface)	PVC extends beyond protective casing
MW-230C	none	none	1.5" ID PVC	yes	Stickup (approx 0.5 ft above ground surface)	well is only a few inches above grade
MW-230E	none	none	1.5" ID PVC	yes	Stickup (approx 24 ft above ground surface)	
MW-238B	6" ID steel	yes	2" ID PVC	none	Stickup (approx 1.5 ft above ground surface)	Not mapped on plan
MW-241C	6" ID steel	yes	1.5" ID PVC	yes	Flushmount Completion (extending approx 0.5 ft above ground surface)	PVC is broken and may be impacted by soil.
MW-241E	6" ID steel	yes	1.5" ID PVC	yes	Flushmount Completion (extending approx 0.5 ft above ground surface)	Soil around well cap.
MW-243C	6" ID steel	yes	1.5" ID PVC	yes	Flushmount Completion	
MW-243E	6" ID steel	yes	1.5" ID PVC	none	Flushmount Completion (extending approx 0.25 ft above ground surface)	PVC extends beyond protective casing
MW-244C	6" ID steel	none	1.5" ID PVC	none	Flushmount Completion (extending approx 0.1 foot above ground surface)	
MW-244E	12" sch 80 PVC	none	1" ID PVC	none	Stickup Completion (0.7 ft above ground surface)	
MW-245C	6" ID steel	yes	1.5" ID PVC	yes	Flushmount Completion (extending approx 0.25 ft above ground surface)	
MW-245E	6" ID steel	yes	1.5" ID PVC	yes	Flushmount Completion (extending approx 0.1 ft above ground surface)	
MW-273K	12" sch 80 PVC	yes	2" ID PVC	none	Stickup (approx 1.5 ft above ground surface)	Not mapped on site base plan

**Notes:**

ID PVC - Inside Diameter, Schedule 40 polyvinyl chloride

Survey completed on April 20, 2008

Several well-like casings or test wells observed that could be conduits to the water table - along the roadway by the intake system.

No wells are locked, however they are located within the protected area



**TABLE 7-2**  
**TRITIUM RESULTS FROM WELLS WITHIN THE OWNER CONTROLLED AREA**

**CONCEPTUAL SITE MODEL FOR UNITS 1 AND 2**  
**GROUNDWATER PROTECTION INITIATIVE**  
**STPEGS, WADSWORTH, TEXAS**

	Monitoring Test Wells		Piezometer Wells												
	Quarterly Frequency														
	#235 (Well # B-3)	#251 (Well # B-4)	#205 (Well # 446A)	#258 (Well # 435-01)	#259 (Well # 435-02)	#266 (Well # 602A)	#206 (Well # 448)	#255 (Well # 415)	#256 (Well # 417)	#257 (Well # 421-02)	#260 (Well # 437)	#263 (Well # 447)	#264 (Well # 447A)	#267 (Windmill)	#268 (Windmill)
1st Qtr.	0														
2nd Qtr.	2.41E+02														
3rd Qtr.	4.69E+02	0													
4th Qtr.	7.53E+02	0													
1st Qtr.	9.15E+02	5.34E+03													
2nd Qtr.	8.95E+02	5.12E+03													
3rd Qtr.	1.30E+03	6.97E+03													
4th Qtr.	1.71E+03	8.00E+03													
1st Qtr.	1.43E+03	7.21E+03													
2nd Qtr.	3.59E+03	6.15E+03													
3rd Qtr.	2.03E+03	6.80E+03													
4th Qtr.	1.20E+03	6.29E+03													
1st Qtr.	1.85E+03	6.16E+03													
2nd Qtr.	1.80E+03	6.16E+03													
3rd Qtr.	1.84E+03	5.70E+03													
4th Qtr.	1.96E+03	6.04E+03													
1st Qtr.	1.50E+03	6.16E+03													
2nd Qtr.	1.66E+03	6.13E+03													
3rd Qtr.	8.03E+02	5.62E+03													
4th Qtr.	9.02E+02	5.00E+03													
1st Qtr.	4.08E+02	5.62E+03													
2nd Qtr.	2.75E+02	6.01E+03													
3rd Qtr.	6.19E+02	6.01E+03													
4th Qtr.	1.03E+03	6.12E+03													
1st Qtr.	1.15E+03	6.27E+03													
2nd Qtr.	1.01E+03	5.90E+03													
3rd Qtr.	1.25E+03	5.68E+03													
4th Qtr.	1.59E+03	6.25E+03													
1st Qtr.	1.56E+03	5.72E+03													
2nd Qtr.	1.74E+03	5.25E+03	0	0	5.93E+02	0	0	0	0	0	0	0	0	0	0
3rd Qtr.	1.63E+03	5.10E+03	0	0	3.95E+02	0	0	0	0	0	0	0	0	0	0
4th Qtr.	1.12E+03	5.11E+03	0	0	3.48E+02	0	0	0	0	0	0	0	0	0	0
1st Qtr.	5.96E+02	5.25E+03	0	0	3.00E+02	0	0	0	0	0	0	0	0	0	0
2nd Qtr.	5.84E+02	5.12E+03	0	0	2.71E+02	0	0	0	0	0	0	0	0	0	0
3rd Qtr.	6.53E+02	5.58E+03	0	2.86E+02	3.92E+02	0	0	0	0	0	0	0	0	0	0
4th Qtr.	7.38E+02	5.39E+03	0	2.62E+02	2.86E+02	0	0	0	0	0	0	0	0	0	0
1st Qtr.	1.21E+03	5.27E+03	0	0	4.01E+02	0	0				0				
2nd Qtr.	1.02E+03	5.15E+03										0	0		
3rd Qtr.															
4th Qtr.															

Reported by STPEGS  
Concentration in picoCuries per Liter pCi/L

**CONCEPTUAL SITE MODEL FOR UNITS 1 AND 2  
GROUNDWATER PROTECTION INITIATIVE  
STPEGS, WADSWORTH, TEXAS**

m\NEI Groupwater Initiative\Tables\

**TABLE 7-4**  
**RADIOLOGICAL ANALYTICAL DATA**  
**CONCEPTUAL SITE MODEL FOR UNITS 1 AND 2**  
**GROUNDWATER PROTECTION INITIATIVE**  
**STPEGS, WADSWORTH, TEXAS**

Analysis Type	Total Analyses / Non-Routine Measurements	Lower Limit of Detection	Indicator Location Mean Range*	Indicator With Highest Annual Mean		Control Locations Range
				Location Information	Mean Range*	
Tritium (Hydrogen - 3)	27 / 0	2.70E+02	2.0E+03 (19/27)	MW-251 (4 miles SSE)	5.3E+03 (6 / 6) (5.0E+03 to 5.8E+03)	No Samples
Iodine - 131	27 / 0	5.30E+00	-- (0 / 27)	--	--	No Samples
Cesium - 124	27 / 0	2.10E+00	-- (0 / 27)	--	--	No Samples
Cesium, - 137	27 / 0	2.20E+00	-- (0 / 27)	--	--	No Samples
Manganese - 54	27 / 0	2.10E+00	-- (0 / 27)	--	--	No Samples
Iron - 59	27 / 0	5.00E+00	-- (0 / 27)	--	--	No Samples
Cobalt-58	27 / 0	2.30E+00	-- (0 / 27)	--	--	No Samples
Cobalt-60	27 / 0	2.30E+00	-- (0 / 27)	--	--	No Samples
Zinc-65	27 / 0	5.20E+00	-- (0 / 27)	--	--	No Samples
Zirconium - 95	27 / 0	3.90E+00	-- (0 / 27)	--	--	No Samples
Niobium - 95	27 / 0	2.30E+00	-- (0 / 27)	--	--	No Samples
Lanthanum -140	27 / 0	4.90E+00	-- (0 / 27)	--	--	No Samples
Berium - 140						

**Notes:**

All data reported in picoCuries per Liter.

\*-- Number of positive measurements / total measurements at specified locations.

**TABLE 10-1  
SUMMARY OF PROPOSED MONITORING WELLS**

**CONCEPTUAL SITE MODEL FOR UNITS 1 AND 2  
GROUNDWATER PROTECTION INITIATIVE  
STPEGS, WADSWORTH, TEXAS**

Location Identification	Exploration Location Description	Target Screened Interval	Proposed Depth(s)	Rationale
MW-801	~30 feet east of TDS line for Unit 1.	Screened interval to be installed to intersect the water table	30 feet bgs	Obtain data on groundwater quality downgradient to the TDS tanks and piping.
MW-802	~30 feet east of TDS line for Unit 1.	Well to be installed to intersect the water table	30 feet bgs	Obtain data on groundwater quality downgradient of the TDS lines.
MW-803	~100 feet east of TDS line for Unit 1.	Well to be installed to intersect the water table	30 feet bgs	Obtain data on groundwater quality downgradient of the TDS lines and condensate discharge pipes.
MW-804	~500 feet north of Units 1 and 2	Groundwater monitoring well	300 feet bgs	Obtain data on groundwater quality from the deep aquifer, below Units 1 and 2. Well to be installed only if groundwater data in lower portion of shallow aquifer contain elevated radionuclides.
MW-805L and U	~1,100 feet west of MCR at property boundary.	Paired groundwater monitoring wells: shallow (U) well set to intersect the water table; deeper (L) well to be set at the same interval as the existing MW-258	30 feet bgs and 50 feet bgs	Obtain data to better delineate the extent of tritium impacted groundwater west of the MCR.

**Notes.**

bgs – below ground surface

MCR – Main Cooling Reservoir

TDS – Total Dissolved Solids

## APPENDIX A

**APPENDIX A**

**SPECIFICATIONS FOR PIEZOMETER AND  
GEOTECHNICAL INSTRUMENTATION INSTALLATION**

STI# 364606

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SPECIFICATION  
FOR  
MAIN COOLING RESERVOIR  
PRESSURE RELIEF WELL AND PIEZOMETER INSTALLATION  
9Y510HS1018  
FOR THE  
HOUSTON LIGHTING & POWER COMPANY  
SOUTH TEXAS PROJECT ELECTRIC GENERATING STATION


1	02-24-87	Incorporated SCN Nos. 1 & 2 and Issued for Construction Contract	PAJ	QA	WDS	N.A.	EA	KTB	N.A.		
0	11-3-86	Issue for Proposal Invitation	WDS	WDS	WDS	N.A.	WDS	WDS	N.A.		
No.	DATE	REVISIONS	BY	CHK	EGS	C.ENG	POE	PE	QA		
HOUSTON AREA OFFICE				SOUTH TEXAS PROJECT ELECTRIC GENERATING STATION							
			JOB No. 14926								
			9Y510HS1018								
			SHEET 1 OF 11								

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APPENDICES

- A Engineering Document Requirements (G-321-E)
- B Quality Verification Document Requirement (G-321-V)

ATTACHMENTS

- 1. Specification for Pressure Relief Well and Piezometer Installation  
- Main Cooling Reservoir 1534Q  
prepared by Harza Engineering Company under  
Technical Services Contract 8004
- 2. Installation Checklist/Witness Points for Relief Wells
- 3. Installation Checklist/Witness Points for Reservoir Piezometers



**1.0     SCOPE OF WORK**

**1.1     GENERAL**

This specification covers work related to (i) piezometer installation and (ii) construction of new relief wells in the vicinity of the Main Cooling Reservoir embankment (1986-87 program) for the South Texas Project under technical direction from Harza Engineering Company.

**1.2     ITEMS INCLUDED**

The work includes furnishing of labor, supervision, materials, tools, and equipment and performance of all operations necessary for (a) construction of relief wells and (b) installation of piezometers including, but not limited to, the following:

- A.   Installation of replacement and/or additional relief wells including manholes, discharge pipes, and other surface fixtures as necessary.
- B.   Installation of piezometers including surface fixtures.
- C.   Furnishing materials and chemicals to accomplish Items A and B above.
- D.   Performing tests or taking measurements related to this work as described in this document or as requested by Reservoir Construction Engineer. This will include implementation of testing for development of relief wells and pumping/drawdown tests.
- E.   Haul water from sources approved by Bechtel to work areas as required.
- F.   Maintaining and submittal of data as specified.
- G.   Break out and replacement of existing concrete lining slabs and splash pads, as necessary, for discharge pipes and related accessories.
- H.   Constructing splash pads for relief wells.
- I.   Disposal of effluent from construction, development and testing efforts, as directed by Bechtel.

**1.3 ITEMS NOT INCLUDED**

- A. Obtaining permission for access and right-of-way.
- B. Survey work for locating relief wells.
- C. Geological investigations except as specified.
- D. Arranging for source of water.

**1.4 DEFINITIONS AND ABBREVIATIONS**

- A. Reservoir Construction Engineer - Harza Engineering Company (TSC-T017) retained by the Owner for providing on-site technical direction to the Contractor.
- B. Site Engineering Manager (SEM) - Bechtel Construction management at the STP jobsite.
- C. On-Site Testing Agency - Pittsburgh Testing Laboratories at the STP job site.
- D. MCR - 7000 acre Main Cooling Reservoir at the STP project site.

**2.0 QUALITY STANDARDS**

**2.1 GENERAL**

The Contractor shall control the quality of items and services to meet the requirements of this specification and the listed codes, specifications and standards applicable to the extent referenced within the text of this specification and its attachment(s).

**3.0 SUBMITTALS**

The Contractor shall submit documentation related to this work per the requirements of this specification and attachment(s).

**3.1 STANDARD FORMS**

Engineering and quality verification document requirements are summarized and scheduled on Form G-321-E (Engineering) and Form G-321-V (Quality Verification) as applicable and augmented by detailed requirements in this specification and attachment(s).

### 3.2 ENGINEERING DOCUMENTS

- A. The Contractor shall submit a proposed work schedule for Bechtel's review and approval prior to start of work.
- B. The Contractor shall submit with its proposal a list of similar work previously performed.
- C. At the end of work on each relief well and piezometer, the Contractor shall submit an "as-built" detail for each installation.
- D. During work on each relief well and piezometer, the Contractor shall fill out the applicable checklist/witness forms (Attachments 2 and 3). The completed forms, including the necessary signatures from the Reservoir Construction Engineer shall be forwarded per the requirements of the G-321-E form at the end of work on each relief well and piezometer.

### 3.3 QUALITY VERIFICATION DOCUMENTS

The Contractor shall submit a material certificate of compliance certifying that all materials and workmanship meet the requirements of this technical specification:

#### 4.0 MATERIALS

See Attachment 1.

#### 4.1 STOCKPILING OF MATERIALS

The Contractor shall stockpile different construction materials in separate, neat, identifiable piles at locations designated by Bechtel.

Materials not meeting the requirements of this specification and rejected by Bechtel shall be promptly removed from site by the Contractor.

#### 5.0 RELIEF WELL INSTALLATION/MODIFICATION

Construction work for installation of relief wells around MCR embankment shall be performed in accordance with the attachments under the technical direction of the Reservoir Construction Engineer.

#### 6.0 PIEZOMETER INSTALLATION

Construction work for installation of piezometers around MCR embankment shall be performed in accordance with the attachments under the technical direction of the Reservoir Construction Engineer.

7.0 SURVEY WORK

Surveyed locations of the piezometers and relief wells will be provided to the Contractor along with a vertical reference point for each location. Additional survey work required for performing this work shall be done by the Contractor.

8.0 MEASUREMENT FOR PAYMENT

Measurement for payment for all work performed within the scope of this specification shall be on the basis of the applicable sections of Exhibit C of this Contract. Provisions in Exhibit C shall not, however, be considered a limitation to or a modification of the work described in this specification and attachment(s).

## APPENDIX A

SPEC. NO. 9Y510HS1018

REV. NO. 1

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## ENGINEERING DOCUMENT REQUIREMENTS

1. DOCUMENT CATEGORY NUMBER	2. SPECIFICATION PARAGRAPH REFERENCE	3. DOCUMENT DESCRIPTION	4. PERMISSION TO PROCEED REQUIRED		5. SUBMITTAL SCHEDULE	6. QUANTITY REQUIRED		7. NO. OF COPIES	8. REMARKS
			YES	NO		MIN	MAX		
1.1	3.2.C ATTACH 1 SEC. 2.14, SEC. 5.3.1	REPORT & DWGS OF COMPLETED WORK		X	P		3	R	(NOTE 1, 2)
3.0	3.2.D	INSTALLATION CHECKLIST/WITNESS FORM		X	P		3	R	(NOTE 1, 2)
4.1 5.0	3.2A & ATTACH 1 SEC. 2.15	WORK SCHEDULE	X				3	R	SUBMIT WITHIN 5 WORKING DAYS AFTER AWARD. (NOTE 1 & 2)
1.3	ATTACH 1 SEC. 3.8.3	SHOP DWG FOR COVER PLATES	X		F		3	R	(NOTE 1, 2)
30.0	ATTACH 1 SEC. 2.11.3.2F, 5.4.5	DRILL LOG		X	P		3	R	(NOTE 1, 2)
12.0	ATTACH 1 SEC. 5.3.2	DRILLING FLUID DETAILS	X		F		3	R	(NOTE 1, 2)
11.0	ATTACH 1 SEC. 5.5.1	PORE PRESSURE CELL DETAILS		X	F		3	R	(NOTE 1, 2)
					NOTE 1: ADDITIONAL COPY TO HARZA ENGINEERING COMPANY 150 S. WACKER DRIVE CHICAGO, IL 60606				
					NOTE 2: ADDITIONAL COPY TO I. BOOHER CONTRACTS MANAGEMENT GR. STP JOBSITE				

## 9. FORWARD COPIES TO:

BECHTEL ENERGY CORP.  
P.O. BOX 2168  
HOUSTON, TEXAS 77282-2168  
ATTENTION: TECHNICAL DOCUMENT CONTROL

## SPECIAL INSTRUCTIONS

 G-321-F	10.	SOUTH TEXAS PROJECT HOUSTON LIGHTING & POWER COMPANY	11. JOB NO. 14928
			12. SPEC. NO. 9Y510HS1018
		ENGINEERING DOCUMENT REQUIREMENTS	Sheet 1 OF 1

**APPENDIX A  
ENGINEERING  
DOCUMENT CATEGORY DEFINITIONS  
G-321-E - SUP A**

SPEC. NO. 9Y510HS1018  
REV. NO. 1  
PAGE 2 OF 3

(E) Engineering Documents. This term comprises procedures, drawings, specifications, QA plans, prototype qualification test reports, and other similar documents that require Bechtel permission to proceed prior to fabrication, or prior to use of the document on the design, fabrication, installation, or other work progress. The term is also applied to price lists, and instructions for erection/installation, operation, maintenance, and site storage and handling.

**A. DEFINITIONS OF TERMS**

(Note: Standard abbreviated titles follow the category definitions).

**Supplier** - This is a comprehensive term and includes seller, vendor, contractor, subcontractor, subsupplier, etc.

**Original** - The initial document of which copies are made, i.e., handwritten copy, typed copy, printed matter, tracings or drawings and photographs.

**Reproducible** - A master copy which can be truly duplicated by either microreproduction, diazo or electronic process. Diazo copies may be submitted, only if they meet and satisfy Bechtel microfilming requirements.

**Microfilm** - Film containing an image reduced in size from the original and capable of being enlarged to a clear reproduction of the original.

**Permission to Proceed Required** - Bechtel review required prior to use of documents in the design, fabrication, installation, or other work processes.

**Initial** - The first submittal of a document in accordance with the schedule mutually agreed to by Bechtel and the supplier.

**Final** - The submittal that reflects the required resolution of review comments or the complete submittal required. Drawings submitted as final shall show Bechtel's job title, job number, procurement document number, line, equipment, tag or code number and the manufacturer's serial number(s).

**B. SUBMITTAL**

In column 5, Bechtel Engineering to place the following codes where applicable:

F - Before Fabrication  
S - Before Shipment

I - Before Installation  
P - Before Final Payment

W - With Shipment  
D - Before Design

or

Expressed in calendar days after notice of award.

In column 7, Bechtel Engineering to place the following letter as applicable:

M - Microfilm  
R - Reproducible  
O - Original

In column 8, supplier to indicate its schedule if different than shown, and agreed with by Bechtel.

**C. DISTRIBUTION**

Items and/or documents required to be provided by the G-321-E shall be forwarded to the Bechtel Engineering designated under entry No. 9, "Forward Copies To."

**D. DOCUMENT CATEGORY NUMBERS & ABBREVIATED DESCRIPTIONS**

Engineering Documents are identified and defined as follows:

**1.0 DRAWINGS (DWG)**

- 1.1 Outline Dimensions, Services, Foundations and Mounting Details (OUTLINE DIM, SERVICES & FDN/MTG DETS) - Drawings providing external envelope, including top, centerline(s), location and size for electrical cable, conduit, fluid, and other service connections, isometrics and details related to foundations and mountings.
- 1.2 Assembly Drawings (ASSEMBLY DWGS) - Detailed drawings indicating sufficient information to facilitate assembly of the component parts of an equipment item.
- 1.3 Shop Detail Drawings (SHOP DET DWGS) - Drawings which provide sufficient detail to facilitate fabrication, manufacture, or installation. This includes pipe spool drawings, internal piping and wiring details, cross-section details and structural and architectural details.
- 1.4 Wiring Diagrams (WIRING DIAGS) - Drawings which show schematic diagrams, equipment internal wiring diagrams, and interconnection wiring diagrams for electrical items.
- 1.5 Control Logic Diagrams (CONT LOGIC DIAGS) - Drawings which show paths which input signals must follow to accomplish the required responses.
- 1.6 Piping and Instrumentation Diagrams (P&IDs) - Drawings which show piping system scheme and control elements.

**2.0 PARTS LIST AND COST** - Sectional view with identified parts and recommended spare parts for one year's operation or specified with unit cost.

**3.0 COMPLETED BECHTEL DATA SHEETS (COMP DATA SHT)** - Information provided by a supplier on data sheets furnished by Bechtel.

# APPENDIX A

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PAGE 3 OF 3

## 4.0 INSTRUCTIONS

- 4.1 Erection/Installation (EREC/INSTL) - Detailed written procedures, instructions, and drawings required to erect or install material or equipment.
- 4.2 Operating - Detailed written instructions describing how an item or system should be operated.
- 4.3 Maintenance - Detailed written instructions required to disassemble, reassemble and maintain items or systems in an operating condition.
- 4.4 Site Storage and Handling (SITE STOR & HDLG) - Detailed written instructions which define the requirements and time period for lubrication, rotation, heating, lifting or other handling requirements to prevent damage or deterioration during storage and handling at jobsite. This includes return shipping instructions.

5.0 SCHEDULES: ENGINEERING AND FABRICATION/ERECTION (SCHED) (ENGRG & FAB EREC) - Bar charts or critical path method diagrams which detail the chronological sequence of activities.

6.0 QUALITY ASSURANCE MANUAL/PROCEDURES (QA MNL/PROC) - The document(s) which describe(s) the planned and systematic measures that are used to assure that structures, systems, and components will meet the requirements of the procurement documents.

7.0 SEISMIC DATA REPORT - The analytical or test data which provides data and demonstrates suitability of material, component or system in relation to the conditions imposed by the stated seismic criteria.

8.0 ANALYSIS AND DESIGN REPORT (ANAL & DSGN RPRT) - The analytical data (stress, electrical loading, fluid dynamics, etc.) which demonstrates that an item satisfies specified requirements.

9.0 ACOUSTIC DATA REPORT (ACST DATA RPRT) - The noise, sound and other acoustic vibration data required by the procurement document.

## 10.0 SAMPLES

10.1 Typical Quality Verification Documents (TYP QUAL VERIF DOC) - A representative data package which will be submitted for the items furnished as required in the procurement documents.

10.2 Typical Material Used (TYP MAT USED) - A representative example of the material to be used.

11.0 MATERIAL DESCRIPTION (MAT DESCRT) - The technical data describing a material which a supplier proposes to use. This usually applies to architectural items, e.g., metal siding, decking, doors, paints, coatings.

12.0 WELDING PROCEDURES AND QUALIFICATIONS (WLOG PROC & QUALF) - The welding procedure, specification and supporting qualification records required for welding, hard facing, overlay, brazing and soldering.

13.0 MATERIAL CONTROL PROCEDURES (MATERIAL CONT PROC) - The procedures for controlling issuance, handling, storage and traceability of materials such as weld rod.

14.0 REPAIR PROCEDURES (REPAIR PROC) - The procedures for controlling material removal and replacement by welding, brazing, etc., subsequent thermal treatments, and final acceptance inspection.

15.0 CLEANING AND COATING PROCEDURES (CLNG & CTG PROC) - The procedures for removal of dirt, grease or other surface contamination and preparation and application of protective coatings.

16.0 HEAT TREATMENT PROCEDURES (HEAT TR PROC) - The procedures for controlling temperature and time at temperature as a function of thickness, furnace atmosphere, cooling rate and method, etc.

19.0 UT - ULTRASONIC EXAMINATION PROCEDURES (UT PROC) - Procedures for detection of presence and certain characteristics of discontinuities and inclusions in materials by the use of high frequency acoustic energy.

20.0 RT - RADIOGRAPHIC EXAMINATION PROCEDURES (RT PROC) - Procedures for detection of presence and certain characteristics of discontinuities and inclusions in materials by x-ray or gamma ray exposure of photographic film.

21.0 MT - MAGNETIC PARTICLE EXAMINATION PROCEDURES (MT PROC) - Procedures for detection of surface (or near surface) discontinuities in magnetic materials by distortion of an applied magnetic field.

22.0 PT - LIQUID PENETRANT EXAMINATION PROCEDURES (PT PROC) - Procedures for detection of surface discontinuities in materials by application of a penetrating liquid in conjunction with suitable developing techniques.

23.0 EDDY CURRENT EXAMINATION PROCEDURES (EDDY CUR EXAM PROC) - Procedures for detection of discontinuities in material by distortion of an applied electromagnetic field.

24.0 PRESSURE TEST - HYDRO, AIR, LEAK, BUBBLE OR VACUUM TEST PROCEDURE (PRESS TEST - HYDRO, AIR, BUBBLE - VAC TEST PROC) - Procedures for performing hydrostatic or pneumatic structural integrity and leakage tests.

25.0 INSPECTION PROCEDURE (INSPECTION PROC) - Organized process followed for the purpose of determining that specified requirements (dimensions, properties, performance results, etc.) are met.

26.0 PERFORMANCE TEST PROCEDURES (PRFM TEST PROC) - Tests performed to demonstrate that functional design and operational parameters are met.

26.1 Mechanical Tests (MECH TEST) - e.g., pump performance data, valve stroking, load, temperature rise, calibration, environmental, etc.

26.2 Electrical Tests (ELEC TEST) - e.g., impulse, overload, continuity, voltage, temperature rise, calibration, saturation, loss, etc.

27.0 PROTOTYPE TEST REPORT (PROTO TYP TEST REPORT) - Report of a test which is performed on a standard or typical example of equipment or item, and is not required for each item produced in order to substantiate the acceptability of equal items. This may include tests which result in damage to the item(s) tested.

28.0 PERSONNEL QUALIFICATION PROCEDURES (PERSONL QUAL PROC) - Procedures for qualifying welders, inspectors and other special process personnel.

29.0 SUPPLIER SHIPPING PREPARATION PROCEDURE (SPLR SHPNG PREP PROC) - The procedure used by a supplier to prepare finished materials or equipment for shipment from its facility to the jobsite.

30.0 (OPEN)

31.0 (OPEN)

32.0 (OPEN)


## APPENDIX B

Spec. No. 9Y510HS1018

Rev. No. 1

Page 1 of 3

## QUALITY VERIFICATION DOCUMENT REQUIREMENTS

1. Document Category Number	2. Specification Paragraph Reference	3. Document Description	4. Bechtel Release	5. Field Receipt Inspection Check-In	6. Remarks	7. Doc Supplier Page Count
17.4	3.3	MAT. CERT. OF COMPL.				
8. Supplier's Order No.		9. Supplier's Part No.		10. Supplier Part Name		11. Quantity
12. Bechtel's Req Or P.O. #		13. Bechtel's Line/Equip Tag Or Code No.		14. Bechtel's Part Name		15.
16. Supplier's Conformance Statement We certify that the work and required documents meet the requirements of the Procuring Documents.			Authorized Supplier Signature		Title	Date
17. Supplier Quality Representative At Plant Work was released based on satisfactory completion of quality surveillance and review of documentation			<input type="checkbox"/> With Authorized deviations noted in column 6 <input type="checkbox"/> No Deviations		Signature of SQA	Date
18. Receiving Inspection At The Field This form and the quality verification documents referenced herein have been received and their relationship to the hardware items verified.			Signature Of Bechtel Supplier Quality Representative			Date
19. Forward Copies To: <b>Bechtel - STP</b> <b>West Gate FM 521</b> <b>9 Miles West Of Wadsworth, Tx.</b> <b>Attention: Receiving Supervisor</b>						
Special Instructions <b>If Mailed Send to:</b> <b>Bechtel - STP</b> <b>P.O. Box 15</b> <b>Bay City, TX. 77414</b> <b>Attn: Field Supervisor</b>						
 <b>G-321-V</b>		<b>SOUTH TEXAS PROJECT</b> <b>HOUSTON LIGHTING &amp; POWER COMPANY</b>			21. JOB NO. 14926	
					22. SPEC NO. 9Y510HS1018	
QUALITY VERIFICATION DOCUMENT REQUIREMENTS					Sheet 1 of 1	
23. Control No. _____ File No. _____						



**APPENDIX B**  
**INSTRUCTIONS FOR THE PREPARATION OF FORM G-321-V**  
**(QUALITY VERIFICATION DOCUMENT REQUIREMENTS)**

SPEC. NO. 9Y510HS1018  
 REV. NO. 1  
 PAGE 2 OF 3

- A. PURPOSE:** The G-321-V is initially prepared by Bechtel Engineering and completed by the supplier when providing Quality Verification Documents to Bechtel in support of the work. The G-321-V is a multi-purpose form to:
- (1) Transmit quality verification documents from the supplier.
  - (2) Provide a Certificate of Conformance from the supplier.
  - (3) Evidence SQR release of documentation and/or work.
  - (4) Provide evidence of a Field Inspection check of the quality verification documentation received at the installation site.
- B. GENERAL INFORMATION:** Instructions for filling out the G-321-V form is found in Section "E". Category numbers and abbreviated descriptions of the information to be used are found in Section "F". Detailed quality verification document definitions are found in G-321-V Supplement A.
- C. DISTRIBUTION:** Quality verification documents required to be provided by the G-321-V form shall be forwarded to the group(s) and destination(s) designated under entry #19, "Forward copies to".
- D. DEFINITIONS OF TERMS:** (Also see Document Category Definitions G-321-SUP A).  
 Supplier - This is a seller, vendor, contractor, subcontractor, sub-supplier, etc.  
 Reproducible - A master copy which can be legibly duplicated by either microreproduction, diase or electrostatic process.  
 Diase copies may be submitted only if they meet and satisfy Bechtel microfilming requirements.  
 Microfilm - Film containing an image reduced in size from the original, and capable of being enlarged to a clear reproduction of the original.  
 Drawings submitted as final show title, job number, purchase order number, line, equipment, tag or code number and the manufacturer's serial number(s).

**E. BECHTEL ENTRY INSTRUCTIONS:**

Entry No. Information Required

1. Enter Document Category Number.
2. Enter Specification Paragraph Reference.
3. Enter Abbreviated Description Corresponding to the Document Category Number.
4. SQR to Complete Upon Release and Sign On Line 17.
5. Bechtel Field Inspection at the jobsite to Complete Check-in and Sign on Line 18.
6. Enter "Remarks" as appropriate. When a deviation has occurred, reference the deviation(s) and Authorization Document(s) in this column, and include the authorization document(s) in the verification package.
17. Upon inspection and verification with the Supplier Quality Verification Document Package and Associated Deviations, if any, and checking appropriate block, SQR or Authorized Representative signs and dates release.

Entry No. Information Required

18. Upon receipt of the Quality Verification Documentation Package at the jobsite, the Field Inspector will review the documents and the appropriate hardware. If found to be satisfactory, he signs and dates the check-in statement, routes hardware to storage and files the form.
19. Enter name and address to whom items or documents are to be forwarded.
20. Project may pre-print or type Project and Client Identification.
21. Project may pre-print Bechtel Job Number.
22. Enter Specification Number/Number of Sheets to the G-321-V and the Revision.
23. Following SQR Check, the G-321-V is identified and filed in the Jobsite Files, available for eventual turn-over to the Client when required.

**SUPPLIER ENTRY INSTRUCTIONS:**

Entry No. Information Required

7. Enter number of pages of Quality Verification Document being submitted, corresponding to the units being released. Sign Entry 16.
- 8-9-10. Enter information required.
11. Enter the quantity of units covered by the Quality Verification Documents being submitted. For each item No. (Entry 12) being released, provide a separate copy of this completed form and the supporting Quality Verification Documents.
- 12-13-14 Enter information required.

Entry No. Information Required

15. Open - This space to be identified and used for traceability. If or when appropriate enter identification numbers, serial numbers, Heat numbers, etc.
16. Supplier - Signature of an employee of the supplier identified in his QA Manual or by suppliers letter as authorized to sign such documents.
19. Upon Inspection Release the completed Quality Verification Documents are forwarded to the address(es) shown. A completed copy of Form G-321-V shall accompany the hardware with an additional copy forwarded to the Field Inspector at the site.

**F. DOCUMENT CATEGORY NUMBERS & ABBREVIATED DESCRIPTIONS:**

Quality-Verification Documents are identified as follows and defined in G-321-V-Supplement A.

- |  |  |
|--|--|
| <p>12.0 WELDING VERIFICATION DOCUMENTS (WELD &amp; QUALIF VERIF DOC)</p> <p>14.0 MAJOR REPAIR VERIFICATION REPORTS (MAJ REPAIR VERIF RPRT)</p> <p>15.0 CLEANING AND COATING VERIFICATION REPORTS (CLNG &amp; CTG VERIF RPRT)</p> <p>16.0 HEAT TREAT REPORTS (HEAT TRT VERIF RPRT)</p> <p>17.0 MATERIAL PROPERTY REPORTS (MAT TEST RPRT)</p> <p>17.1 MTR Material Test Reports (MAT TEST RPRT)</p> <p>17.2 Impact Test Data (IMP TEST DATA)</p> <p>17.3 Ferrite Data (FERRITE DATA)</p> <p>17.4 Material Certificate of Compliance (MAT CERT OF COMPL)</p> <p>17.5 Electrical Property Reports (ELEC PROP RPRT)</p> <p>18.0 CODE COMPLIANCE (CODE COMPL)</p> <p>19.0 UT - Ultrasonic Examination and Verification Reports (UT - REPORT)</p> | <p>20.0 RT - Radiographic Examination and Verification Reports (RT - REPORT)</p> <p>21.0 MT - Magnetic Particle Examination and Verification Reports (MT - REPORT)</p> <p>22.0 PT - Liquid Penetrant Examination and Verification Reports (PT - REPORT)</p> <p>23.0 Eddy Current Examination and Verification Reports (EDDY CUR EXAM &amp; VERIF REPORT)</p> <p>24.0 Pressure Test - Hydro, Air, Leak, Bubble or Vacuum Test and Verification Reports (PRESS TEST) (HYDRO, AIR, BUBBLE - VAC TEST &amp; VERIF REPORT)</p> <p>25.0 Inspection and Verification Reports (INSP &amp; VERIF RPRT)</p> <p>26.0 Performance Test and Verification Reports (PRFM TEST REPORT)</p> <p>26.1 Mechanical Test (MECH TEST)</p> <p>26.2 Electrical Test (ELEC TEST)</p> <p>27.0 Prototype Test Report (PROTO TYP TEST REPORT)</p> |
|--|--|

# **APPENDIX B** **QUALITY VERIFICATION** **DOCUMENT CATEGORY DEFINITIONS** **G-321-V - SUP A**

- (IV) **Quality Verification Documents.** This term comprises material test reports, heat treatment charts, welding records, NDE results, performance test reports, and similar document(s), which demonstrate or certify conformance to the technical or inspection requirements of the procurement documents.
- 12.0 WELDING QUALIFICATION VERIFICATION REPORTS -** A verification report of welds performed including the identification of the qualified weld(s), and certification that the weld(s) were qualified.
- 13.0 MATERIAL VERIFICATION REPORTS -** Reports relative to material which confirm, substantiate or assure that an activity or condition has been implemented in conformance with code and material specifications imposed by the procurement documents.
- 14.0 MAJOR REPAIR VERIFICATION REPORTS -** Verification reports may include weld repair locations (maps), material test reports for filler metal, pre- and post-weld heat treatment records, NDE records, etc. The resolution of whether a repair is major or not is a Bechtel responsibility.
- 15.0 CLEANING AND COATING VERIFICATION REPORTS -** Verification reports include certification of visual examination for surface preparation, surface profile, materials, etc., humidity data, temperature data and coating thickness data as required by the procurement documents.
- 16.0 HEAT TREAT REPORTS -** Verification reports normally include furnace charts or similar records which identify and certify the item(s) treated, the procedure used, furnace atmosphere, time at temperature, cooling rate, etc.
- 17.0 MATERIAL PROPERTY REPORTS**
- 17.1 MTP (Material Test Reports) -** These reports include all chemical, physical, mechanical, and electrical property test data required by the material specification and applicable codes. This is applicable to cement, concrete, metals, cable jacket materials, rebar, rebar splices, etc.
  - 17.2 Impact Test Data -** Results of Charpy or drop weight tests including specimen configuration, test temperature and fracture data.
  - 17.3 Ferrite Data -** Report of the ferrite percentage for stainless steel materials used, including castings & welding filler metals as deposited.
  - 17.4 Material Certificate of Compliance -** Verification document which certifies conformance to the requirements of the applicable material specification.
  - 17.5 Electrical Property Reports -** Report of electrical characteristics, e.g., dielectric, impedance, resistance, flame tests, corona, etc.
- 18.0 CODE COMPLIANCE -** Verifying documents (such as data Forms U-1, M-2, State, etc.), which are prepared by the manufacturer or installer and certified by the Authorized Code Inspector.
- 19.0 UT - ULTRASONIC EXAMINATION AND VERIFICATION REPORTS -** Examination results of presence and certain characteristics of discontinuities and inclusions in material by the use of high frequency acoustic energy.
- 20.0 RT - RADIOGRAPHIC EXAMINATION AND VERIFICATION REPORTS -** Examination results of presence and certain characteristics of discontinuities and inclusions in materials by x-ray or gamma-ray exposure of photographic film.
- 21.0 MT - MAGNETIC PARTICLE EXAMINATION AND VERIFICATION REPORTS -** Examination results of surface (or near surface) discontinuities in magnetic materials by distortion of an applied magnetic field.
- 22.0 PT - LIQUID PENETRANT EXAMINATION AND VERIFICATION REPORTS -** Examination results of surface discontinuities in materials by application of a penetrating liquid in conjunction with suitable developing techniques.
- 23.0 EDDY CURRENT EXAMINATION AND VERIFICATION REPORTS -** Examination results of discontinuities in material by distortion of an applied electromagnetic field.
- 24.0 PRESSURE TEST - HYDRO, AIR, LEAK, BUBBLE OR VACUUM TEST AND VERIFICATION REPORTS -** Results of hydrostatic or pneumatic structural integrity and leakage tests.
- 25.0 INSPECTION AND VERIFICATION REPORTS -** Documented findings resulting from an inspection.
- 26.0 PERFORMANCE TEST AND VERIFICATION REPORTS -** Report of test results.
- 26.1 Mechanical Tests, e.g., pump, performance data, valve stroking, load, temperature rise, calibration, environment, etc.**
  - 26.2 Electrical Tests, e.g., load, impulse, overload, continuity, voltage, temperature rise, calibration, saturation, loss, etc.**
- 27.0 PROTOTYPE TEST REPORT -** Report of the test which is performed on a standard or typical example of equipment, material or item, and is not required for each item produced in order to substantiate the acceptability of equal items. This normally includes tests which may, or could be expected to, result in damage to the item(s) tested.
- 33.0 (OPEN)**
- 34.0 (OPEN)**
- 35.0 (OPEN)**

BECHTEL ENERGY CORPORATION

SOUTH TEXAS PROJECT

TECHNICAL SPECIFICATIONS 1534Q

FOR

PRESSURE RELIEF WELL AND PIEZOMETER INSTALLATION

MAIN COOLING RESERVOIR EMBANKMENT

Prepared by

HARZA ENGINEERING COMPANY

ATTACHMENT TO BECHTEL SPECIFICATION NO. 9Y510HS1018

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**FIGURES**

<u>Drawing Number</u>	<u>Title</u>
1534Q-3-01	Site Location Map
1534Q-3-02	Pressure Relief Well Installation
1534Q-3-03	Piezometer Installation

1.0 STATEMENT OF WORK

1.1 DESCRIPTION OF WORK

The work consists of the construction of pressure relief wells and piezometers for the Main Cooling Reservoir of the South Texas Project.

1.2 PRINCIPAL ELEMENTS OF WORK

The work to be performed includes the following principal features:

1. Drilling Relief Wells and Piezometers.
2. Installation of Well and Piezometer Pipe.
3. Backfilling Around Well and Piezometer Pipes.
4. Development of Relief Wells.
5. Test Pumping of Relief Wells.
6. Access and Well Outlet Construction.



## 2.0 PRESSURE RELIEF WELLS

### 2.1 SCOPE OF WORK

The work to be performed under this section consists of furnishing all plant, labor, materials and equipment required to construct, develop, and test the pressure relief wells in accordance with these specifications and applicable drawings. The pressure relief wells shall consist of a screen penetrating the pervious foundation stratum and discharging through a riser and discharge pipe as specified herein and indicated on the drawings.

### 2.2 REFERENCED CODES AND STANDARDS

The following Codes and Standards have been referenced here:

1. ASTM D2564-80 Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
2. ASTM C150-85 Standard Specification for Portland Cement.
3. ASTM C76-85a Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
4. ASTM D422-72 Particle Size Analysis of Soils.

### 2.3 SUBMITTALS

2.3.1 The Contractor shall make the following submittals for approval prior to commencing work.

1. A complete plan for accomplishing the work in connection with the relief wells.
2. Full details of the method and equipment he proposes to use for centering and holding the well pipe.

2.3.2 The Contractor shall submit the following at the completion of each hole:

A complete soil log of each relief well boring and an as-built relief well installation sketch.

### 2.4 GENERAL

#### 2.4.1 Location

The location, number and design depths of the wells will be approximately as shown on the drawings. The exact location and

depth of each well will be established in the field by the Resident Construction Engineer (RCE). All wells shall have outlets as shown on the drawings.

#### 2.4.2 Disposal of Effluents

Water used for drilling, developing, and testing pressure relief wells may be discharged into the Main Cooling Reservoir (MCR) unless directed otherwise. The Contractor shall use temporary piping to carry the effluents into the reservoir without causing erosion or damage to the embankment or other structures.

#### 2.4.3 Depth of Well

The design depths listed in the schedule indicate the approximate lengths of well screen and riser pipe required for each well. The well hole shall be drilled at least 2-feet deeper than the bottom elevation of the well screen. The top of the well screen generally will be placed at the top of pervious sand stratum. The actual depth to which the well shall be drilled and the lengths and spacing of slotted and unslotted pipe to be assembled for each well will be determined by the RCE in the field.

#### 2.4.4 Obstructions Encountered

If obstructions are encountered in the foundation which are such as to render it impracticable to advance the drill hole to the design depth, the depth will be adjusted, if so directed, in order to utilize the well in the final system at the depth actually obtained. The Contractor may be directed to abandon the well, plug the hole by backfilling with suitable material as prescribed in subsection 2.12.2 and construct another well at an adjacent site. Where obstructions are encountered, drilling shall be continued until it is demonstrated that further efforts to advance the drill hole are impracticable. Such demonstration shall include, but not be limited to continuing drilling operations when no gain in depth is being made for a minimum of 15 minutes. Wells which are abandoned because of impracticability of completion to the desired depth will be paid for to the extent specified in the contract. Payment will not be made for the wells for which abandonment is necessitated by faulty operation or neglect of the Contractor.

#### 2.4.5 Delay of Work

In the event the Contractor is prevented from surging, developing and/or test pumping any well because the groundwater level is drawn down lower than the top of the well screen, work on that well shall be suspended, and shall not be resumed until the groundwater level has risen above the top of the well screen, in accordance with subsection 2.11.3.

## 2.5 WELL SCREEN AND RISER PIPE

Well screen and riser pipe shall be 6 inch inside diameter, flush joint, schedule 40 PVC pipe. The riser and screen section shall be joined with solvent cement meeting ASTM Standard D2564-80. The bottom of the well screen shall be plugged with a PVC cap cemented in place. Screen openings shall be uniform in size and pattern, and shall be spaced approximately equally around the circumference of the pipe. The width of the slots shall be .050 inch plus or minus 0.005 inch. The number of slots shall be such as to provide a total slot area of not less than 30 square inches per linear foot of screen.

## 2.6 WELL FILTER

Material approved for the filter around the well screen and riser pipe shall be a washed sand composed of hard, tough, and durable particles free from adherent coatings. It shall contain no vegetable matter nor soft, friable, thin, or elongated particles in appreciable quantities and shall meet the following gradation requirements.

<u>U.S. Standard Sieve No. (ASTM D422-72)</u>	<u>Percent Passing by Weight</u>
3/8 inch	100
4	90-100
8	70-90
16	30-55
30	10-25
50	0-10
100	0-3

Materials shall be uniformly graded between the limits specified above. All points on individual grading curves obtained from representative samples of filter material shall lie between the boundary limits as defined by smooth curves drawn through the tabulated grading limits plotted on a mechanical analysis diagram. The individual grading curves within these limits shall not exhibit abrupt changes in slope denoting skip grading, scalping of certain sizes or other irregularities which would be detrimental to the proper functioning of the filter.

## 2.7 WELL ACCESS AND OUTLETS

Access and outlets for the pressure relief wells are addressed in Section 3.0. In general, the flow from each well will discharge onto concrete aprons as shown on the drawings. The final top of the relief well riser pipe shall be set above the concrete backfill as shown on the drawings. A backflow check valve shall be installed on each well. The backflow check valve shall conform to the applicable provisions in Section 3.0.

## **2.8 DRILLING**

### **2.8.1 General**

Wells may be drilled by the reverse rotary, bucket auger or other approved methods which will insure a properly formed hole suitable for proper placement of the well screen, riser pipe and well filter. Methods which involve radical displacement of the formation, or contaminate the pervious foundation, will not be permitted. Effluents shall be disposed of in accordance with subsection 2.4.2. During the drilling operation, 2 lbs of 70 percent Calcium Hypochlorite shall be added to the drilling fluid at the beginning of drilling. The addition of Calcium Hypochlorite shall be done upon completion of the displacement of the fresh drill fluid. As the filter sand is placed in the hole, 70 percent Calcium Hypochlorite shall be added to evenly distribute a minimum of 2 lbs per ton of filter material placed.

### **2.8.2 Reverse Rotary Method**

If the reverse rotary method is used for drilling wells, all of the drilling fluid shall be removed from the filter and the natural pervious formation. If the walls of the hole above the top of the filter require support during surging operations, a temporary casing similar to that specified in subsection 2.8.3 below shall be placed so as to extend from the ground surface to at least 3-feet below the top of the filter. The diameter of the hole shall be such as will permit the placement of the minimum thickness of filter as specified in subsection 2.10. The drilling fluid shall be an approved suspension of fine-grained soil (not bentonite) and shall have the characteristic of being readily removable from the walls of the formation by surging or other approved methods.

### **2.8.3 Temporary Casing Method**

Temporary well casing may be required to support the sides of the hole during drilling and placement of screen, riser pipe, and filter. The temporary casing shall have an outside diameter of not less than 18 inches, shall have sufficient thickness to retain its shape and maintain a true section throughout its depth, and may be in sections of any convenient length. The temporary casing shall be such as to permit its removal without interfering with the filter or well pipe. The Contractor may set the temporary casing by any approved method which will not displace the natural formation outside of the temporary casing. Removal of material from inside the temporary casing shall be done in a manner that will not disturb the material ahead of the casing. The water level inside the casing shall be maintained above the natural groundwater level during installation of the casing. In the event the temporary casing should become distorted, the Contractor may be ordered to remove the distorted casing and

install a new casing at no additional cost. When temporary casing is used, it shall be carried to a minimum depth of 2-feet below the prescribed bottom elevation of the well screen.

#### 2.8.4 Samples

The Contractor shall take soil samples for use in determining the depth at which the top of the well screen is to be set. Samples may be taken from the drilling fluid at the pump discharge if the reverse rotary method is used or they may be taken from the tools used in advancing the boring if other methods are used. The Contractor shall furnish the depth of the bore hole from which the sample is taken and shall furnish any other information available which may assist in determining the depth from which the sample was obtained or where any soil changes might have occurred.

### 2.9 INSTALLATION OF RISER PIPE AND SCREEN

#### 2.9.1 General

All riser pipe and screen shall be in good condition before installation and all joints and accessory parts shall be securely fastened in place. The successive lengths of pipe shall be arranged to provide accurate placement of the screen sections in the pervious strata. Particular care shall be exercised to prevent damage to the top of the riser pipe during installation and throughout all subsequent operations and any damage thereto shall be repaired at the Contractor's expense. After surging and pumping operations the top of the riser shall be finished as described in subsection 2.11.6. The riser pipe and screen shall be centered in the well and held securely in that position during placement of the filter by means of centering guides and a tremie holder, or other approved method.

#### 2.9.2 Installation

The assembled riser pipe and screen shall be placed in the hole as indicated on the drawings and in such a manner as to avoid jarring impacts and to insure that the assembly is not damaged or displaced. The riser pipe shall be held secure at the designated elevation during placement of the backfill. Immediately after the installation of the well screen and riser pipe, the depth of the well shall be measured under the direction of the RCE. After the screen and riser pipe have been placed, a filter shall be constructed around the screen section as specified in subsection 2.10 and the well surged and pumped as specified in subsection 2.11.

#### 2.9.3 Alignment

Each completed well shall be reasonably straight and plumb. A variation of 6-inches will be permitted in the alignment of the

combined riser pipe and screen from a plumb line from the top of the well; however, this will not relieve the Contractor of the responsibility of maintaining adequate clearance for installation of the bailing, surging and pumping equipment required for testing the wells.

## 2.10 PLACEMENT OF WELL FILTER

Well filter shall not be placed in the hole before the well screen and riser pipe are installed. After the well screen and riser pipe have been installed, well filter shall be tremied to the bottom of the hole, in an approved manner, so that no significant segregation will occur. The filter shall have a minimum thickness of 6 inches between the outside of the well screen and the natural formation, and shall be placed to the required elevation as determined by detailed requirements at the time the well is installed. At the start of operations, the tremie shall rest on the bottom of the hole and be filled with well filter. After the operation is started, the elevation of the well filter in the tremie shall be kept above the fill in the well at all times. If a temporary casing is used, the well filter shall be placed in increments not to exceed two feet; the tremie and casing shall then be raised in increments equal to the increments of well filter placed, except that at no time prior to completing the operation shall the bottom of the temporary casing be less than one foot below the top of the filter. The alternate placing of well filter and withdrawing of temporary casing shall be continued until the well filter has been placed to the required elevation.

## 2.11 DEVELOPMENT OF WELL

### 2.11.1 General

Within 4 hours after completion of the placing of the well filter, material which may have entered the well during the placing operation shall be removed, and development of the well shall be commenced so as to achieve a stable well of maximum efficiency. Development of the well shall consist of surging and pumping as hereinafter specified. The method and amount of surging and pumping considered necessary to develop the well shall be approved. Effluents shall be disposed of in accordance with subsection 2.4.2.

### 2.11.2 Surging

Within 4 hours after installation, the well should be pumped for at least 30 minutes. Development of the well should be started within 12 hours after the well has been pumped. The well shall be developed by surging with a smooth-fitting double surge block while simultaneously pumping the space between the packers with air, or a suction pump, so as to draw fresh water through the

screen and filter simultaneously with the surging operation. The surge block shall be raised and lowered at a rate of about 2 ft/sec. The well will be surged for not less than 1 hour. The amount of material deposited in the bottom of the well shall be determined after each cycle (about 15 trips with the surge block per cycle). Surging shall continue until the accumulation of material pulled through the well screen in any one cycle becomes less than 0.1 foot. The well screen shall be cleaned with a bottom-suction pump, or a suction pump with a hose extending to the bottom of the well when the accumulation of material in the bottom of the well becomes more than 1 foot at any time during surging. All material in the bottom of the well shall be removed at the end of the surging operation. Material pumped from the well shall be visually inspected to see if any foundation sand or silt is being removed.

### 2.11.3 Pumping Tests

#### 2.11.3.1 General

Upon completion of installation, surging and development pumping, and before final acceptance, each well shall be subjected to a pumping test. The test pumping and sand infiltration tests hereinafter specified shall be performed before placement of the concrete backfill prescribed in subsection 2.12. The pumping rate shall be adjusted by the Contractor so that the water level in the well is at all times above the top of the uppermost well screen. In no event shall the pumping tests be performed when the water level in the well is drawn down to a point lower than the top of the well screen. In such cases the test shall be suspended and shall not be resumed until the groundwater table has risen above the top of the well screen and the Contractor has received approval to proceed. Prior to commencement of the pumping test, and again after completion of the test, the depth of the well shall be measured, under the direction of a representative of the RCE.

#### 2.11.3.2 Equipment

##### A. Pump

The Contractor shall provide a pump capable of producing the specified drawdown over a period of time sufficient to satisfactorily perform the pumping test specified. The use of deep well pumps will be permitted provided that the pump itself is kept within the riser pipe, and the Contractor demonstrates that all specified requirements of pumping and sand measurement can be complied with. The pump shall be complete with either gasoline, diesel or electric motor of adequate size. In case an electric motor is used, the Contractor shall provide, without additional cost, the electric power and the necessary wiring which he will remove at the completion of the pumping test.

**B. Water Level**

The Contractor shall provide approved means for accurately determining the water level in the well under all conditions.

**C. Flow Meter**

The Contractor shall furnish and install a calibrated flow meter of standard design for the purpose of measuring the discharge from the well during the pumping test. The calibration of the flow meter shall be checked at periodic intervals as directed.

**D. Pipe Discharge Line**

The Contractor shall furnish, install or construct the necessary pipe discharge line, troughs, or ditches necessary to conduct the pumping test discharge in the reservoir a sufficient distance from the embankment or the area adjacent thereto to prevent damage. All measures for the disposal of the pump discharge shall be subject to approval and all damage caused by the installation or operation of the test equipment shall be repaired by the Contractor at no additional cost.

**E. Tank**

The Contractor shall furnish an approved large suitably baffled tank (minimum capacity 1000 gallons) into which the well discharge shall be pumped for the purpose of determining whether sand and/or other material is being pumped out of the well.

**F. Data**

The following test data as detailed in Attachment 2, Main Document, shall be obtained by the Contractor, with items 1 through 7 to be recorded and furnished by the Contractor.

1. Time of observation.
2. Depth of water in well before, during and after pumping.
3. Flow in gpm.
4. Elevation of water in well before and after pumping.
5. Elevation of water in adjacent wells or piezometers before and during pumping as directed.
6. The depth of sand in well before, during, and after pumping.



7. Amount of sand pumped out of well and collected in tanks.

2.11.3.4 Procedure

Contractor shall test each well by pumping continuously for a minimum of 2 hours. The pumping shall be at a constant rate sufficient to produce either a drawdown of 5 feet, or to the top of the well screen whichever occurs first. No test pumping of a well will be permitted concurrently with drilling, surging or pumping of any other well within 400 feet therefrom. In the event that the test is interrupted, unless so directed, prior to the completion of the specified period of continuous operations, the test shall be re-run at no additional expense. In addition to the test described above, the Contractor may be directed to perform additional testing. Such additional testing shall conform in general to the requirements specified above with the exception that the duration of the tests and the drawdown will be determined by the RCE. To be successful, the test shall be continuous throughout the specified period. In the event that sand or other material infiltrates into the well as a result of the pumping test, the following procedure will be followed: If the rate of sand infiltration during the later part of the two hour pumping test has not been reduced to one pint per hour or less for two consecutive 15 minute test periods, the well shall be resurged by manipulation of the test pump for 20 minutes after which the test pumping shall be resumed and shall be continued at the constant rate specified above until the sand infiltration rate is reduced to less than one pint per hour for two consecutive 15 minute test periods, but not for more than a total of 8 hours. If at the end of 8 hours of pumping the rate of infiltration of sand is more than two pints per hour, the well shall be abandoned, except that the Contractor, if he so elects, may continue the test pumping and perform such other approved remedial work as he considers desirable, all at his own expense. If, after such additional test pumping and other remedial measures the sand infiltration rate of a well is reduced to not more than 2 pints per hour for two consecutive 15 minute test periods, the well will be accepted. Abandoned wells shall be satisfactorily plugged as prescribed in subsection 2.12.2, and, if so approved, a new well installed nearby. Upon completion of the pumping test, if there is more than 0.5-foot of sand or filter material in the bottom of the well, such material shall be removed by pumping or a piston type bailer, after which the Contractor shall remove all equipment, discharge lines, etc., and shall backfill any excavated areas.

2.11.4 Records

As required in Attachment 2 of the Main Document, The Contractor shall obtain and furnish for record purposes the elevation of the water in each well before and after the development pumping, the

flow in g.p.m. at the completion of the pumping, and the time of observation. The aforesaid data shall be obtained immediately before starting the surge pump and just before stopping the pump upon completion of the development pumping.

#### 2.11.5 Discharge Disposal

The discharge from the wells shall be disposed of in the MCR as specified in subsection 2.4.2, and any damage caused thereby shall be repaired by and at the expense of the Contractor.

#### 2.11.6 Cleaning and Sealing

If, after completion of all surging and pumping, there is more than 0.5 of a foot of material in the bottom of the well, such material shall be removed with either a piston-type bailer or by pumping. Immediately upon completion of the development of the well the top of the riser pipe shall be sealed by installation of a PVC backflow check valve on top of the riser pipe. The well shall be kept sealed at all times until acceptance, except during pumping or cleaning operations. Abandoned wells shall be plugged as prescribed in subsection 2.12.2, and, if so approved, a new well installed nearby.

### 2.12 FINAL BACKFILLING OF WELL

#### 2.12.1 General

After the well has been satisfactorily developed, the annular space above the well filter shall be backfilled with concrete as shown on the drawings. Prior to placement of concrete, well filter shall be placed as necessary to replace material lost during surging and development. Concrete for backfill shall conform to the provisions of Section 4.0. The concrete shall be placed by tremie so that segregation is held to a minimum and rodded to insure compaction and absence of voids. Temporary casing, if used, shall be withdrawn as backfill is placed so that its bottom is at all times near the top of the placed fill.

Except as otherwise specified, indicated or required, the Contractor shall fill to original grade, with compacted materials similar to the materials removed, all pits dug by him such as those incidental to the reverse rotary method of drilling, as well as holes or pits dug for any other purpose.

#### 2.12.2 Abandoned Wells

##### 2.12.2.1 Abandoned Prior to Well Screen Placement

Well holes abandoned prior to the placement of well screen and riser pipe shall be completely filled in an approved manner. Backfill of the upper portion of the hole through the relatively

impervious blanket shall be made in an approved manner to the depth of said blanket with compacted impervious material at least equal to the impervious characteristics of said blanket as approved by the RCE. Backfill below the upper blanket may be made with compacted sand.

#### 2.12.2.2 Abandoned After Well Screen Placement

Wells abandoned after placement of well screen and riser pipe shall be plugged as follows: The lower portion of the well shall be completely filled with sand or sandy material to within 10 feet of the ground surface. Fill material placed above the groundwater level shall be thoroughly compacted by approved methods. The top of the riser pipe shall be removed to a point not less than 5 inches below the natural ground surface, and the top 10 feet of well filled with concrete, both inside and outside of the pipe, to the natural ground surface.

#### 2.13 REPAIR OF DAMAGE

##### 2.13.1 Embankment and Berms

Any damage to the existing structures and berms resulting from the Contractor's operations, shall be repaired by and at the expense of the Contractor.

##### 2.13.2 Work Areas

The surface of the entire right-of-way shall, except as otherwise specified or required, be restored to substantially the same level and condition as prevailed therein at the commencement of the work. All ruts and holes caused by the Contractor's operations shall be filled and all waste concrete and other debris shall be removed from the site of the work, buried under at least 2 feet of earth cover, or otherwise disposed of as approved.

#### 2.14 LOG OF OPERATIONS

The Contractor will keep records of all operations in connection with the relief wells. The Contractor shall furnish a complete and accurate log of operations, soil log and an as-built sketch of the well installation for each relief well as per the Main Document. All dimensions and elevations shown in the as-built sketch shall be accurate to the nearest 0.1 ft.

#### 2.15 CONTRACTOR'S PLAN OF OPERATION

Subject to the requirements of the specifications, the Contractor prior to commencing work shall prepare a complete plan for accomplishing the work in connection with the relief wells. The plan shall indicate by drawings and description the equipment proposed for use; sequence of operations for each relief well;

order of commencing and completing relief wells; details of drilling relief wells, placing well pipe, placing well filter, developing and test pumping. Approval of the Contractor's plan of operations shall not relieve the Contractor of full responsibility for satisfactory construction of the relief wells.

### 3.0 WELL ACCESS AND OUTLETS

#### 3.1 SCOPE

The work to be performed under this section consists of furnishing all plant, labor, materials and equipment, and performing all operations required for the construction of the access and outlets for the pressure relief wells in accordance with these specifications and drawings.

#### 3.2 REFERENCED CODES AND STANDARDS

The following codes and standards shall be met:

1. ASTM C76-85a Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

#### 3.3 SUBMITTALS

The Contractor shall submit the shop drawings of the well cover plates and the well outlets for acceptance prior to fabrication.

#### 3.4 WELL OUTLETS, GENERAL

The flow from each well shall discharge through a 4 inch inside diameter (I.D.) PVC pipe onto the surface of a concrete apron as shown on the drawings. The top of the 6 inch PVC riser pipe shall be set above the concrete backfill as shown on the drawings. A backflow check valve shall be installed on each well riser pipe. Each well shall be provided access and protected with a concrete pipe conforming to subsection 3.8. The concrete backfill and reinforced concrete outfall protection shall not be placed on any well until after the pumping and sand infiltration tests for that well have been satisfactorily complete in accordance with subsection 2.11.3. Concrete shall be in accordance with the applicable provisions of Section 4.0. Flap check valve assemblies shall be in accordance with subsection 3.8.2.3.

#### 3.5 EXCAVATION

The Contractor shall be responsible for excavating all material, regardless of character, to the lines and grades indicated on the drawings. The Contractor may excavate by any method or methods that he elects to use insofar as the method or methods will result in work conforming to the requirements herein.

Excavated material shall be used for backfill to the extent required. Excavated material not required for backfill shall be wasted in nearby approved areas. Waste areas shall be left in a neat condition smoothly dressed to blend with adjacent topography, and sloped to drain.

### 3.6 BACKFILL

Excavations for relief well construction shall be backfilled to original ground with approved excavated material. All areas to be backfilled shall be free of water, trash and debris prior to placing backfill. The Contractor may be required to suspend work at any time when satisfactory work cannot be done on account of rain, weather or other unsatisfactory conditions. Backfill around pipes shall be performed simultaneously on both sides with the top of backfill on both sides approximately equal at all times. Backfill shall be placed in layers of not over 6-inches uncompacted thickness and compacted to a density at least equal to that of the adjacent undisturbed earth by power tampers or other approved equipment. All backfill slopes shall be maintained until any overlying material is placed thereon or until the contract work is completed and accepted.

### 3.7 BACKFLOW CHECK VALVES

#### 3.7.1 Installation

The top of the riser pipe for each well shall be fitted with a PVC backflow check valve conforming to the drawings and the provisions of subsection 3.7.2 below. The check valve shall be installed on top of the riser pipe immediately after completion of the development pumping prescribed in subsection 2.11, and thereafter shall be kept in place on the pipe at all times except during pumping and cleaning operations.

#### 3.7.2 Backflow Check Valve

The PVC check valves shall be fabricated in accordance with details shown on the drawings and as specified herein. PVC plank stock shall be 200 mil minimum thickness, and shall be used for fabricating all portions of the check valves shown in the drawings. Edges which will be in contact with the well riser pipe shall be beveled and smoothed to insure the valve will not bind within the pipe or in any way obstruct the free movement of flow out of the well riser pipe. All joining of fabricated pieces used in valve construction shall be by an approved cold applied solvent or adhesive. All portions of the valves shall be neatly finished. The top, circular member shall be flat and free of any warp which would prevent it from completely sealing against the soft foam rubber gasket.

### 3.8 WELL ACCESS AND OUTFALL

#### 3.8.1 General Description

Access to each well shall be by a manhole complete with cover plate, as shown on the drawings. Each well access unit shall consist of sections of 24 inch diameter reinforced concrete pipe

jointed together with the bottom section embedded 2-foot into the concrete backfill as shown in the drawings. The discharges for relief well flows will be provided by a 4 inch inside diameter (I.D.) Schedule 40 PVC pipe penetrating the concrete access pipe, and with a backflow flap check valve at the discharge end, as shown on the drawings. Materials and appurtenances for the well access and outfall shall conform to the provisions of subparagraphs below.

### **3.8.2      Materials**

#### **3.8.2.1    Reinforced Concrete Pipe.**

This section of the outlet shall be a reinforced concrete pipe of standard strength with tongue-and-groove joint, Table II, Wall A, Class II, conforming to ASTM C76-85a. Each well installation shall include a galvanized steel manhole cover as shown on the drawings.

#### **3.8.2.2    PVC Outfall Pipe**

The 4-inch inside diameter (I.D.) ASTM Schedule 40 polyvinyl chloride (PVC) pipe shall be used to discharge flow from the well. The bedding surface for the outfall pipe shall be accurately graded to provide firm and uniform support along the entire length of the pipe.

#### **3.8.2.3    Flap Check Valve**

Flap check valves for relief wells shall be equal to #3284 4-in. (nominal) moulded ABS plastic backwater valve as manufactured by Canplas Industries, Ltd. Valves shall be modified to include flappers as manufactured by Plastic Oddities, Inc., by Wilco Plastics, St. Louis, Missouri.

#### **3.8.2.4    Miscellaneous Materials**

Galvanized steel cover plates, and all bolts, nuts, washers and other miscellaneous materials, required for the well shall be fabricated and installed as indicated on the drawings.

### **3.8.3      Shop Drawings**

The Contractor shall submit for approval shop drawings of the well cover plates and the well outlets, showing full details of materials, fabrication and installation.

### **3.9        PAINTING**

The concrete manhole pipes above the ground surface for each well shall be thoroughly cleaned after which the well number shall be

stenciled on the side facing upstream in approved figures approximately 6 inches high with black enamel paint having an oil or asphalt base and recommended by the paint manufacturer for exterior concrete surfaces.



4.0 CONCRETE WORK

4.1 SCOPE OF WORK

The work covered by this section consists of furnishing all material and equipment, and performing all labor for the manufacture, transporting, placing, finishing and curing of concrete and removal of existing concrete as required under this contract.

4.2 REFERENCED CODES AND STANDARDS

The following publications of the issues listed below form a part of this specification to which all materials and work shall conform except as stated hereinafter.

1. American Concrete Institute (ACI).
  - 301-84 Specifications for Structural Concrete for Buildings.
2. American Society for Testing and Materials (ASTM).
  - C33-82 Standard Specification for Concrete Aggregates.
  - C150-81 Standard Specification for Portland Cement.
  - C494-81 Standard Specification for Chemical Admixtures for Concrete.
  - C595-82 Standard Specification for Blended Hydraulic Cements.
  - C618-80 Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
  - A185-79 Standard Specification for Welded Steel Wire Fabric for Concrete Reinforcement.
  - A615-82 Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

#### 4.3 SUBMITTALS

The Contractor shall make the following submittals:

1. Certificate of Compliance.
  - (a) Cementitious materials.
  - (b) Admixtures.
  - (c) Curing materials.
  - (d) Concrete.
2. Certified Test Results.
  - (a) Aggregates.
  - (b) Concrete mixture designs.
  - (c) Reinforcing steel.
3. Concrete Mixture Proportions.

#### 4.4 MATERIALS

Materials shall meet the requirements as specified below and in the PARAGRAPH: APPLICABLE PUBLICATIONS.

##### 4.4.1 Cementitious Material

1. Portland cement: ASTM C150, Type I or II.
2. Portland-pozzolan cement: ASTM C595, Type IP.
3. Pozzolan: ASTM C618, Class N, F, or C.

##### 4.4.2 Aggregate

1. ASTM C33 with the grading requirements for coarse aggregate of Size Designation No. 57 or 67.

##### 4.4.3 Admixtures

1. Water reducing admixture: ASTM C494, Type D.

##### 4.4.4 Concrete Quality

1. Specified compressive strength ( $f'_c$ ) of 3000 psi at 28 days.

2. Maximum water-cementitious material ratio of 0.55 by weight.
3. Maximum slump of 4 inches.

4.4.5 Reinforcement

1. Bars: ASTM A615, Grade 40 or 60.
2. Welded wire fabric: ASTM A185.

4.5 BATCHING AND MIXING

4.5.1 Equipment

The Contractor shall provide materials from a modern and dependable batch-type mixing plant having a capacity suitable to meet the concrete requirements under this contract. The equipment shall be capable of combining the aggregate, cement, admixture and water into a uniform mixture and of discharging this mixture without segregation. Adequate facilities shall be provided for the accurate measurement and control of each of the materials entering the concrete. Ready-mixed and transit-mixed concrete from an approved plant may be used. Except as herein specified ready-mixed and transit-mixed concrete shall conform to ACI 301-84. Bechtel shall have free access to the batching and mixing plant at all times.

4.5.2 Mixing Time

When concrete is transit-mixed, each batch of concrete shall be mixed not less than 70 nor more than 100 revolutions of the drum at the rate of rotation designated by the manufacturer of the equipment as mixing speed and at the capacity designated in ACI 301-84. If the batch is at least 1/2 cubic yard less than the rated capacity, the number of revolutions at mixing speed may be reduced to not less than 50. All materials shall be batched at the batching plant, and there shall be no subsequent addition of water to the batch without specific approval of the RCE. Truck mixers or other transporting equipment shall conform to the requirements of ACI 301-84. When a stationary mixer is used, it shall not be charged in excess of the capacity recommended by the manufacturer on the name plate. Excessive overmixing, requiring additions of water to preserve the required consistency, will not be permitted. The mixing time for each batch after all solid materials are in the mixer drum, provided that all of the mixing water shall be introduced before one-fourth of the mixing time has elapsed, shall be not less than one minute for mixers having a capacity of one cubic yard or less; for mixers of larger capacities, the minimum mixing times shall be increased 15 seconds for each additional one-half cubic yard or fraction thereof of concrete mixed.

#### 4.6 CONVEYING

Concrete shall be conveyed from mixer to forms as rapidly as practicable, by methods which will prevent segregation or loss of ingredients.

#### 4.7 PLACING

Concrete shall be worked into the corners and angles of the forms and around all reinforcement and embedded items without permitting the materials to segregate. Concrete shall be placed within 45 minutes from the time all ingredients are charged into the mixing drum unless otherwise authorized. It shall be placed on clean, damp surfaces free from water, ice, frost, mud, debris or objectionable coatings. Concrete shall be consolidated with the aid of mechanical vibrating equipment supplemented by handspading and tamping. Vibrating equipment shall at all times be adequate to properly consolidate all concrete. All concrete placing equipment and methods shall be subject to approval. Placing will not be permitted when the sun, heat, wind, or limitations of facilities furnished by the Contractor prevent proper finishing and curing of the concrete.

#### 4.8 FINISHING

Defective concrete, voids left by the removal of tie rods, ridges and local bulging on all concrete surfaces permanently exposed to view shall be repaired immediately after the removal of forms unless otherwise authorized or directed. Voids left by the removal of the rods shall be reamed and completely filled with dry-patching mortar. The cement used for dry-patching and other repair work shall be a blend of portland cement and white portland cement properly proportioned so that the final color of the cured mortar or concrete will be the same as the color of the surrounding concrete. Defective concrete shall be repaired by cutting out the unsatisfactory material and placing new concrete which shall be secured with keys, dovetails or anchors. Excessive rubbing of formed surfaces will not be permitted. All unformed surfaces of concrete, exposed in the complete work, shall have a wood float finish without additional mortar and shall be true to elevation as shown on the drawings. Care shall be taken to see that all free water which has accumulated at the surface is removed before making any finish. Other surfaces shall be brought to specified elevations and left true and regular.

#### 4.9 CURING AND PROTECTION

All cast-in-place concrete shall be cured by an approved method or combination of methods for a period of not less than 7 days when Type I cement is used and 14 days when Type II cement is used. All concrete shall be adequately protected from damage at all times.

**4.10 FURNISHING AND PLACING STEEL REINFORCEMENT**

The Contractor shall furnish, cut, bend, and place all steel reinforcement including rods and fabric as indicated on the drawings or otherwise required. All reinforcement shall be, when surrounding concrete is placed, free from loose, flaky rust and scale, and free from oil, grease, or other coating which might destroy or reduce its bond with the concrete. All placing shall be in accordance with drawings furnished or approved.

**4.11 CONCRETE LINING REMOVAL/REPLACEMENT**

Installation of the Well Outlet Facility for relief wells constructed along the existing concrete-lined ditches requires that a section of that lining be removed and later replaced. Removal of lining will be accomplished by sawcutting the outside edges of the concrete in order to prevent damage to the remaining lining. Disposal of the removed concrete will be as directed. Replacement of the concrete lining will be made to the existing lines and grades.

5.0 PIEZOMETERS

5.1 SCOPE OF WORK

The work to be performed consists of furnishing all equipment, labor, supplies, and materials, and the performance of all operations in connection with the installation of pneumatic piezometers as shown on the Drawings in accordance with the provisions of this Specification.

5.2 REFERENCED CODES AND STANDARDS (not applicable)

5.3 SUBMITTALS

The Contractor shall submit the following:

1. A complete log of each piezometer boring and an as-built piezometer installation drawing.
2. Manufacturer's instructions for use of biodegradable drilling additive.
3. Manufacturer's information on the instrumentation to be installed, if other than by Slope Indicator Company. Such submittal shall be made at least 14 days prior to the date the Contractor intends to begin such installations, and model numbers for pneumatic pore pressure transducers, tubing, terminal pipe and connections, and pneumatic pressure indicators.
4. Transducer calibration test results.

5.4 DRILLING

5.4.1 Water Supply

The Contractor shall provide all water necessary to perform the work. The equipment required may include pumps, water trucks or trailers, hoses, storage tanks, and all other items necessary to provide an adequate water supply. The source of the water shall be subject to approval. All discharge water shall be controlled to prevent contamination, pollution, excessive erosion or any other damage, in accordance with subsection 2.11.5.

5.4.2 Drilling Equipment

The drilling equipment shall be of the rotary type with hydraulic feed, and in good working condition. Supplies for drilling shall include all casings, drill rods, bits, pipe, pumps, water and tools.

#### 5.4.3 Drilling

Drilling shall be performed using rotary equipment or any bit that will produce a suitable hole for the intended purpose. Hollow stem augering will be permitted. Drilling may be performed using water to remove the cuttings. Casing shall be driven or reamed where necessary to keep the hole open. Diameter of holes shall be approximately 6 inches.

#### 5.4.4 Temporary Casing and Use of Drilling Fluid Additives

Where necessary to keep the holes open and enable the holes to be advanced, temporary casing shall be used. Casing shall not be abandoned in any hole unless specifically approved. Drilling fluid additives with a bentonite base shall not be permitted. The case-and-wash method of advancing the hole is preferred. Casing shall be advanced ahead of the drill bit.

#### 5.4.5 Driller's Logs

The Contractor shall keep and, within 24 hours of the completion of each drill hole, furnish an accurate driller's log of that hole. The log shall show the following:

- A. Material description and depth at which each change in material or stratification occurs.
- B. Depth of gain or loss of drilling fluids.
- C. Depth to water table at the completion of a hole.
- D. Other drilling data as requested.

The Contractor shall furnish all necessary assistance and cooperation with regard to record keeping.

#### 5.5 PIEZOMETERS

The pneumatic piezometers shall be installed as shown on the Drawing or as directed.

##### 5.5.1 Materials

##### 5.5.1.1 Pore Pressure Transducer

Pneumatic pore pressure transducers shall be Slope Indicator Company (Seattle, Washington) pneumatic pore pressure transducer Model 514178, or equal.

**5.5.1.2 Pneumatic Pressure Indicator**

The pneumatic pressure indicator used to measure pore pressures shall be Slope Indicator Company (Seattle, Washington) pneumatic pressure indicator Model 51421-A, or equal.

**5.5.1.3 Terminal Pipe**

Terminal pipes shall be Slope Indicator Company (Seattle, Washington) Model 51499, or equal.

**5.5.1.4 Tubing**

Tubing shall be Slope Indicator Company (Seattle, Washington) twin tubing, Model 514169, or equal.

**5.5.1.5 Well Filter**

Well filter shall be in accordance with subparagraph 2.6.

**5.5.1.6 Bentonite**

Bentonite used to form impervious seal in drill holes above pore pressure transducers shall be constructed of pellets as manufactured by Slope Indicator Co., Seattle, Washington, or equal.

**5.5.1.7 Backfill**

Backfill in the annular space between the bentonite seal and concrete backfill shall consist of cement-bentonite grout, tremied in place. The cement-bentonite grout mix shall consist of 300 lbs of cement and 70 lbs of bentonite per 200 gallons of water.

**5.5.1.8 Surface Fitting**

Unless otherwise directed, surface fitting shall consist of terminal pipe extending 2 feet below and 3 feet above the dike crest surface. A concrete backfill seal at least 12" in diameter as shown on the Drawing shall be provided to protect the terminal pipe and to drain surface water away from the installation. Each piezometer shall be clearly marked for identification with a numbering system as shown on the Drawing or as directed.

**5.5.2 Construction**

**5.5.2.1 Drilling**

The piezometer holes will all be drilled to the depths indicated on the drawings. The piezometers shall be constructed as shown on the Drawings and described herein. A biodegradable drilling additive, such as Johnson's "Revert" or Baroid's "LoLoss", will



be the only drilling fluid additive that may be used to stabilize holes and prevent caving if required and approved. Care shall be exercised in mixing drilling additives according to the manufacturer's instructions. A copy of the manufacturer's instructions shall be provided. Improperly mixed additives do not break down and any hole in which the drilling additive does not break down shall be replaced by and at the expense of the Contractor. If, at any time, RCE determines that the drilling fluid is inadequate or significantly contaminated, the Contractor shall replace it.

#### 5.5.2.2 Installing Transducer

Prior to transducer installation, boreholes shall be flushed of drilling fluid, if other than water. All transducers shall be calibrated prior to delivery to the site, and calibration test results for any instrument submitted to Bechtel for approval at least 1 day before installation of that instrument.

The final depth of the hole shall be measured to assure it is one foot below the proposed transducer tip elevation. Well filter shall be placed to El. 30.0, and the transducer and attached tubing lowered into the hole. Preparation of transducers and installation procedures shall be in accordance with manufacturer's recommendations. Approved centering devices shall be used.

#### 5.5.2.3 Installing Well Filter

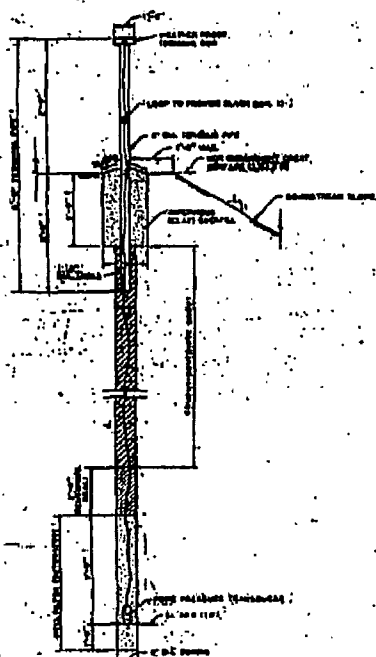
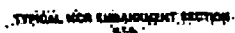
As soon as the transducer is in place, the hole shall be back-filled with clean water and maintained at ground surface while the pore pressure is monitored to verify the transducer is functioning properly. If, any transducer is not functioning properly, it shall be replaced by another calibrated and approved transducer. After verification that the transducer is functioning properly, well filter shall be poured into the annular space around the transducer as shown on the drawings.

#### 5.5.2.4 Installing Bentonite Seal and Cement-Bentonite Grout

After the well filter is placed, the min. 2 ft bentonite seal shall be placed as shown on the Drawings, followed by grouting the hole to within 2 feet of the dike crest surface with cement-bentonite grout. The terminal pipe installation shall be centered in the hole and held in place during final grouting operations and the grout set period.

#### 5.5.2.5 Testing

Upon completion of the installation and terminal pipe connections, each piezometer shall be retested to confirm that it is still operative. If, as a result of improper installation, a piezometer is considered inoperative the Contractor shall, at his expense, modify or replace the piezometer with a satisfactory piezometer.



### EMBANKMENT PIERCEMENTS LOCATIONS

[illegible]

- [illegible]

Exptl - a ccv  
Cm 2 - 1000

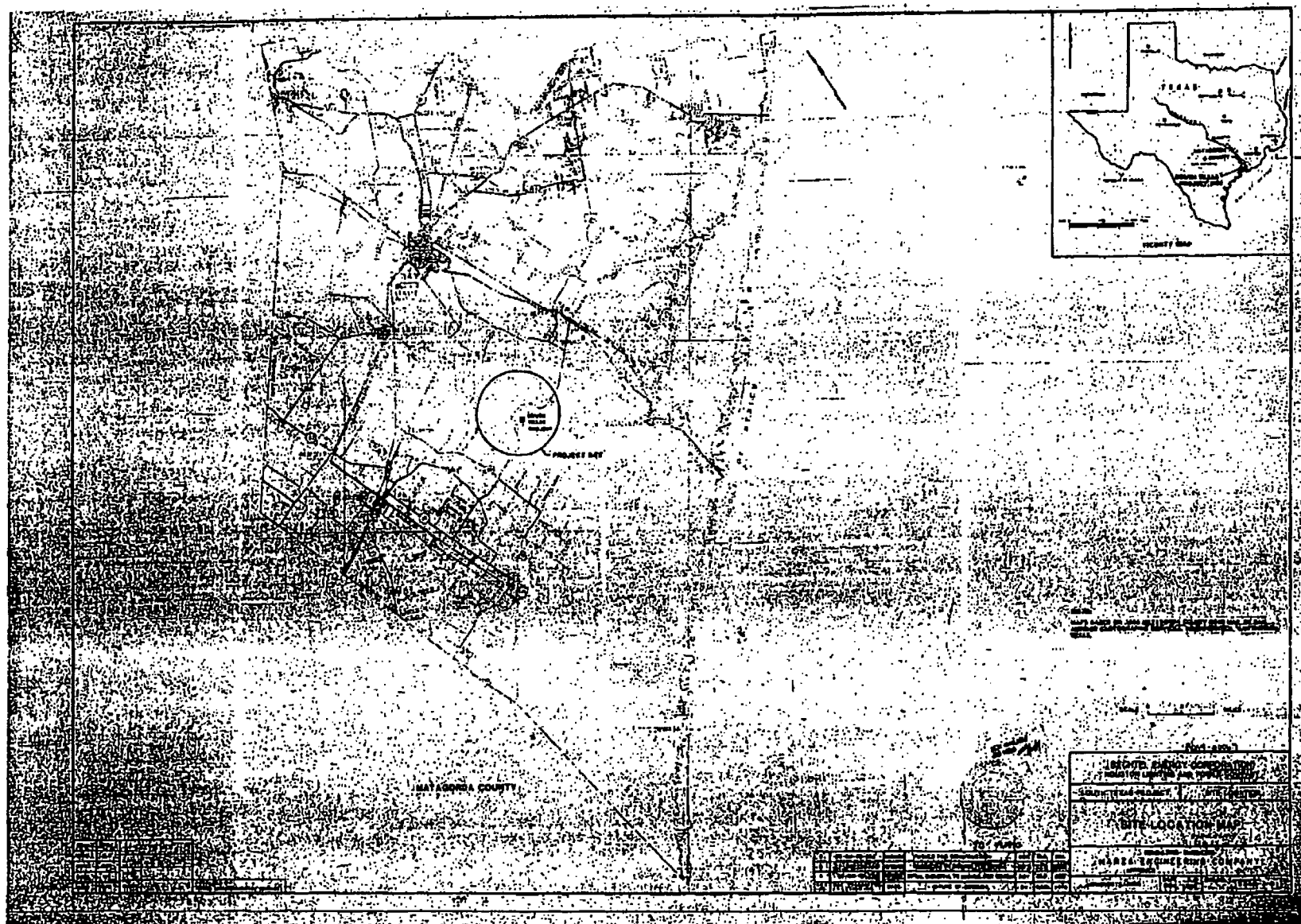
ESCHTEL, LARRY CORPORATION  
NORTON, LARRY AND SONS, INC.

.. SOUTH TEXAS PROJECT.	and Locating
-------------------------	--------------

### PIEZOMETER INSTALLATION

MAZZA ENGINEERING COMPANY

[illegible][illegible]





INSTALLATION CHECKLIST/WITNESS POINTS  
FOR RELIEF WELLS

Relief Well No.: \_\_\_\_\_

Actual Location: MCR Station \_\_\_\_\_ + \_\_\_\_\_

Offset \_\_\_\_\_ ft from embankment centerline

Ground Level: \_\_\_\_\_

Filler Material Acceptable? \_\_\_\_\_

Source of Water \_\_\_\_\_

Acceptable? \_\_\_\_\_

Discharge location \_\_\_\_\_

Acceptable? \_\_\_\_\_

Erosion Protection \_\_\_\_\_

Acceptable? \_\_\_\_\_

\_\_\_\_\_  
RCE

\_\_\_\_\_  
Date

PART I DRILLING PHASE

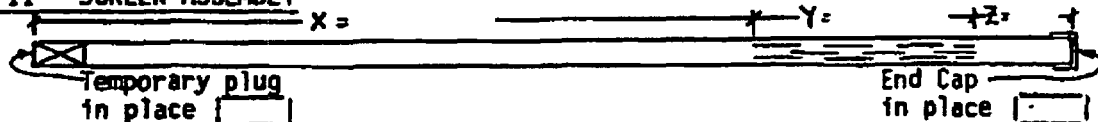
(Note: Attach Driller's Log. Include sampling depths and sample classifications.)  
Sand Stratum to be screened: \_\_\_\_\_ from \_\_\_\_\_ ft. to \_\_\_\_\_ ft.

Screen depths to be used: \_\_\_\_\_ ft. to \_\_\_\_\_ ft.

\_\_\_\_\_  
RCE

\_\_\_\_\_  
Date

PART II SCREEN ASSEMBLY



Spacers @ \_\_\_\_\_ ft. \_\_\_\_\_ ft. \_\_\_\_\_ ft.

Joints @ \_\_\_\_\_ ft. \_\_\_\_\_ ft. \_\_\_\_\_ ft.

Assembly complete

Accepted for placement

\_\_\_\_\_  
Contractor

\_\_\_\_\_  
Date

\_\_\_\_\_  
RCE

\_\_\_\_\_  
Date

**PART-III FILTER PLACEMENT & DEVELOPMENT**

The screen/riserpipe assembly plumb and properly centered?       

Filter placement technique used                                      Acceptable?       

Time and date when placement was completed                                     

Ground water depth                                      ft.

**INITIAL PUMPING**

                                     start  
                                     finish

Surging tool used                                     

Rate of movement of tool                                      ft./min.

Pressure of water at wellhead                                      psi

**FIRST CYCLE OF DEVELOPMENT**                                      start  
                                     finish

Depth of sand                                      ft.

Was surging stopped because sand depth exceeded 1 ft.       

Formation material present in removed sand?       

Depth of filter sand added                                      ft.

**SECOND CYCLE OF DEVELOPMENT**                                      start  
                                     finish

Depth of sand                                      ft.

Formation material present in removed sand?       

Depth of filter sand added                                     

**THIRD CYCLE OF DEVELOPMENT**                                      start  
                                     finish

Depth of sand                                      ft.

Formation material present in removed sand?       

Depth of filter sand added                                      ft.

Development performed by                                     

Witnessed by                                     

                                      
Contractor Date

                                      
RCE Date

PART IV--FINAL PUMP TEST

Concrete backfill in-place? \_\_\_\_\_

Any other activity within 400 ft. of the well which could affect water level in the the well? \_\_\_\_\_

Piezometers and wells to be monitored during pump test:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Condition of flowmeter \_\_\_\_\_

Device used for measuring  
depth of water in well \_\_\_\_\_ Acceptable? \_\_\_\_\_

Discharge arrangements acceptable? \_\_\_\_\_

Accepted for Pump Test

\_\_\_\_\_  
RCE Date

PUMP TEST RESULTS

Start of test \_\_\_\_\_ (Date & time)

Time (min)	Rate of Pumping (GPM)	Water Level in Well	Water Level in Piezometer #	Water Level in Piezometer #	Water Level in Well #	Sanding Rate pt/hr.
0.00	_____	_____	_____	_____	_____	_____
.15	_____	_____	_____	_____	_____	_____
.30	_____	_____	_____	_____	_____	_____
.45	_____	_____	_____	_____	_____	_____
1.00	_____	_____	_____	_____	_____	_____
.15	_____	_____	_____	_____	_____	_____
.30	_____	_____	_____	_____	_____	_____
.45	_____	_____	_____	_____	_____	_____
2.00	_____	_____	_____	_____	_____	_____

Was resurging required? \_\_\_\_\_

Length of time \_\_\_\_\_ min.

2.20 \_\_\_\_\_  
.35 \_\_\_\_\_  
.50 \_\_\_\_\_  
3.05 \_\_\_\_\_

End of Test \_\_\_\_\_ (Date & time).

Temporary plug for riser pipe has been replaced Yes: \_\_\_ No: \_\_\_

Test performed by \_\_\_\_\_

Test has been witnessed by \_\_\_\_\_

Contractor \_\_\_\_\_ Date \_\_\_\_\_

RCE \_\_\_\_\_ Date \_\_\_\_\_

PART V - WELL OUTLET

Concrete was compacted? \_\_\_\_\_ Acceptable? \_\_\_\_\_

Filter sand backfill was compacted? \_\_\_\_\_ Acceptable? \_\_\_\_\_

Top-of-riser pipe elev after placement of concrete \_\_\_\_\_ Acceptable? \_\_\_\_\_

Length of RC pipe manhole \_\_\_\_\_ ft.

6" discharge pipe invert at proper deviation? \_\_\_\_\_

Draining towards ditch? \_\_\_\_\_

Valve assembly properly working? \_\_\_\_\_

Valve hinge placed at vertical position? \_\_\_\_\_

Reinforcement bars checked? \_\_\_\_\_

Elevation of invert of discharge pipe \_\_\_\_\_

Concrete properly compacted? \_\_\_\_\_

Splash pad in place? \_\_\_\_\_

Manhole coverplate properly galvanized? \_\_\_\_\_

Tag with relief well number in place? \_\_\_\_\_

Placement of Well Outlets witnessed by \_\_\_\_\_

RCE \_\_\_\_\_ Date \_\_\_\_\_



INSTALLATION CHECKLIST/WITNESS POINTS  
FOR RESERVOIR PIEZOMETERS

Piezometer No. \_\_\_\_\_

Actual Location: MCR Sta. \_\_\_\_\_ + \_\_\_\_\_  
Offset \_\_\_\_\_ ft. from Embankment centerline

Ground Level: \_\_\_\_\_

Filter Material acceptable? \_\_\_\_\_

Source of Water \_\_\_\_\_ Acceptable? \_\_\_\_\_

Dischrg Location \_\_\_\_\_ Acceptable? \_\_\_\_\_

Erosion Protection \_\_\_\_\_ Acceptable? \_\_\_\_\_

\_\_\_\_\_ RCE \_\_\_\_\_ Date \_\_\_\_\_

PART I: DRILLING PHASE

(Attach Driller's Log. Include sampling depth and sample classification.)

Sampling technique: \_\_\_\_\_

Was drilling fluid used? \_\_\_\_\_ Brand Name \_\_\_\_\_

Was drilling fluid used in accordance with manufacturer's recommendation? \_\_\_\_\_

Rate of application (approximate) \_\_\_\_\_ /gal

Actual final depth of hole \_\_\_\_\_ ft; Actual approx dia of hole: \_\_\_\_\_

PART II: INSTALLING TRANSDUCER

Transducer Model \_\_\_\_\_ Manufacturer \_\_\_\_\_ Serial No. \_\_\_\_\_

Any signs of physical damage to the unit? \_\_\_\_\_

Transducer calibration test results acceptable? \_\_\_\_\_

Flushing of the borehole completed? \_\_\_\_\_

Was drilling fluid degrader used \_\_\_\_\_ Type of degrader \_\_\_\_\_

Final depth of hole ..... Elevation of bottom of hole + .....ft MSL:

Filter placement technique used .....

Top of filter depth for placing transducer .....

ft. MSL

Transducer was placed in accordance with manufactures' recommendations .....

Centering device used? ..... Type .....

Transducer verification:

Water level elevation .....

Depth of water over transducer .....

Instrument read out (initial) ..... Time .....

Instrument readout (final) ..... Time .....

Verification test performed by ..... Witnessed by .....

.....  
Contractor ..... Date .....

.....  
RCE ..... Date .....

PART-III:---BACKFILLING OPERATION

Technique for placing filter sand .....

Backfilling around transducer acceptable? .....

Top of filter sand elevation .....

Depth of bentonite seal .....

Cement - bentonite mix acceptable? .....

Bottom of terminal pipe elevation .....


Loops provided in the transducer tubing? .....

Surface fixtures installed satisfactorily .....

STI# 364706

SPECIFICATION  
FOR  
GEOTECHNICAL INSTRUMENTATION MONITORING  
AND  
INSPECTION  
OF  
MAIN COOLING RESERVOIR  
9Y510YS1004  
FOR THE  
HOUSTON LIGHTING & POWER COMPANY  
SOUTH TEXAS PROJECT ELECTRIC GENERATING STATION

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		Incorporates HPCRBC4153,													
6	10-18-89	Incorporates HSCN No. 8 and General Revision. FCR No. BC03761 was incorporated in Revision 5.		R. G. P. K. G.		P. K. G.		P. K. G.		P. K. G.		P. K. G.		P. K. G.	
		Revisions 0-5 On File		(See Microfilm for Signatures)											
No.	DATE	REVISIONS		BY	CHK	ENG	CENG	JOE	PE	QA					
HOUSTON AREA OFFICE		 SOUTH TEXAS PROJECT ELECTRIC GENERATING STATION		JOB No. 10028											
				9Y510YS1004											
				SHEET 1 OF 111											

<u>TYPE</u>	<u>AMENDMENT NO.</u>	<u>INCORPORATED IN REVISION NO.</u>	<u>TYPE CLOSED</u>	<u>CLOSED BY</u>
SCN	0000001	1		
FCR	BC-00849	1		
SCN	0000002	2		
SCN	0000003	3		
SCN	0000004	3		
SCN	0000005	3		
SCN	0000006	3		
FCR	BC01785	N/I		
SCN	0000007	4		
FCR	BC03761	5		
HSCN	0000008	6		
FCR	BC04153	N/I		

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APPENDICES

A Engineering Document Requirements (Form G-321-E)

TABLES

- 1 Frequency of Geotechnical Instrumentation Monitoring for Main Cooling Reservoir
- 2 Main Cooling Reservoir Settlement Point Data and Permanent Structural Benchmarks
- 3 Main Cooling Reservoir Piezometer Data
- 4 Main Cooling Reservoir Relief Well Data
- 5 Main Cooling Reservoir Inclinator Data
- 6 (Deleted)

FIGURES

- 1 Main Cooling Reservoir, Embankment Stations
- 2 Settlement Points
- 3A Standpipe Piezometer Detail
- 3B Standpipe Piezometer Detail
- 3C Standpipe Piezometer Detail
- 3D Pneumatic Piezometer Detail
- 4A Relief Well Detail
- 4B Relief Well Detail
- 4C Relief Well Detail
- 5 Relief Well Drainage System
- 6 Inclinator Detail
- 7 Geotech. Monitoring Program, Data Control Form
- 8 Structural Benchmark Data Form
- 9 Reservoir Piezometer Data Form
- 10 Relief Well Flow Report Form
- 11 Inclinator Data Form
- 12 Pneumatic Piezometer Data Form

1.0 SCOPE OF WORK

1.1 GENERAL

1.1.1 Items Included

This specification provides procedures for the following activities relative to operation and integrity of the physical aspects of the Main Cooling Reservoir and related structures:

- A. Gathering geotechnical instrumentation data (monitoring)
- B. Responsibilities regarding reduction, interpretation and evaluation of monitored data.
- C. Physical inspections
- D. Emergency preparation work
- E. Identification of maintenance needs relative to inspectability, instrument operability, identification and accessibility and embankment integrity.

1.1.2 Items Not Included

Following related work items are beyond the scope of this specification:

- A. Original installation of instruments
- B. Operating procedures for MCR and related systems, such as circulating water system, blowdown system, and makeup water system
- C. Normal maintenance or repair procedures

1.2 DEFINITIONS

The following words shall have these special meanings when used herein:

<u>Site Engineering Manager (SEM)</u>	-	Bechtel Construction management at the STP jobsite
<u>Contractor</u>	-	Harza Engineering Company
<u>Constructor</u>	-	Ebasco Constructors Inc.
<u>Owner</u>	-	Houston Lighting & Power Company
<u>MCR</u>	-	Main Cooling Reservoir

### 1.3 RESPONSIBILITIES

The responsibilities for implementation of the MCR related work activities during PRE-OPERATIONAL PERIOD covered in this specification are to be as per the following matrix, where PREOPERATIONAL PERIOD is defined as period prior to plant operation or until such time as the Owner decides to take-over these activities prior to normal plant operation. OPERATIONAL PERIOD is defined as the balance of the plant life.

During the transition period when the responsibilities are being transferred to the Owner, the responsibilities shown in the matrix below shall take precedence over those in the body of the Specification.

PRE-OPERATIONAL PERIOD RESPONSIBLE ORGANIZATION				
ACTIVITIES	BECHTEL	CONTRACTOR	CONSTRUCTOR	OWNER
1. Coordination of Work Activities	X	X		X
2. Geotechnical Instrumentation Monitoring				X (Note 3)
3. Completion Check of Data				X (Note 4)
4. Distribution of Data	X (SEM) (Note 5)			X (Note 5)
5. Data Reduction Plotting and Storage	X (Note 6)			X (Note 6)
6. Data Interpretation, Analysis and Evaluation		X		
7. MCR Action Items Lists		X		
8. MCR Emergency Notification Reports	X	X	X	X
9. MCR Facilities Inspections		X		
10. Emergency Preparation Work	X	X	X (Note 1)	



**NOTES:**

1. Actual fieldwork in case of emergency to be performed by the Constructor with technical guidance from Contractor.
2. (Deleted)
3. From December 1, 1988 the Owner shall monitor and collect data from MCR Structural Benchmarks and Settlement Plates and from MCR Inclinoimeters per the requirements of this Specification. From January 1, 1989 the Owner shall monitor and collect data from MCR Piezometers and Relief Wells at a monthly frequency. All other monitoring and collection of data required by this Specification shall be performed by the Contractor. From May 1, 1989 the Owner shall monitor all geotechnical instruments per the requirements of this specification.
4. From December 1, 1988 the Owner shall perform the completion check of data which it has collected and the Contractor shall perform the completion check of the data which it has collected.
5. From January 1, 1989 the Owner shall distribute the data which it has collected and Bechtel shall distribute the data collected by the Contractor.
6. From January 1, 1988 the Owner shall perform the reduction, plotting and storage of instrumentation data.

1.3.1 Whenever specified herein, the Contractor shall provide Bechtel with prior written notification of his intentions relative to changes in the current monitoring and inspection program. Bechtel will provide non-technical coordination and review as required (i.e., with respect to licensing, budgetary, scheduling, administrative or other non-technical aspects) prior to implementation of any change by the Contractor.

**1.4 QUALITY STANDARDS**

The Contractor shall control the quality of items and services to meet the requirements of this specification, applicable codes and standards, and other contract documents.

**1.4.1 Quality Requirements**

Work covered in this specification is classified as a nonsafety related item under Quality Class 9.

**1.5 SUBMITTALS**

**1.5.1 Engineering Documents**

Engineering document requirements are detailed in applicable sections of this specification, and in Appendix A.

## 1.6 FILLING PLAN

The impoundment of water in the MCR, per current plan, is to be attained in six stages, with approximately constant Reservoir Levels (R.L.) in between filling periods.

- i. Stage I, R.L. was raised to El. +28.0 ft. M.S.L. (Approx.); (Completed in September 1983)
- ii. Stage II, the R. L. was raised to El. +35.0 ft. M.S.L. (Approx.); (Completed in November 1985)
- iii. Stage III, the R. L. was raised to El. +40.0 ft. M.S.L. (Approx.); (Completed in April 1988).
- iv. Stage IV, the R.L. is scheduled to be raised to El. +45.0 ft. M.S.L. (Approx.), maintaining this R.L. for a duration sufficiently long to monitor the performance of the MCR embankment and related facilities in order to evaluate the structural integrity of the MCR embankment at this reservoir level.
- v. Stage V, following an evaluation of the behavior of the MCR at El. +45.0 ft. M.S.L. (Approx.) the R.L. may be raised to El. +49.0 ft. M.S.L. (Approx.). In this case, the R.L. will be maintained for a duration as described in Stage IV (above).
- vi. Stage VI, the R.L. will be lowered to a level between El. +40.0 ft. M.S.L. and El. +45.0 ft. M.S.L. to support normal plant operation.

Schedule for Stages IV, V and VI may be revised to permit modification work to the MCR to be implemented.

## 2.0 GEOTECHNICAL INSTRUMENTATION MONITORING

### 2.1 SCOPE

Instruments have been installed to monitor the performance of the Main Cooling Reservoir during filling and operation. This section of the specification covers the geotechnical instrumentation monitoring activities to be carried out by the Contractor.

2.1.1 Monitoring of the Geotechnical instruments shall be performed by qualified and experienced personnel.

2.1.2 The monitored data shall be made available for use by the Owner and Bechtel at all times.

2.1.3 Items Included

The work to be performed by the Contractor shall consist of the following:

- A. Geotechnical instrumentation monitoring activities and recording and submitting of data to the Site Engineering Manager on schedules and frequencies as defined herein and summarized in Table 1 or as required otherwise by Bechtel.
- B. Maintaining records of all geotechnical instruments including locations, status, and events which may affect instrument accuracy and reporting any changes to the Site Engineering Manager, and,
- C. Maintenance, including calibration, of geotechnical monitoring equipment as necessary and notifying the Site Engineering Manager when equipment will not function within the accuracy specified herein.
- D. Identifying maintenance needs for:
  - (i) Geotechnical instruments including repair cleaning, splicing or any other work required to keep instruments in working condition.
  - (ii) Labeling and protection of geotechnical instruments including providing steel collars, timber barricades, protective caps or other suitable protection and labeling of instruments such that all instruments are identifiable at all times.
  - (iii) Relocation of structural benchmarks as required.
  - (iv) Providing access to geotechnical instruments as required for taking readings including providing or moving scaffolding or any other materials, objects or equipment.

2.2 LIST OF INSTRUMENTS

The type and number of instruments to be monitored and reference tables are as follows:

	<u>Instrument Type</u>	<u>Approximate Number</u>	<u>Table</u>
1.	Structural Benchmarks and Settlement Points	75	2
2.	Piezometers	445	3

	<u>Instrument Type</u>	<u>Approximate Number</u>	<u>Table</u>
3.	Relief Wells	774	4
4.	Inclinometers	12	5

The number of instruments listed are approximate only. Instruments may be added, deleted or relocated as deemed necessary by the Contractor, with prior written notification to Bechtel.

#### 2.2.1 Additional Instrumentation

The need for installation of additional major instruments requiring the services of specialty geotechnical contractor(s) and equipment shall be transmitted by the Contractor to Bechtel in writing. The Contractor shall prepare the technical specifications and other documents required for installation of such instruments by specialty geotechnical contractor(s) under separate contract(s). The Contractor shall provide technical guidance during the field work.

#### 2.3 SURVEYING CRITERIA

Surveying is required for monitoring the structural benchmarks and settlement points. The survey shall be performed in accordance with the criteria supplied by the Contractor.

#### 2.4 INSTRUMENTATION MAINTENANCE

##### 2.4.1 System Documentation

The Contractor shall maintain an accurate listing of all instruments including their horizontal and vertical locations. The Contractor shall notify the Site Engineering Manager of all significant changes in the geotechnical instrumentation system.

##### 2.4.2 Identification

The Contractor shall identify maintenance needs for the currently existing marking system which provides a visible form of identification of all geotechnical instruments in the field. The identification shall include the instrument number as shown on the tables referenced in Section 2.2 above, type of instrument and revision number of instrument, if any.

Identification (by others) shall be painted on or attached to an adjacent permanent structure or on the instrument casing. Identification shall be placed in highly visible locations and shall be moved or replaced when obstructed or covered by construction activities.

#### 2.4.3 Protection

The Contractor shall inspect the condition of protection for geotechnical instruments including steel collars into floors or steel sleeves which are slipped over the top of instruments. For instruments outside the structures, the condition of barricades for protecting instruments from damage by construction or maintenance equipment shall be inspected. Barricades shall be painted in a highly visible color by others.

#### 2.4.4 Redevelopment

The Contractor shall identify the need for redevelopment or cleaning, by air or water jetting, tube-type instruments which may become plugged. Alternatively, plugged instruments may be decommissioned by the Contractor after prior written notification to Bechtel.

#### 2.4.5 Abandoned Instruments

Permanently damaged or inactive instruments (e.g., pipes, casings, mandrels) shall be abandoned, with prior written notification to Bechtel, by filling with grout or other such suitable means, to prevent potential hydraulic communication between the various aquifers penetrated by the instrument, as well as to prevent possible local adverse effects of collapse of the instrument hole.

For each abandoned instrument, the Contractor shall prepare a formal document showing the instrument identification, date, reason for abandoning and detailed procedure used. The documents shall be transmitted to Bechtel for project records.

#### 2.4.6 Maintenance of Instruments

The Contractor shall identify the needs and, if applicable, prepare detailed technical procedures for the maintenance of all geotechnical instruments on the MCR and related facilities (Section 2.1.3D). Contractor recommended maintenance work that does not require the services of skilled personnel or supervision shall be performed by the Owner under the existing maintenance services contract with direct technical guidance from the Contractor. However, the maintenance needs requiring trained or experienced personnel shall be performed by geotechnical contractor(s) under separate contract(s) with technical direction from the Contractor, or minor maintenance items may be performed by the Contractor at his option. The Contractor shall determine if skilled personnel or supervision are required to perform the maintenance work.

### 2.5 MONITORING ACTIVITIES

The specified frequencies shall be revised by the Contractor, as required, to support engineering evaluation efforts. However, the Contractor shall notify Bechtel in writing prior to changing the frequencies.

### 2.5.1 General

All instruments shall be read in conformance with the frequencies specified herein. If deemed necessary by the Contractor, more frequent readings shall be obtained to supplement the results of the observations and to support evaluation of critical activities related to the reservoir. Based on the evaluation of data, the Contractor may, at anytime, revise the monitoring frequency for any of the geotechnical instruments, with prior written notification to Bechtel.

Inaccessible or damaged instruments which cannot be observed according to schedule shall be reported to the Site Engineering Manager and noted in the transmittal package.

The term "Prefilling Period" in this specification shall mean the period before August 1983 when planned raising of the reservoir began. The term "Filling Period" shall mean from the start of planned filling (August 1983) to the time the reservoir water level reaches the maximum operating level. This period is divided into "During Filling" which shall mean the periods of rising reservoir level due to planned pumping of water and "During Hold" which shall mean remaining periods of approximately constant reservoir levels. The term "Post Filling Period" shall mean that period after the reservoir has attained the maximum operating level. This period is divided into "0-1 years" "1-5 years" and "After 5 years" of reaching the maximum operating level.

### 2.5.2 Structural Benchmarks and Settlement Points

#### 2.5.2.1 Introduction

Structural benchmarks have been installed on the Spillway Structure and Makeup Discharge Structure for monitoring of movements both during construction and plant operation. These benchmarks shall be monitored as part of the geotechnical monitoring program for the Main Cooling Reservoir.

Settlement points have been installed at approximately 3000-foot intervals along the centerline of the Main Cooling Reservoir embankment and at selected critical locations.

#### 2.5.2.2 Permanent Structural Benchmarks

The locations of permanent structural benchmarks are shown in Table 2. The need for additional benchmarks shall be transmitted to SEM.

Solid brass survey markers with flat or domed heads and with shank area of 0.4 sq. in. and shank length of 2 in. as manufactured by LIETZ or Bechtel approved equal are used for structural benchmarks.

#### 2.5.2.3 Settlement Points

The locations of Main Cooling Reservoir embankment settlement points are shown in Table 2. The Contractor shall maintain a record of the status of settlement points and shall report any damage or alteration to the markers or their location to the SEM.

#### 2.5.2.4 Surveying

Surveying for structural benchmarks and settlement points shall be performed in accordance with the criteria developed by the Contractor.

#### 2.5.2.5 Frequency of Monitoring

Structural benchmarks and settlement points shall be surveyed at the frequencies indicated in Table 1.

#### 2.5.2.6 Reporting

The Contractor shall report the data to the Site Engineering Manager on the Structural Benchmark Data Form (Figure 8) and the data shall be transmitted to the SEM using the Data Control Form (Figure 7).

### 2.5.3 Piezometers

#### 2.5.3.1 Introduction

Standpipe piezometers have been installed at various locations around the embankment to monitor the piezometric levels that develop in the foundation sand layer, in the sand core, and in the horizontal drainage blanket beneath portions of the embankment.

Pneumatic piezometers have been installed in the embankment immediately downstream of the sand core to monitor the piezometric levels in the embankment.

Piezometers damaged or destroyed by construction or maintenance activities shall be abandoned. The Contractor shall provide complete documentation to the SEM including the reasons, data and actual procedure used for abandonment.

#### 2.5.3.2 Instrument Locations

The location of the piezometers by embankment station and their position on the embankment are shown on Table 3 and Figure 3, respectively (Reference Drawing 9Y51 O-H-1163).

#### 2.5.3.3 Monitoring Equipment

The equipment used for obtaining the standpipe piezometer measurements shall consist of a down-hole probe unit connected by an electric cable to an ohmmeter-type gauge. Submergence of the probe's bare electrodes beneath the water level in the piezometer activates the readout unit.

The equipment used for obtaining the pneumatic piezometer measurements consists of a portable readout unit which, when connected to tubes attached to the pneumatic transducer, will give a direct readout of embankment hydrostatic pressure at the transducer location.

#### 2.5.3.4 Monitoring Procedures

##### A. Standpipe Piezometers

1. To obtain a measurement at the field installation, probe shall be lowered into the standpipe until a signal is obtained at the read-out. The depth is to be read to the nearest 0.1 foot and recorded.
2. Step 1 shall be repeated by raising probe several feet and relowering, and data shall be recorded on the form.
3. Until two measurements within 0.1 foot of each other are obtained, Step 2 shall be repeated.
4. Cap on standpipe shall be replaced after the probe is removed.
5. Average of two or three measurements (as the case may be) for each standpipe piezometer shall then be entered in the "Readings" column on Reservoir piezometer data form (Fig. 9). Data shall be recorded to the nearest 0.1 foot.

##### B. Pneumatic Piezometers

These remote sensing devices consist of two tubes leading from an observation station connected to two openings in the cell body. Hydrostatic pressure exerted on the cell causes the diaphragm to close. The procedures outlined below permit a measurement of embankment hydrostatic pressure to be made by allowing nitrogen to be introduced by one tube until the pressures on both sides of the diaphragm are balanced thus allowing air to return to the observation station through the second tube.

1. Check zero setting on Output Pressure gauge with Transfer and Vent valves open. If adjustment is required, release pressure within the gauge (i.e., leave valves open), carefully remove the glass lens cover, and turn the recalibrator screw until the pointer resets at zero.
2. Close all the valves on the Pneumatic Pressure Indicator.
3. Open the vent valve.
4. Adjust the Supply Pressure to approximately 140 psi by turning the Supply Regulator handle clockwise.
5. Adjust the Metered Input valve so that the Flowmeter reads a flowrate of 0.1 SCFH\* with the Input Vent open.



**\*Note:** Calibration of the pneumatic piezometer is recorded at the flowrate of 0.1 SCFH (Standard Cubic Feet per Hour) at the time of the stabilized output pressure reading.

This flowrate must be repeated to maintain the full accuracy of the transducer. The flowrate for the INITIAL reading may be increased to prefill and pressurize the pneumatic tubes. A flowrate of approximately 0.2 SCFH is sufficient until the pointer on the Output Pressure gauge stabilizes. At this time flowrate must be returned to 0.1 SCFH for full accuracy.

6. Open the Transfer valve. This connects the Input circuitry to the Output Pressure gauge.
7. Remove all the protective caps from the pneumatic tubes and couplers.
8. Wipe clean all connecting couplers before connecting to the Pneumatic Indicator.
9. Close the Vent valve.
10. Connect the Pneumatic Input coupler (with the small tube vented to atmosphere) and observe the pressure increase on the Output Pressure gauge.
11. Wait for the Output Pressure gauge to stabilize, then gently, using your finger, tap the Output Pressure gauge and record the pressure reading.
12. Verify the reading by opening the Vent valve until the pointer on the Output Pressure gauge starts to fall, then close the Vent valve so that the flowrate can re-pressurize the transducer.
13. Recheck the flowrate on the flowmeter and adjust if necessary to 0.1 SCFH.
14. Record the pressure measurement reading indicated on the Output Pressure gauge after the pointer comes to a complete Stop.

**NOTE:** Verify the reading again, by repeating the last four steps.

15. Disconnect the pneumatic tube coupler and replace the protective caps. DO NOT vent the pneumatic tube, as the gas retained in the tubing and transducer helps guard against moisture and contamination entering the system. The gas retained also aids in faster pressurization of the transducer on the next recording date.

16. Close the Supply Pressure Regulator by turning the handle counter-clockwise.
17. Open the Vent and Transfer valves to zero the Output Pressure gauge.
18. Close all valves except the Metering valves.

C. Reservoir Level

At the completion of a cycle of monitoring the piezometers, the elevation of water level in the Reservoir shall be measured at a suitable location and noted on the data form. The elevation shall be measured to the nearest 1/10th of a foot and designated "PRES" for reporting purposes (example: PRES +27.8 ft).

2.5.3.5 Frequency of Monitoring

The piezometers shall be monitored at the frequencies indicated in Table 1.

Piezometers shall be read in a manner so that all embankment piezometers are read within one working week for any given cycle of readings. Each cycle of readings (and every second cycle during initial filling) shall coincide with a cycle of relief well flow readings.

2.5.3.6 Reporting

When piezometers are installed, the initial data shall be reviewed and the readings taken before the instrument stabilizes need not be reported. The piezometer data shall be reported to Site Engineering Manager on the Reservoir Piezometer Data forms for the standpipe and pneumatic piezometers (Figures 9 and 12 respectively) and transmitted to the SEM using the Data Control Form (Figure 7).

2.5.4 Relief Wells

2.5.4.1 Introduction

Relief wells have been installed around the downstream perimeter of the Main Cooling Reservoir embankment to relieve foundation hydrostatic pressure in the permeable soil layers beneath the embankment. The relief wells are free-draining and self-contained. The monitoring specified herein consists of the periodic measuring of the rate (volume per unit of time) of water flow from the discharge pipe of each flowing well.

The location of relief wells are tabulated in Table 4 by their station number along the Main Cooling Reservoir embankment.

#### 2.5.4.2 Monitoring Procedures

Flow from relief wells shall be measured using a graduated container and stopwatch. The flow shall be measured without raising the flap valve at the end of discharge pipes. However for the next (after November 25, 1985) two cycles of monitoring, the rate of flow from the relief wells shall also be measured after raising the flap valves and allowing the flow to stabilize to a steady stream. Flowrate can be measured in any unit, but in all cases the readings shall be converted to and reported in gallons per minute (gpm). The effluent shall be visually checked for fines by holding the container against light. A qualitative comment (e.g., highly turbid, lightly turbid, or clear) shall be noted on the form. If silt is present in the discharge pipe due to drainage ditch flooding, it shall be so noted. The flow shall be measured at least twice to achieve repeatability. The rate of flow, or if not flowing, an appropriate note, e.g. "DRY," "UNDER WATER," "INACCESSIBLE," shall be recorded on Relief Well Flow Report (Figure 10). Water level in the Reservoir at the time of monitoring relief well flow shall also be noted on the Flow Report Form.

The Contractor may, at his discretion, but with prior written notification to Bechtel, use alternate monitoring procedure(s) for relief wells that are accessible, but may have their discharge pipes temporarily underwater.

#### 2.5.4.3 Frequency of Monitoring

The rate of flow from relief wells shall be measured at the frequencies indicated in Table 1. Readings shall be taken in a manner so that all relief well flows are read within one working week. Schedule of relief well readings shall be coordinated with piezometer readings as specified above in 2.5.3.5.

The metallic relief well discharge flap valves (pre-1981) shall be inspected on a monthly basis.

#### 2.5.4.4 Reporting

The relief well data shall be reported to the SEM on the Relief Well Flow Report Form (Figure 10) and transmitted under the Data Control Form (Figure 7).

### 2.5.5 Inclinometers

#### 2.5.5.1 Introduction

Inclinometers have been installed at selected stations on the Main Cooling Reservoir embankment to monitor horizontal ground movement at those stations. Each of the monitored stations have three inclinometers - one at the embankment crest, one on the upstream face at an approximate elevation of 50 feet, and the third one on the embankment downstream berm.

#### 2.5.5.2 Location

The inclinometer sets are located at approximately Stations 262 + 00, 280 + 00, 318 + 20 and 341 + 50 of the Main Cooling Reservoir embankment and tabulated by their numbers in Table 5.

#### 2.5.5.3 Method of Measurement

The inclinometer sensor, referred to as a torpedo, is moved through the permanently installed aluminum or plastic casing along four internal longitudinal grooves which guide the torpedo. Variations detected by the tilt sensor show on a portable indicator and are read and recorded.

Procedures for performing inclinometer measurements shall be as follows:

- A. The groove or slot orientation shall be recorded. The slots are designated as A+, A-, B+, and B- as shown on Figure 6.
- B. With the inclinometer sensor, cable and readout unit connected, the torpedo is lowered with its upper wheel in the A+ groove (for a biaxial device this will give inclinations for the A+ and B+ directions).
- C. The torpedo is then lowered to a reference point established during calibration. The cable may be fixed by an extension cable clamp while awaiting stabilization of the readings on the indicator unit. Once stabilized, the complete readings are recorded.
- D. The cable is then pulled up 2 feet, and another reading taken. Readings are continued in this manner at 2-foot increments until the top of the casing is reached.
- E. After reaching the top of the casing the torpedo is removed and rotated 180 degrees then is inserted back into the grooves (upper wheels in the A- groove). The instrument is then ready to record the inclination with respect to the A- and B- directions.
- F. The procedures outlined in steps B through D shall be repeated.

#### 2.5.5.4 Frequency of Monitoring

The inclinometers shall be monitored at the frequencies indicated in Table 1.

#### 2.5.5.5 Reporting

The inclinometer readings shall be reported to the Site Engineering Manager on the Inclinometer Data Form (Figure 11), and transmitted under the Data Control Form (Figure 7).

### 2.6 RECORDING OF READINGS

#### 2.6.1 General

Readings shall be entered by the Contractor's field personnel on the forms as specified herein, and recorded on hand held input devices at the discretion of the Contractor.

#### 2.6.2 Transmittal of Data

The data (original forms) shall be assembled into a package (Data Package), and transmitted to SEM on a monthly basis under a Data Control Form in Figure 7. However, during periods when the reservoir level is being raised the Data Packages will be transmitted on a biweekly basis. The Data Control Form shall be signed by the Contractor certifying that the data forms have been checked for completeness and that all "readable" instruments have been monitored by qualified personnel following the specified procedure. The data packages shall be numbered sequentially by the Contractor starting with R001. While the original forms shall be transmitted to SEM, the HRE shall maintain a copy of each package transmitted for traceability.

#### 2.6.3 Completion Check

The Data Packages transmitted to the SEM shall be checked by the Contractor for completeness of the comprising documents. As a minimum, the Contractor shall check that all the data forms in the package are completely filled out and that all the readable instruments have been read per established schedule.

#### 2.6.4 Control of Reading in Error

A faulty reading shall be cancelled by a red line. Readings shall never be erased.

Errors discovered by the Contractor after processing the data shall be corrected and reported as soon as possible. Replacement data must have the same date (i.e., same year, month, date and hour), and, instrument and point identification as the erroneous data.

Also, should a question arise regarding the data during processing by Bechtel, the inquiry will be transmitted to the Contractor. In the event a correction to previously submitted data is required, the Contractor shall process the correction in accordance with the provisions in Section 2.6.4.1.

#### **2.6.4.1 Retransmittal of corrected data**

Corrected data shall be transmitted to SEM under a second Data Control Form. The form shall carry the data package number of the original submittal and shall be labeled "CORRECTION" in the "Package Contents" block.

All corrected data pertaining to each month's measurements shall be forwarded to the SEM no later than the 15th day of the next month.

### **3.0 DATA MANAGEMENT**

The completed original data packages shall be retained by the SEM for eventual hand-over to the Owner. The SEM shall maintain an up-to-date file of the original data packages.

#### **3.1 REDUCTION**

The data shall be entered into the GEMP data base by Owner. The data base shall be checked for accuracy and maintained by a qualified engineer.

3.1.1 The GEMP software shall be maintained by the SEM until turned over to the Owner. Responsibilities shall include data manipulations and outputs, changing fields, entering new instruments, input and output modes.

#### **3.2 DATA INTERPRETATION AND EVALUATION**

Bechtel shall transmit the reduced data plots, in a mutually agreed-upon format, to the Contractor through computer linkups or hardcopies at an established schedule.

3.2.1 The Contractor shall review, analyze and evaluate the data from Data Packages and the reduced data transmittals per Specification 9Y510HS1014.

### **4.0 INSPECTIONS**

#### **4.1 GENERAL**

The objective of the inspection program is to evaluate the performance of the MCR embankment and appurtenant structures for the purpose of identifying existing or potential conditions that could affect structural integrity. This involves evaluation of the interrelationships of the design of structures and embankment.

4.1.1 The Contractor shall be responsible for all inspections of the MCR embankment and related structures. Detailed technical conditions for the MCR inspection program shall be prepared by the Contractor for carrying out his responsibilities.

4.1.2 Project requirements relative only to the documentation and administrative aspects of the inspection program are set forth in the following sections.

4.1.3 The inspection reports prepared by the Contractor shall conform, in principle, to the general format recommended by Dames and Moore in the "MANUAL - for Inspection Programs for Cooling Lake Dams, Embankments and Associated Impoundments owned by Houston Lighting and Power Company" dated August, 1979 (TPNS No. Y570XQ005-AHL).

#### 4.2 DAILY INSPECTIONS

4.2.1 Inspection of the MCR embankment, during reservoir filling, shall consist of the following:

- a. Daily inspection tour by horse or slow moving vehicle around the MCR.
- b. Daily on-vehicle inspections
- c. Inspection of problem areas as needed
- d. During reservoir hold periods the inspection frequency may be modified at the option of the MCR Engineer.

4.2.2 Weekly Inspection Reports (WIR) shall be prepared and signed by the Contractor. The reports shall be prepared once a week during periods when the reservoir level is being raised and once every two weeks for the remainder of the time. The WIRs shall be numbered sequentially starting with MCR-85-WIR-001.

4.2.3 The original signed WIRs shall be transmitted by the Contractor per Appendix A. The Contractor shall maintain an up-to-date file of the WIRs at site.

#### 4.3 PERIODIC INSPECTIONS

4.3.1 Periodical inspections shall be performed to formally review the overall performance of the MCR embankment. The inspection shall include both an on-site inspection and review of WIRs, Data Packages, Data Plots and presentations from the Contractor.

A guide format and other details for Periodic Inspections shall be prepared by the Contractor. Requirements may be changed by the Inspection Team as required.

4.3.2 Regular Periodic Inspections shall be performed by an inspection team established by the Contractor who shall also co-ordinate the on-site activities for inspection.

4.3.3 Upon completion of each periodic inspection, inspection team shall prepare and submit a report to Bechtel. The Regular Periodic Inspection Reports (PIRs) per established format shall be co-ordinated by the Contractor. The PIRs shall be reviewed and signed by the members of the inspection team. The PIRs shall be numbered in accordance with TPNS by STP Records Management System (9Y510HRXXXX).

4.3.4 The PIRs shall be transmitted by the Contractor to Bechtel per Appendix A. The Contractor shall maintain an up-to-date file of the PIRs.

#### 4.4 SPECIAL INSPECTIONS

4.4.1 Special inspections shall be performed as required, to address specific conditions or features requiring evaluation and to support ongoing engineering evaluations. Conditions which may warrant special inspections include:

1. Occurrence of unusual natural events; e.g., earthquakes, tornadoes, hurricane, local intense precipitation, etc. near the Reservoir, that, in the opinion of the Contractor could affect the integrity of the MCR structures.
2. When key points in startup are reached during construction; e.g., the spillway passes the first major flood, the Circulating Water system starts operating, the Blowdown System starts operating.
3. Any other condition detected by the Contractor, which, in his opinion, warrants onsite inspection. This may include items identified by maintenance crew, monitoring crew and/or other inspections.

4.4.2 These inspections shall be performed by technical personnel designated by the Contractor who shall also determine the scope and schedule for each inspection.

4.4.3 Upon completion of the special inspections, inspection personnel shall prepare and submit a report to Bechtel per Appendix A. The report shall document the observed site conditions or features, results of evaluation, and recommendations.

#### 5.0 MCR ACTION ITEMS LIST

5.1 As part of the Periodic and Special Inspection Reports or when the Contractor deems necessary, a list of recommended major work items relative to MCR embankment shall be prepared. Each major work item shall be numbered uniquely and sequentially starting with 85-MCR-001. The running list of major work items shall be transmitted to SEM upon completion of the inspection for coordination of remedial actions.



5.2 Regular maintenance or minor repairs shall be coordinated by the Contractor with SEM, Owner and Owner's maintenance crew supervisor on a weekly basis. Specific repairs will be identified and incorporated into the maintenance crews work schedule. A copy of the work schedule showing completed and outstanding items of work will be obtained by the Contractor on a weekly basis. The Contractor will maintain a record of all work completed.

6.0 EMERGENCY ACTION

6.1 EMERGENCY NOTIFICATION

Emergency notification shall be the responsibility of the Contractor. Bechtel, Constructor, the Owner's maintenance crew and the Owner will assist the Contractor to the extent possible.

6.2 Whenever a situation considered potentially hazardous to the MCR embankment is observed during inspection, monitoring or maintenance, the designated personnel shall be immediately notified verbally.

7.0 EMERGENCY PREPARATION WORK

7.1 The list of materials and services that may be required for immediate repairs in case of emergencies shall be prepared by the Contractor.

7.2 The Contractor shall be responsible for maintaining the list in a current status.

7.3 The Contractor shall be responsible for inspection to ensure that the stockpiles and other services are maintained in proper order. Maintenance needs shall be reported to SEM.

7.4 The Contractor shall prepare the documents detailing the procedures to be followed for the remedial work in case of emergencies.

APPENDIX A

ENGINEERING DOCUMENT REQUIREMENTS

1. DOCUMENT CATEGORY NUMBER	2. SPECIFICATION PARAGRAPH REFERENCE	3. DOCUMENT DESCRIPTION	4. PERMISSION TO PROCEED REQUIRED		5. ESSENTIAL SCHEDULE	6. QUANTITY REQUIRED		7. KIND OF COPIES	8. REMARKS
			YES	NO		MIN	MAX		
8.0	2.5.2.6	STRUCT. BENCHMARK DATA FORM	X			1		R	PER SEC. 2.5.2.5
8.0	2.5.3.6	PIEZOMETER DATA	X			1		R	PER SEC. 2.5.3.5
8.0	2.5.4.4	RELIEF WELL DATA	X			1		R	PER SEC. 2.5.4.3
8.0	2.5.5.5	INCLINOMETER DATA	X			1	1	R	PER SEC. 2.5.5.4
8.0	2.6.2	DATA CONTROL FORM	X			1		R	AS NEEDED
8.0	4.2.3	MCR WIRS	X		B1- Wkly	1		R	
8.0	5.0	MCR ACTION ITEM LISTS	X			1		R	AS NEEDED
8.0	6.0	MCR EMERGENCY NOTIFICATION	X			1		O	AS NEEDED
8.0	4.3.4	PERIODIC INSPECTION REPORT	X			1		R	
8.0	4.4.3	SPECIAL INSPECTION REPORT	X			1		R	

9. FORWARD COPIES TO:

SPECIAL INSTRUCTIONS

BECHTEL ENERGY CORP.  
 P. O. Box 15  
 Bay City, TX 77414  
 ATTENTION: PROJECT DOCUMENT CONTROL CENTER



11-321-F

10.

SOUTH TEXAS PROJECT  
 HOUSTON LIGHTING & POWER COMPANY

ENGINEERING DOCUMENT REQUIREMENTS

11. JOB NO. 14926

12. SPEC. NO. 9Y510YS1004

Sheet 1 OF 1

**APPENDIX A**  
**ENGINEERING**  
**DOCUMENT CATEGORY DEFINITIONS**  
**G-321-E - SUP A**

SPEC. NO. 9Y510YS1004  
REV. NO. 6  
PAGE 2 OF 3

(E) Engineering Documents. This term comprises procedures, drawings, specifications, QA plans, prototype qualification test reports, and other similar documents that require Bechtel permission to proceed prior to fabrication, or prior to use of the document on the design, fabrication, installation, or other work progress. The term is also applied to price lists, and instructions for erection/installation, operation, maintenance, and site storage and handling.

**A. DEFINITIONS OF TERMS**

(Note: Standard abbreviated titles follow the category definitions).

Supplier - This is a comprehensive term and includes seller, vendor, contractor, subcontractor, subsupplier, etc.

Original - The initial document of which copies are made, i.e., handwritten copy, typed copy, printed matter, tracings or drawings and photographs.

Reproducible - A master copy which can be legibly duplicated by either microreproduction, diazo or electrostatic process. Diazo copies may be submitted, only if they meet and satisfy Bechtel microfilming requirements.

Microfilm - Film containing an image reduced in size from the original and capable of being enlarged to a clear reproduction of the original.

Permission to Proceed Required - Bechtel review required prior to use of documents in the design, fabrication, installation, or other work processes.

Initial - The first submittal of a document in accordance with the schedule mutually agreed to by Bechtel and the supplier.

Final - The submittal that reflects the required resolution of review comments or the complete submittal required. Drawings submitted as final shall show Bechtel's job title, job number, procurement document number, line, equipment, tag or code number and the manufacturer's serial number(s).

**B. SUBMITTAL**

In column 5, Bechtel Engineering to place the following codes where applicable:

F - Before Fabrication  
S - Before Shipment

I - Before Installation  
P - Before Final Payment

W - With Shipment  
D - Before Design

or

Expressed in calendar days after notice of award.

In column 7, Bechtel Engineering to place the following letter as applicable:

M - Microfilm  
R - Reproducible  
O - Original

In column 8, supplier to indicate its schedule if different than shown, and agreed with by Bechtel.

**C. DISTRIBUTION**

Items and/or documents required to be provided by the G-321-E shall be forwarded to the Bechtel Engineering designated under entry No. 9, "Forward Copies To:"

**D. DOCUMENT CATEGORY NUMBERS & ABBREVIATED DESCRIPTIONS**

Engineering Documents are identified and defined as follows:

**1.0 DRAWINGS (DWG)**

- 1.1 Outline Dimensions, Services, Foundations and Mounting Details (OUTLINE DIM. SERVICES & FOUN/MTG DETS) - Drawings providing external envelope, including bays, centerline(s), location and size for electrical cable, conduit, fluid, and other service connections, isometrics and details related to foundations and mountings.
- 1.2 Assembly Drawings (ASSEMBLY DWGS) - Detailed drawings indicating sufficient information to facilitate assembly of the component parts of an equipment item.
- 1.3 Shop Detail Drawings (SHOP DET DWGS) - Drawings which provide sufficient detail to facilitate fabrication, manufacture, or installation. This includes pipe spool drawings, internal piping and wiring details, cross-section details and structural and architectural details.
- 1.4 Wiring Diagrams (WIRING DIAGS) - Drawings which show schematic diagrams, equipment internal wiring diagrams, and interconnection wiring diagrams for electrical items.
- 1.5 Control Logic Diagrams (CONT LOGIC DIAGS) - Drawings which show paths which input signals must follow to accomplish the required responses.
- 1.6 Piping and Instrumentation Diagrams (P&IDs) - Drawings which show piping system scheme and control elements.

2.0 PARTS LIST AND COST - Sectional view with identified parts and recommended spare parts for one year's operation or specified with unit cost.

3.0 COMPLETED BECHTEL DATA SHEETS (COMP DATA SHT) - Information provided by a supplier on data sheets furnished by Bechtel.

# APPENDIX A

SPEC. NO. 9Y510YS1004

REV. NO. 6

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## 4.0 INSTRUCTIONS

- 4.1 Erection/Installation (EREC/INSTL) - Detailed written procedures, instructions, and drawings required to erect or install material or equipment.
- 4.2 Operating - Detailed written instructions describing how an item or system should be operated.
- 4.3 Maintenance - Detailed written instructions required to disassemble, reassemble and maintain items or systems in an operating condition.
- 4.4 Site Storage and Handling (SITE STOR & HDLG) - Detailed written instructions which define the requirements and time period for lubrication, rotation, heating, lifting or other handling requirements to prevent damage or deterioration during storage and handling at jobsite. This includes return shipping instructions.

5.0 SCHEDULES: ENGINEERING AND FABRICATION/ERECTION (SCHED) (ENGRG & FAB EREC) - Bar charts or critical path method diagrams which detail the chronological sequence of activities.

6.0 QUALITY ASSURANCE MANUAL/PROCEDURES (QA MNL/PROC) - The document(s) which describe(s) the planned and systematic measures that are used to assure that structures, systems, and components will meet the requirements of the procurement documents.

7.0 SEISMIC DATA REPORT - The analytical or test data which provides data and demonstrates suitability of material, component or system in relation to the conditions imposed by the stated seismic criteria.

8.0 ANALYSIS AND DESIGN REPORT (ANAL & DSGN RPRT) - The analytical data (stress, electrical loading, fluid dynamics, etc.) which demonstrates that an item satisfies specified requirements.

9.0 ACOUSTIC DATA REPORT (ACST DATA RPRT) - The noise, sound and other acoustic vibration data required by the procurement document.

## 10.0 SAMPLES

10.1 Typical Quality Verification Documents (TYP QUAL VERIF DOC) - A representative data package which will be submitted for the items furnished as required in the procurement documents.

10.2 Typical Material Used (TYP MAT USED) - A representative example of the material to be used.

11.0 MATERIAL DESCRIPTION (MAT DESCRT) - The technical data describing a material which a supplier proposes to use. This usually applies to architectural items, e.g., metal siding, decking, doors, paints, coatings.

12.0 WELDING PROCEDURES AND QUALIFICATIONS (WLOG PROC & QUALF) - The welding procedure, specification and supporting qualification records required for welding, hard facing, overlay, brazing and soldering.

13.0 MATERIAL CONTROL PROCEDURES (MATERIAL CONT PROC) - The procedures for controlling issuance, handling, storage and traceability of materials such as weld rod.

14.0 REPAIR PROCEDURES (REPAIR PROC) - The procedures for controlling material removal and replacement by welding, brazing, etc., subsequent thermal treatment, and final acceptance inspection.

15.0 CLEANING AND COATING PROCEDURES (CLNG & CTG PROC) - The procedures for removal of dirt, grease or other surface contamination and preparation and application of protective coatings.

16.0 HEAT TREATMENT PROCEDURES (HEAT TR PROC) - The procedures for controlling temperature and time at temperature as a function of thickness, furnace atmosphere, cooling rate and method, etc.

19.0 UT - ULTRASONIC EXAMINATION PROCEDURES (UT PROC) - Procedures for detection of presence and certain characteristics of discontinuities and inclusions in materials by the use of high frequency acoustic energy.

20.0 RT - RADIOGRAPHIC EXAMINATION PROCEDURES (RT PROC) - Procedures for detection of presence and certain characteristics of discontinuities and inclusions in materials by x-ray or gamma ray exposure of photographic film.

21.0 MT - MAGNETIC PARTICLE EXAMINATION PROCEDURES (MT PROC) - Procedures for detection of surface (or near surface) discontinuities in magnetic materials by distortion of an applied magnetic field.

22.0 PT - LIQUID PENETRANT EXAMINATION PROCEDURES (PT PROC) - Procedures for detection of surface discontinuities in materials by application of a penetrating liquid in conjunction with suitable developing techniques.

23.0 EDDY CURRENT EXAMINATION PROCEDURES (EDDY CUR EXAM PROC) - Procedures for detection of discontinuities in material by distortion of an applied electromagnetic field.

24.0 PRESSURE TEST - HYDRO, AIR, LEAK, BUBBLE OR VACUUM TEST PROCEDURE (PRESS TEST - HYDRO, AIR, BUBBLE - VAC TEST PROC) - Procedures for performing hydrostatic or pneumatic structural integrity and leakage tests.

25.0 INSPECTION PROCEDURE (INSPECTION PROC) - Organized process followed for the purpose of determining that specified requirements (dimensions, properties, performance results, etc.) are met.

26.0 PERFORMANCE TEST PROCEDURES (PRFM TEST PROC) - Tests performed to demonstrate that functional design and operational parameters are met.

26.1 Mechanical Tests (MECH TEST) - e.g., pump performance data, valve stroking, load, temperature rise, calibration, environmental, etc.

26.2 Electrical Tests (ELEC TEST) - e.g., impulse, overload, continuity, voltage, temperature rise, calibration, saturation, loss, etc.

27.0 PROTOTYPE TEST REPORT (PROTO TYP TEST REPORT) - Report of a test which is performed on a standard or typical example of equipment or item, and is not required for each item produced in order to substantiate the acceptability of equal items. This may include tests which result in damage to the item(s) tested.

28.0 PERSONNEL QUALIFICATION PROCEDURES (PERSONL QUAL PROC) - Procedures for qualifying welders, inspectors and other special process personnel.

29.0 SUPPLIER SHIPPING PREPARATION PROCEDURE (SUPR SHPG PREP PROC) - The procedure used by a supplier to prepare finished materials or equipment for shipment from its facility to the jobsite.

30.0 (OPEN)

31.0 (OPEN)

32.0 (OPEN)

TABLE 1  
FREQUENCY OF GEOTECHNICAL INSTRUMENTATION MONITORING FOR MAIN COOLING RESERVOIR

Page 1 of 1

Frequency of Monitoring

Instrument Type	PREFILLING PERIOD	FILLING PERIOD		POST FILLING PERIOD		
		During Filling	During Hold	0-1 year	1-5 years	After 5 years
Structural Benchmarks and Settlement Plates	Monthly	Monthly	Bimonthly	Bimonthly	Quarterly	Semiannually
Piezometers	Monthly	Biweekly	Monthly	Monthly	Bimonthly	Quarterly
Relief Wells	Monthly	Biweekly	Monthly	Monthly	Bimonthly	Quarterly
Inclinometers	Monthly	Biweekly	Monthly	Monthly	Bimonthly	Quarterly

Notes:

- (1) The prefix "bi-" shall mean "once every two"; for example, biweekly is once every two weeks.
- (2) The different periods used in this table are described in Section 2.5.1 of this specification.

TABLE 2  
MAIN COOLING RESERVOIR SETTLEMENT POINT DATA

Page 1 of 2

Settlement Point No.	Embankment Station	Settlement Point No.	Embankment Station
1	Destroyed	34	120 + 00
4	90 + 00	35	210 + 00
5	130 + 00	36	250 + 00
8	160 + 00	37	250 + 00
9	180 + 00	38	270 + 00
10	190 + 00	39	270 + 00
10a	Destroyed	40	310 + 00
11	Destroyed	41	310 + 00
12	345 + 00	42	345 + 00
13	390 + 00	43	365 + 00
14	420 + 00	44	365 + 00 (3)
15	480 + 00	45	365 + 00
16	515 + 00	46	390 + 00
17	535 + 00	47	420 + 00
18	Destroyed	48	450 + 00
19	595 + 00	49	450 + 00
20	625 + 00	50	480 + 00
21	Destroyed	51	515 + 00
22	30 + 00	52	535 + 00
23	30 + 00	53	561 + 75
24	50 + 00	54	595 + 00
25	50 + 00	55	625 + 00
26	70 + 00	56	640 + 00
27	70 + 00	57	640 + 00
28	90 + 00		
29	112 + 00		
30	112 + 00		
31	160 + 00		
32	180 + 00		
33	190 + 00		

1. Settlement Points 22 to 57 were installed in October 1983.
2. Of the two settlement points in same embankment station, one is a shallow settlement point and the other one is a deep settlement point.
3. All Settlement Points (except No. 44) are located on the embankment crest.

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TABLE 2

MAIN COOLING RESERVOIR PERMANENT STRUCTURAL BENCHMARKS

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Benchmark No.	Coordinates		Approx. Elev.	Location
BM-545	N45,172.51	E55,632.45	+67.25	Spillway/Blowdown Structure
BM-544	N54,655.63	E55,309.87	+66.75	Reservoir Makeup Structure

TABLE 3

MAIN COOLING RESERVOIR PIEZOMETER DATA

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Reference Drawing: 9Y51 O-H-1163

Piez. No.	Embank. Station	Tip* Elev.	Location**	Piez. No.	Embank. Station	Tip* Elev.	Location**
P0-1	Deleted from Program			P32	110 + 00	-18.0	D
P0-2	Deleted from Program			P33	120 + 20	-23.0	C
P0-3	Deleted from Program			P34	130 + 40	-7.0	A
P1-1	2 + 65	-8.0	B	P35	130 + 40	-7.0	B
P1-2	2 + 70	-16.0	B	P36	130 + 40	-7.0	C
P1-3	2 + 75	-50.0	B	P37	150 + 00	-24.0	C
P2-1	2 + 65	-8.0	C	P38	160 + 00	0.0	A
P2-2	2 + 70	-16.0	C	P39	160 + 00	0.0	B
P2-3	2 + 75	-50.0	C	P40	160 + 00	0.0	C
P3-1	2 + 65	-8.0	400' (1)	P41	170 + 40	-3.0	C
P3-2	2 + 70	-16.0	400' (1)	P42	180 + 25	-1.0	A
P3-3	2 + 75	-50.0	400' (1)	P43	180 + 25	-1.0	B
P4	3 + 39	+9.0	C	P44	180 + 25	-1.0	C
P5	7 + 00	-6.0	A	P45	190 + 40	-2.0	C
P6	7 + 00	-6.0	B	P46	200 + 20	-7.0	A
P7	7 + 00	-6.0	C	P47	200 + 20	-7.0	B
P8	7 + 00	-6.0	415' (1)	P48	200 + 20	-7.0	C
P9	11 + 00	-1.0	A	P49	209 + 80	-16.0	C
P10	11 + 00	-1.0	B	P50	219 + 80	-25.0	A
P11	11 + 00	-1.0	C	P51	219 + 80	-25.0	B
P12	Deleted from Program			P52	219 + 80	-25.0	C
P13	20 + 00	-15.0	A	P53	226 + 40	-20.0	A
P14	20 + 00	-15.0	B	P54	226 + 40	-20.0	B
P15	20 + 00	-15.0	C	P55	226 + 40	-20.0	C
P16	30 + 00	-8.0	C	P56	230 + 20	-17.0	C
P17	40 + 20	-10.0	A	P57	240 + 00	-23.0	A
P18	40 + 20	-10.0	B	P58	240 + 00	-23.0	B
P19	40 + 20	-10.0	C	P59	240 + 00	-23.0	C
P20	49 + 80	-9.0	C	P60	250 + 00	-21.0	C
P21	59 + 60	-9.0	A	P61	260 + 25	-13.0	A
P22	59 + 60	-9.0	B	P62	260 + 25	-13.0	B
P23	59 + 60	-9.0	C	P63	260 + 25	-13.0	C
P24	70 + 20	-16.0	C	P64	283 + 00	-9.0	A
P25	79 + 80	-15.0	A	P65	283 + 00	-9.0	B
P26	79 + 80	-15.0	B	P66	283 + 00	-9.0	C
P27	79 + 80	-15.0	C	P67	290 + 25	-16.0	C
P28	89 + 20	-9.0	C	P68	300 + 00	-19.0	A
P29	100 + 20	-5.0	A	P69	300 + 00	-19.0	B
P30	100 + 20	-5.0	B	P70	300 + 00	-19.0	C
P31	100 + 20	-5.0	D	P71	310 + 00	-25.0	C



TABLE 3

MAIN COOLING RESERVOIR PIEZOMETER DATA

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Reference Drawing: 9Y51 O-H-1163

Piez. No.	Embank. Station	Tip* Elev.	Location**	Piez. No.	Embank. Station	Tip* Elev.	Location**
P72	320 + 00	-8.0	A	P112	541 + 00	-10.0	C
P73	320 + 00	-8.0	B	P113	550 + 50	-3.0	A
P74	320 + 00	-8.0	C	P114	550 + 50	-3.0	B
P75	330 + 25	-21.0	C	P115	550 + 50	-3.0	C
P76	350 + 00	-17.0	C	P116	570 + 35	-11.0	A
P77	359 + 60	-0.0	A	P117	570 + 35	-11.0	B
P78	359 + 60	-0.0	B	P118	570 + 35	-11.0	C
P79	359 + 60	-0.0	C	P119	580 + 40	-13.0	C
P80	370 + 20	-26.0	C	P120	590 + 40	+4.0	A
P81	380 + 00	-24.0	A	P121	590 + 40	+4.0	B
P82	380 + 00	-24.0	B	P122	590 + 40	+4.0	C
P83	380 + 00	-24.0	C	P123	601 + 00	-12.0	C
P84	389 + 50	-24.0	C	P124	610 + 00	-12.0	A
P85	400 + 50	-22.0	A	P125	610 + 00	-12.0	B
P86	400 + 50	-22.0	B	P126	610 + 00	-6.0	C
P87	400 + 50	-22.0	C	P127	619 + 00	-13.0	C
P88	410 + 00	-23.0	C	P128	629 + 00	-13.0	A
P89	420 + 00	-22.0	A	P129	629 + 00	-13.0	B
P90	420 + 00	-22.0	B	P130	629 + 00	-13.0	C
P91	420 + 00	-22.0	C	P131	639 + 00	-14.0	C
P92	430 + 00	-22.0	C	P132	Deleted from Program		
P93	440 + 20	-4.0	A	P133	Deleted from Program		
P94	440 + 20	-4.0	B	P134	652 + 00	-16.0	C
P95	440 + 20	-4.0	C	P135	652 + 00	-16.0	400' (1)
P96	450 + 50	-4.0	C	P136	245 + 00	-6.6	C
P97	460 + 10	-22.0	A	P137	255 + 05	-6.7	C
P98	460 + 10	-22.0	B	P138	265 + 95	-8.3	C
P99	460 + 10	-22.0	C	P139	272 + 05	-12.8	C
P100	470 + 90	-20.0	C	P140	278 + 00	-12.4	C
P101	491 + 00	-22.0	A	P141	233 + 95	-13.8	C
P102	491 + 00	-22.0	B	P142	248 + 40	-10.8	C
P103	491 + 00	-22.0	C	P143	105 + 00	0.0	A
P104	501 + 00	-16.0	C	P144	105 + 00	-4.5	B
P105	511 + 00	-22.0	A	P145	105 + 00	-7.5	C
P106	511 + 00	-22.0	B	P146	135 + 00	16.8	A
P107	511 + 00	-22.0	C	P147	135 + 00	19.2	B
P108	521 + 00	-15.0	C	P148	153 + 70	17.6	A
P109	531 + 00	-13.0	A	P149	153 + 50	17.3	B
P110	531 + 00	-13.0	B	P150	270 + 00	15.8	A
P111	531 + 00	-13.0	C	P151	269 + 80	16.1	B

TABLE 3

MAIN COOLING RESERVOIR PIEZOMETER DATA

Page 3 of 8

Reference Drawing: 9Y51 0-H-1163

Piez. No.	Embank. Station	Tip* Elev.	Location**	Piez. No.	Embank. Station	Tip* Elev.	Location**
P152	250 + 00	-8.8	A	P192	Grouted		(6)
P153	250 + 00	-3.8	B	P193	283 + 00	16.2	(5)
P154	559 + 50	24.9	A	P194	Grouted		(6)
P155	559 + 50	23.9	B	P195	300 + 00	15.5	(5)
P156	318 + 00	-3.8	A	P196	Grouted		(6)
P157	318 + 00	-5.0	B	P197	320 + 00	15.5	(5)
P158	365 + 10	-13.2	A	P198	Grouted		(6)
P159	405 + 00	-13.8	C	P199	359 + 60	16.0	(5)
P160	(2)	-16.7	-	P200	Grouted		(6)
P161	(3)	-17.9	-	P201	380 + 00	22.1	(5)
P162	(4)	-17.1	-	P202	Grouted		(6)
P163	7 + 00	26.4	(5)	P203	400 + 50	29.5	(5)
P164	Deleted from Program			P204	Grouted		(6)
P165	11 + 00	26.9	(5)	P205	420 + 00	23.1	(5)
P166	Deleted from Program			P206	Grouted		(6)
P167	20 + 00	26.7	(5)	P207	440 + 20	24.6	(5)
P168	Grouted		(7)	P208	Grouted		(6)
P169	40 + 20	26.4	(5)	P209	460 + 10	26.7	(5)
P170	Grouted		(7)	P210	Grouted		(6)
P171	59 + 60	24.0	(5)	P211	491 + 00	26.6	(5)
P172	Grouted		(7)	P212	Grouted		(6)
P173	79 + 80	25.5	(5)	P213	511 + 00	24.2	(5)
P174	Grouted		(7)	P214	Grouted		(6)
P175	100 + 20	22.3	(5)	P215	531 + 00	23.9	(5)
P176	Grouted		(7)	P216	Grouted		(6)
P177	132 + 65	22.2	(5)	P217	550 + 50	26.4	(5)
P178	Grouted		(6)	P218	Grouted		(6)
P179	160 + 00	18.9	(5)	P219	570 + 35	29.1	(5)
P180	Grouted		(6)	P220	Grouted		(6)
P181	180 + 25	16.2	(5)	P221	590 + 40	26.2	(5)
P182	Grouted		(6)	P222	Grouted		(6)
P183	200 + 20	20.3	(5)	P223	610 + 00	27.3	(5)
P184	Grouted		(6)	P224	Grouted		(6)
P185	219 + 80	19.7	(5)	P225	629 + 00	29.0	(5)
P186	Grouted		(6)	P226	Grouted		(6)
P187	Deleted from Program			P227	652 + 50	29.3	(5)
P188	Grouted		(6)	P228	Deleted from Program		
P189	240 + 00	19.0	(5)	P229	Grouted	450'	(8)
P190	Grouted		(6)	P230	Grouted	900'	(8)
P191	260 + 25	17.3	(5)	P231	Deleted from Program		

TABLE 3

## MAIN COOLING RESERVOIR PIEZOMETER DATA

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Reference Drawing: 9Y51 O-H-1163

Piez. No.	Embank. Station	Tip* Elev.	Location**	Piez. No.	Embank. Station	Tip* Elev.	Location**
P232	Deleted from Program			P272	446 + 90	-21.3	D
P233	Grouted		450' (8)	P273	454 + 45	-19.5	D
P234	Grouted		900' (8)	P274	485 + 00	-4.9	D
P235	125 + 50	-11.1	C	P275	593 + 45	-2.6	C
P236	135 + 00	-9.0	C	P276	597 + 00	-3.0	C
P237	140 + 00	-22.0	C	P277	605 + 00	-11.6	C
P238	145 + 00	-21.4	C	P278	648 + 00	-14.8	C
P239	155 + 50	-22.0	C	P279	19 + 00	-10.9	D
P240	159 + 80	-22.8	C	P280	83 + 45	-0.6	D
P241	175 + 00	-2.6	C	P281	185 + 24	-0.1	C
P242	497 + 00	-19.2	D	P282	187 + 75	-1.2	C
P243	506 + 50	-16.6	D	P283	195 + 05	-5.0	C
P244	516 + 50	-10.2	D	P284	201 + 80	-8.3	C
P245	526 + 50	-15.0	D	P285	212 + 80	-10.1	C
P246	536 + 50	-14.2	D	P286	217 + 00	-15.7	C
P247	555 + 50	4.2	D	P287	639 + 00	2.3	A
P248	559 + 50	-54.4	D	P288	641 + 60	1.3	C
P249	565 + 00	-15.3	D	P289	641 + 60	-14.9	A
P250	615 + 00	-4.7	C	P290	644 + 20	1.5	C
P251	625 + 00	0.9	C	P291	644 + 20	-11.6	A
P252	634 + 00	-6.2	C	P292	646 + 80	-1.7	C
P253	115 + 00	-18.9	C	P293	646 + 80	-6.6	A
P254	440 + 80	-17.6	D	P294	649 + 40	-16.2	C
P255	465 + 80	-17.5	D	P295	649 + 40	-8.9	A
P256	545 + 00	-0.7	D	P296	655 + 00	-7.6	C
P257	248 + 00	-10.2	C	P297	655 + 00	-6.3	A
P258	248 + 80	-10.1	C	P298	04 + 87	-1.3	C
P259	262 + 25	-12.9	C	P299	04 + 87	-2.3	A
P260	294 + 75	-12.3	C	P300	09 + 00	-1.6	C
P261	340 + 00	-23.1	C	P301	09 + 00	0.4	A
P262	344 + 00	-24.4	C	P302	13 + 25	0.8	C
P263	358 + 00	-2.0	C	P303	13 + 25	-0.2	A
P264	362 + 00	-25.8	C	P304	15 + 50	1.1	C
P265	384 + 00	-19.6	D	P305	15 + 50	0.4	A
P266	391 + 40	-20.7	D	P306	17 + 75	-16.1	C
P267	395 + 00	-25.2	D	P307	17 + 75	-2.5	A
P268	416 + 55	-23.4	D	P308	22 + 50	-7.9	C
P269	427 + 50	-20.7	D	P309	22 + 50	-18.8	A
P270	435 + 60	-24.9	D	P310	25 + 00	-1.5	C
P271	443 + 25	-22.4	D	P311	25 + 00	-18.1	A

TABLE 3

MAIN COOLING RESERVOIR PIEZOMETER DATA

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Reference Drawing: 9Y51 O-H-1163

Piez. No.	Embank. Station	Tip* Elev.	Location**	Piez. No.	Embank. Station	Tip* Elev.	Location**
P312	27 + 50	-1.1	C	P352(PZ23)	653 + 96	26.7	151(10)
P313	27 + 50	-10.3	A	P353(PZ22)	654 + 44	18.0	190(10)
P314	30 + 00	-10.4	A	P354(PZ21)	654 + 90	26.8	150(10)
P315	32 + 55	-3.5	C	P355(PZ20)	0 + 39	25.2	190(10)
P316	32 + 55	-19.5	A	P356(PZ19W)	0 + 57	25.8	151(10)
P317	35 + 00	-15.3	C	P357(PZ19S)	0 + 89	25.9	134(10)
P318	35 + 00	-20.2	A	P358(PZ19)	0 + 89	27.1	151(10)
P319	37 + 65	-18.8	C	P359(PZ19W)	0 + 89	26.1	170(10)
P320	37 + 65	2.2	A	P360(PZ19E)	1 + 21	26.1	151(10)
P321	35 + 10	3.6	D	P361(PZ18)	1 + 37	27.2	190(10)
P322	37 + 50	-10.1	D	P362(PZ17)	1 + 89	26.0	151(10)
P323	34 + 40	-0.1	D	P363(PZ16)	2 + 39	19.3	190(10)
P324	38 + 80	3.4	D	P364(PZ15)	3 + 20	17.3	151(10)
P325	32 + 55	10.7	D	P365(PZ14)	3 + 70	23.7	190(10)
P326	Deleted from Program			P366(PZ13)	4 + 15	-1.1	151(10)
P327(K-1)	92 + 50	-0.0	B	P367(PZ12)	4 + 70	0.8	190(10)
P328(K-2)	92 + 50	-4.4	C	P368(PZ11)	5 + 20	12.4	151(10)
P329(K-3)	92 + 50	1.3	(9)	P369(PZ10A)	5 + 20	12.5	189(10)
P330(K-4)	97 + 50	-6.7	C	P370(PZ10)	5 + 70	-1.0	189(10)
P331(K-5)	97 + 50	-6.5	(9)	P371(PZ9)	6 + 20	10.0	152(10)
P332(K-6)	102 + 50	-11.5	B	P372(PZ8)	6 + 69	8.5	190(10)
P333(K-7)	102 + 50	-0.3	C	P373(PZ7)	7 + 15	8.7	151(10)
P334(K-8)	107 + 50	8.8	C	P374(PZ6)	7 + 69	1.0	190(10)
P335(K-9)	107 + 50	-5.7	(9)	P375(PZ5)	8 + 20	8.6	152(10)
P336(K-10)	115 + 00	-9.2	(9)	P376(PZ4)	9 + 01	9.2	190(10)
P337(K-11)	102 + 50	-8.9	(9)	P377(PZ3)	9 + 39	8.6	151(10)
P338(K-12)	100 + 00	-8.1	(9)	P378	99 + 93	-10.6	D
P339(K-13)	102 + 50	14.8	C	P379	180 + 93	-1.0	C
P340(K-14)	102 + 50	10.0	D	P380	181 + 18	-1.6	C
P341(PZ30)	130 + 69	31.3	A	P381	319 + 70	-11.4	C
P342(PZ31)	130 + 82	30.4	A	P382	319 + 86	-10.0	C
P343(PZ32)	130 + 95	30.2	A	P383	448 + 18	-5.4	C
P344	Deleted from Program			P384	448 + 43	-5.9	C
P345(PZ28)	651 + 59	17.0	190(10)	P385	448 + 85	-4.3	C
P346(PZ26A)	651 + 90	24.9	190(10)	P386	570 + 35	-0.4	C
P347(PZ26)	652 + 46	18.5	190(10)	P387	570 + 77	2.2	C
P348(PZ24A)	652 + 94	26.5	190(10)	P388	570 + 88	1.6	C
P349(PZ25)	652 + 95	27.3	151(10)	P389(SP1)	225 + 88	11.1	243(10), (11)
P350(PZ24)	653 + 40	25.6	190(10)	P390(SP2)	226 + 10	20.8	172(10), (11)
P351(PZ22A)	653 + 94	26.6	190(10)	P391(SP3)	225 + 89	26.0	77(10), (11)

TABLE 3

## MAIN COOLING RESERVOIR PIEZOMETER DATA

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Reference Drawing: 9Y51 0-H-1163

Piez. No.	Embank. Station	Tip* Elev.	Location**	Piez. No.	Embank. Station	Tip* Elev.	Location**
P392(TP1)	225 + 25	6.8	293(10), (12)	P431(14)	408 + 90	-15.1	D
P393(TP2)	226 + 69	5.8	293(11), (12)	P432(14)	420 + 00	-9.7	D
P394	40 + 20	-12.3	(13b)	P433(14)	450 + 50	3.9	D
P395	40 + 20	-14.8	(13a)	P434(14)	460 + 10	10.8	D
P396	49 + 80	7.2	(13b)	P435(14)	479 + 70	-1.7	D
P397	59 + 60	3.8	(13b)				
P398	59 + 60	3.1	(13a)	P436(14)	481 + 50	-13.2	D
P399	70 + 20	3.3	(13b)	P437(14)	491 + 00	-19.8	D
P400	79 + 70	7.6	(13b)	P438(14)	511 + 00	-6.9	D
P401(14)	25 + 00	0.7	D	P439(14)	531 + 00	-12.1	D
P402(14)	89 + 40	-1.6	D	P440(14)	550 + 50	6.3	D
P403(14)	105 + 00	8.2	D				
P404(14)	165 + 00	3.7	C	P441(14)	579 + 45	0.8	D
P405(14)	172 + 03	-2.1	C	P442(14)	592 + 03	1.7	C
				P443(14)	594 + 65	5.3	C
P406(14)	177 + 25	0.6	C	P444(14)	598 + 50	4.3	C
P407(14)	197 + 50	3.3	C	P445(14)	603 + 00	-2.7	C
P408(14)	205 + 40	-7.2	C				
P409(14)	213 + 40	-1.8	C	P446(14)	608 + 05	1.9	C
P410(14)	236 + 75	-4.2	C	P447(14)	611 + 15	7.4	C
				P448(14)	613 + 20	2.6	C
P411(14)	252 + 75	-1.6	C	P449(14)	614 + 40	1.0	C
P412(14)	257 + 25	-2.1	C	P450(14)	400 + 50	-16.5	80' (15)
P413(14)	269 + 00	-8.6	C				
P414(14)	275 + 00	-3.1	C	P451(14)	400 + 50	-15.1	495' (15)
P415(14)	280 + 50	-12.1	C	P452(14)	226 + 40	-0.6	(16)
				P453(14)	226 + 40	1.6	(16)
P416(14)	286 + 25	-2.8	C				
P417(14)	297 + 20	-2.2	C	P454(17)	7 + 00	31.2	A
P418(14)	305 + 20	-2.7	C	P455(17)	20 + 00	29.9	A
P419(14)	314 + 90	-6.4	C	P456(17)	59 + 60	30.0	A
P420(14)	322 + 80	0.2	C	P457(17)	100 + 20	30.2	A
				P458(17)	160 + 00	30.1	A
P421(14)	327 + 25	-10.4	C				
P422(14)	335 + 50	-11.6	C	P459(17)	200 + 20	30.2	A
P423(14)	347 + 00	-9.6	C	P460(17)	226 + 40	30.2	A
P424(14)	354 + 00	-9.2	C	P461(17)	260 + 25	30.1	A
P425(14)	376 + 05	-15.0	D	P462(17)	300 + 00	30.0	A
				P463(17)	359 + 60	29.9	A
P426(14)	386 + 50	-12.7	D				
P427(14)	389 + 90	-11.8	D	P464(17)	400 + 50	31.0	A
P428(14)	397 + 25	0.2	D	P465(17)	440 + 20	30.5	A
P429(14)	400 + 50	-9.5	D	P466(17)	491 + 00	30.1	A
P430(14)	405 + 30	-1.3	D	P467(17)	531 + 00	30.2	A
				P468(17)	570 + 35	30.0	A

TABLE 3

MAIN COOLING RESERVOIR PIEZOMETER DATA

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Reference Drawing: 9Y51 0-H-1163

Piez. No.	Embank. Station	Tip* Elev.	Location**	Piez. No.	Embank. Station	Tip* Elev.	Location**
P469(17)	610 + 00	30.2	A				
P470(17)	640 + 00	30.0	A				
P471(18)	170 + 00	10.4	D				
P472(18)	115 + 00	11.8	D				
P473(18)	132 + 70	8.9	C				
P474(18)	137 + 50	8.8	C				
P475(18)	152 + 75	6.5	C				
P476(18)	352 + 00	-0.6	C				
P477(18)	364 + 80	4.6	C				
P478(18)	568 + 00	17.4	D				
P479(19)	132 + 80	7.9	C				
P480(19)	152 + 85	10.3	C				
P481(19)	455 + 50	7.4	C				
P482(19)	457 + 00	8.1	C				
P483(19)	459 + 00	7.7	C				
P484(19)	460 + 50	12.5	C				

TABLE 3

MAIN COOLING RESERVOIR PIEZOMETER DATA

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\*Tip Elevation refers to bottom of screen or sensor.

\*\*See Figure 3 for locations A, B, C and D with respect to embankment centerline.

- A = Crest-downstream edge
- B = Downstream berm
- C = Along lined and unlined toe ditch.
- D = Relief well line along Plant Area Drainage Ditch and Relocated Little Robbins Slough

- NOTES:
- (1) Left of embankment centerline per embankment section on Figure 3.
  - (2) N 361,399.61 E 2,946,267.22
  - (3) N 360,898.79 E 2,947,070.52
  - (4) N 361,017.61 E 2,947,895.63
  - (5) At upstream edge of crest.
  - (6) On upstream berm (inside Reservoir).
  - (7) On upstream floor of Reservoir near embankment toe.
  - (8) Approximate distance from upstream toe of embankment.
  - (9) Vicinity of Kelly Lake beyond relief well line.
  - (10) Distance downstream of embankment center line.
  - (11) In spillway chute
  - (12) On bank of stilling basin
  - (13) These piezometers were installed in June 1986 per recommendation from Harza Engineering Co. for monitoring PADD. The piezometers are located on edge of side slopes.
    - (a) These piezometers are on north side of ditch.
    - (b) These piezometers are on south side of ditch.
  - (14) These piezometers were installed in February and March, 1987. Refer to Harza letter nos. ST-XH-YB-0271 and -0273 for as-built piezometer information.
  - (15) Approximate distance landward from the centerline of Relocated Little Robbins Slough.
  - (16) Along the south side of the spillway discharge channel.
  - (17) These pneumatic piezometers were installed in May and June, 1987 to monitor the piezometric pressure in the downstream embankment shell. For typical piezometer details refer to Figure 3c.
  - (18) These piezometers were installed in March 1988. Refer to Harza Letter No. ST-XH-YB-295 for as-built piezometer information.
  - (19) These piezometers were installed in November 1988. Refer to Harza Letter No. ST-XH-YB-321 for additional information.

References: Dwg. 9Y51 O-H-1161  
Spec. 9Y51OHS1002

TABLE 4  
MAIN COOLING RESERVOIR  
RELIEF WELL DATA

Specification No. 9Y51OYS1004  
Revision 6  
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Well	NCR Sta	Top of Well (Elev) Note 1	Manhole (Elev)		Screen Length (Ft)	Well Depth (Ft) Note 2	Year Installed Note 3	Disch. Pipe Location
			Top	Ground				
W-1	0+00	26.10	31.26	28.2	15.0	27.80	-79	PDD
W-1A	0+50	26.00	30.73	28.2	15.0	27.90	-79	PDD
W-1B	1+00	26.00	29.52	28.2	15.0	27.00	-79	PDD
W-1C	1+50	26.10	31.25	28.2	10.0	27.50	-79	PDD
W-1D	2+10	25.94	30.00	28.4	5.0	28.90	-85, S	PDD
W-2	2+00	26.60	30.98	28.2	10.0	27.10	-79	PDD
W-2AA	2+25	26.50	30.81	28.2	10.0	18.70	-79	PDD
W-2A	2+50	26.10	30.39	28.8	5.0	27.10	-79	PDD
W-2B	2+40	25.97	30.20	28.2	5.0	28.60	-85, S	PDD
W-2C	3+98	26.06	29.36	28.3	5.0	28.80	-85, S	PDD
W-3	4+00	26.80	31.13	28.2	5.0	28.00	-79	PDD
W-3A	4+50	27.00	31.40	28.2	10.0	29.90	-79	PDD
W-3AA	4+24	27.00	31.17	28.2	10.0	18.70	-79	PDD
W-3B	5+00	27.00	31.32	28.2	10.0	28.70	-79	PDD
W-3C	5+50	26.60	30.84	28.1	10.0	27.20	-79	PDD
W-3D	4+98	26.35	30.34	28.3	5.0	30.72	-85, R	PDD
W-3E	5+92	26.46	30.38	28.6	10.0	31.16	-85, R	PDD
W-4	6+00	26.20	30.44	28.2	10.0	24.00	-79	PDD
W-4A	6+50	27.00	31.11	28.2	10.0	28.20	-79	PDD
W-4B	7+00	27.10	31.75	28.1	10.0	26.70	-79	PDD
W-4C	7+50	25.70	30.94	28.1	10.0	27.60	-79	PDD
W-5	8+00	26.30	30.67	28.2	10.0	28.70	-79	PDD
W-5A	8+50	26.60	30.83	28.2	10.0	28.70	-79	PDD
W-5B	10+10	27.06	31.27	30.6	7.0	33.58	-85, R	PDD
W-5AA	9+70	27.00	30.74	28.2	10.0	23.30	-79	PDD



References: Dwg. 9Y51 Q-H-1161  
Spec. 9Y51OHS1002

TABLE 4  
MAIN COOLING RESERVOIR  
RELIEF WELL DATA

Specification No. 9Y51OYS1004  
Revision 6  
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Well	MCR Sta	Top of Well (Elev) Note 1	Manhole (Elev)		Screen Length (Ft)	Well Depth (Ft) Note 2	Year Installed Note 3	Disch. Pipe Location
			Top	Ground				
W-6	10+00	27.00	31.28	28.2	10.0	28.90	-79	PDD
W-6AA	10+21	27.30	31.00	28.2	10.0	28.80	-79	PDD
W-6A	10+42	27.20	30.97	28.2	10.0	28.50	-79	PDD
W-6B	11+21	26.50	30.60	28.2	10.0	27.50	-79	PDD
W-6C	11+50	26.50	30.72	28.2	10.0	27.90	-79	PDD
W-6D	10+61	26.87	29.88	28.6	7.0	31.57	-85, R	PDD
W-7	12+00	26.30	30.08	28.2	10.0	27.60	-79	PDD
W-7A	12+50	26.20	30.04	28.1	10.0	27.00	-79	PDD
W-7B	13+00	26.10	29.86	28.2	10.0	28.00	-79	PDD
W-7C	13+50	26.20	30.13	28.2	10.0	27.40	-79	PDD
W-7D	12+61	26.14	30.81	29.4	5.0	27.71	-85, R	PDD
W-7E	14+41	26.21	31.31	29.6	7.0	30.19	-85, R	PDD
W-8	14+00	26.20	30.09	28.2	10.0	27.20	-79	PDD
W-9	16+73	20.40	29.11	27.6	20.0	31.50	-79	PDD
W-10	18+00	18.85	27.35	27.3	15.0	26.00	-78	PDD
W-11	20+00	18.74	27.18	26.7	15.0	23.16	-78	PDD
W-12	22+00	18.79	26.85	26.5	5.0	13.09	-78	PDD
W-12-1	22+06	18.55	28.59	26.4	10.0	26.79	-85, R	PDD
W-13	24+00	18.57	26.77	26.3	10.0	17.72	-78	PDD
W-14	26+00	18.68	26.48	26.3	10.0	17.73	-78	PDD
W-15	32+00	17.74	25.09	25.5	10.0	16.80	-78	PDD
W-16	33+50	18.27	25.87	25.6	10.0	16.45	-78	PDD
W-17	35+00	17.96	25.91	25.6	10.0	13.85	-78	PDD
W-18	36+00	18.15	25.93	25.5	10.0	18.32	-78	PDD
W-19	36+80	17.69	25.59	25.3	10.0	20.28	-78	PDD

References: Dwg. 9Y51 O-H-1161  
Spec. 9Y51OHS1002

TABLE 4  
MAIN COOLING RESERVOIR  
RELIEF WELL DATA

Specification No. 9Y51OYS1004  
Revision 6  
Page 3 of 31

Well	MCR Sta	Top of Well (Elev) Note 1	Manhole (Elev)		Screen Length (Ft)	Well Depth (Ft) Note 2	Year Installed Note 3	Disch. Pipe Location
			Top	Ground				
W-20	37+60	17.38	25.50	25.5	15.0	24.35	-78	PDD
W-21	38+40	17.53	25.95	25.8	15.0	20.64	-78	PDD
W-22	39+20	18.29	26.27	26.0	10.0	20.46	-78	PDD
W-23	40+00	17.76	25.77	25.6	15.0	26.03	-78	PDD
W-24	40+80	17.76	25.94	25.6	15.0	24.71	-78	PDD
W-25	41+60	17.95	25.79	25.5	15.0	25.67	-78	PDD
W-26	42+40	18.13	25.76	25.4	15.0	25.91	-78	PDD
W-27	43+20	18.14	25.54	25.1	15.0	25.09	-78	PDD
W-28	44+00	18.16	25.39	25.0	15.0	26.28	-78	PDD
W-29	44+80	17.81	25.01	24.8	15.0	27.25	-78	PDD
W-30	45+60	17.94	25.08	25.1	20.0	26.56	-78	PDD
W-31	46+40	18.05	24.93	24.6	20.0	26.82	-78	PDD
W-32	47+00	18.15	25.01	24.8	15.0	26.67	-78	PDD
W-33	47+60	18.06	25.12	24.9	15.0	26.70	-78	PDD
W-34	48+20	17.91	24.76	24.5	15.0	25.65	-78	PDD
W-35	48+80	17.91	24.79	24.8	15.0	23.28	-78	PDD
W-36	49+40	18.05	24.68	24.5	15.0	26.24	-78	PDD
W-37	50+00	17.88	24.43	24.3	15.0	27.07	-78	PDD
W-38	50+60	18.21	24.53	24.3	20.0	27.31	-78	PDD
W-39	51+20	17.93	24.44	24.2	20.0	27.41	-78	PDD
W-40	51+80	17.50	24.36	24.1	15.0	26.77	-78	PDD
W-41	52+30	17.40	24.27	24.1	15.0	26.44	-78	PDD
W-42	52+90	17.62	24.35	24.2	15.0	27.05	-78	PDD
W-43	53+50	17.81	24.44	24.3	15.0	27.01	-78	PDD
W-44	54+10	18.02	24.57	24.3	20.0	26.95	-78	PDD

References: Dwg. 9Y51 O-H-7161  
Spec. 9Y51OHS1002

TABLE 4  
MAIN COOLING RESERVOIR  
RELIEF WELL DATA

Specification No. 9Y51OYS1004  
Revision 6  
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Well	MCR Sta	Top of Well (Elev) Note 1	Manhole (Elev)		Screen Length (Ft)	Well Depth (Ft) Note 2	Year Installed Note 3	Disch. Pipe Location
			Top	Ground				
W-45	54+70	18.38	24.80	24.6	20.0	27.55	-78	PDD
W-46	55+30	17.89	24.46	24.2	20.0	27.35	-78	PDD
W-47	55+90	17.91	24.37	24.3	15.0	27.29	-78	PDD
W-48	56+50	17.77	24.39	24.1	15.0	27.53	-78	PDD
W-49	57+20	17.53	24.13	24.1	15.0	26.82	-78	PDD
W-50	57+90	17.82	24.39	24.0	20.0	26.68	-78	PDD
W-51	58+60	17.51	24.11	24.0	20.0	28.63	-78	PDD
W-52	59+30	17.71	24.25	24.0	15.0	27.08	-78	PDD
W-53	60+00	17.48	23.95	23.8	20.0	27.84	-78	PDD
W-54	60+70	17.60	24.08	23.7	20.0	27.83	-78	PDD
W-55	61+40	17.68	24.05	23.7	20.0	27.46	-78	PDD
W-56	62+10	17.51	23.91	23.8	20.0	26.81	-78	PDD
W-57	62+80	17.43	23.81	23.6	20.0	27.87	-78	PDD
W-58	63+50	17.56	23.69	23.4	20.0	27.07	-78	PDD
W-59	64+20	17.49	23.64	23.3	15.0	26.40	-78	PDD
W-60	64+90	17.72	23.79	23.6	20.0	27.66	-78	PDD
W-61	65+60	17.53	23.44	22.6	20.0	25.07	-78	PDD
W-62	66+30	17.32	23.29	23.1	20.0	27.59	-78	PDD
W-63	67+00	17.55	23.37	23.1	15.0	28.06	-78	PDD
W-64	67+70	17.54	23.39	23.1	20.0	26.46	-78	PDD
W-65	68+40	17.41	23.36	23.1	15.0	27.16	-78	PDD
W-66	69+10	17.37	23.35	23.0	20.0	25.39	-78	PDD
W-67	69+80	17.44	23.22	22.9	20.0	27.80	-78	PDD
W-68	70+50	17.26	22.77	23.8	20.0	28.65	-78	PDD
W-69	71+20	18.17	23.62	24.6	20.0	28.82	-78	PDD

References: Dwg. 9Y51 O-H-1161  
Spec. 9Y51OHS1002

TABLE 4  
MAIN COOLING RESERVOIR  
RELIEF WELL DATA

Specification No. 9Y51OYST004  
Revision 6  
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Well	MCR Sta	Top of Well (Elev) Note 1	Manhole (Elev)		Screen Length (Ft)	Well Depth (Ft) Note 2	Year Installed Note 3	Disch. Pipe Location
			Top	Ground				
W-70	71+90	17.08	22.85	22.8	20.0	27.10	-78	PDD
W-71	72+60	17.19	22.64	22.5	15.0	27.24	-78	PDD
W-72	73+30	17.40	22.75	22.7	15.0	23.96	-78	PDD
W-73	74+00	17.43	22.68	22.9	15.0	23.53	-78	PDD
W-74	74+70	17.45	22.72	22.9	15.0	24.15	-78	PDD
W-75	75+40	17.44	22.73	23.7	15.0	22.80	-78	PDD
W-76	76+10	18.02	23.26	23.2	15.0	25.76	-78	PDD
W-77	76+80	17.46	22.66	23.1	20.0	27.19	-78	PDD
W-78	77+50	17.57	22.82	23.3	15.0	25.91	-78	PDD
W-79	78+20	17.29	22.18	22.1	15.0	23.60	-78	PDD
W-80	78+90	17.69	22.60	22.4	20.0	28.90	-78	PDD
W-81	79+60	18.28	23.26	23.0	20.0	29.98	-78	PDD
W-82	80+30	18.32	23.42	23.3	20.0	26.30	-78	PDD
W-83	81+00	18.47	22.98	22.8	20.0	29.19	-78	PDD
W-84	81+70	18.35	22.95	22.8	20.0	29.21	-78	PDD
W-85	82+40	18.31	22.90	22.7	15.0	27.14	-78	PDD
W-86	83+10	18.30	22.82	22.6	15.0	24.83	-78	PDD
W-87	83+80	18.34	22.78	22.6	20.0	28.21	-78	PDD
W-88	84+50	18.02	22.19	24.2	20.0	27.68	-78	PDD
W-89	85+20	18.36	22.33	24.3	20.0	27.64	-78	PDD
W-90	86+40	17.36	21.49	21.3	15.0	27.47	-78	PDD
W-91	87+60	17.10	20.98	20.8	20.0	27.95	-78	PDD
W-92	88+80	17.34	21.10	20.9	20.0	27.72	-78	PDD
W-93	90+00	17.26	20.72	20.6	20.0	28.01	-78	PDD
W-94	91+20	17.41	20.72	20.6	15.0	21.31	-78	PDD

References: Dwg. 9Y51 O-H-1161  
Spec. 9Y51OHS1002

TABLE 4  
MAIN COOLING RESERVOIR  
RELIEF WELL DATA

Specification No. 9Y51OYS1004  
Revision 6  
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Well	MCR Sta	Top of Well (Elev) Note 1	Manhole (Elev)		Screen Length (Ft)	Well Depth (Ft) Note 2	Year Installed Note 3	Disch. Pipe Location
			Top	Ground				
W-94-1	91+26	17.40	22.79	20.8	15.0	21.27	-85, R	PDD
W-95	92+40	17.25	20.70	20.6	15.0	23.83	-78	PDD
W-96	93+60	17.11	20.50	20.4	15.0	24.36	-78	PDD
W-97	94+20	17.14	20.50	20.3	15.0	22.15	-78	PDD
W-98	94+80	17.20	20.31	20.2	15.0	26.32	-78	PDD
W-99	95+40	17.40	20.42	20.2	15.0	26.67	-78	PDD
W-99A	95+65	17.52	22.81	20.5	15.0	25.26	-85, S	PDD
W-100	96+00	17.24	20.26	19.7	15.0	24.32	-78	PDD
W-101	96+40	17.48	20.48	20.0	15.0	23.68	-78	PDD
W-102	96+80	17.44	20.44	20.2	15.0	26.65	-78	PDD
W-102A	97+00	16.83	22.19	20.23	15.0	25.20	-85, S	PDD
W-103	97+20	17.59	20.58	19.8	20.0	28.00	-78	PDD
W-104	97+60	16.97	19.98	19.7	20.0	27.66	-78	PDD
W-105	98+00	17.41	20.27	19.8	20.0	27.28	-78	PDD
W-106	98+40	17.30	20.16	19.7	20.0	27.73	-78	PDD
W-107	98+80	17.37	19.93	19.4	20.0	28.08	-78	PDD
W-108	99+20	17.22	20.06	19.5	20.0	27.98	-78	PDD
W-109	99+60	17.48	20.19	19.7	20.0	26.49	-78	PDD
W-110	100+00	17.46	20.04	19.5	20.0	27.39	-78	PDD
W-111	100+40	17.33	19.86	19.4	20.0	27.84	-78	PDD
W-112	100+80	17.30	19.91	19.4	20.0	27.96	-78	PDD
W-113	101+20	17.56	19.97	19.5	20.0	27.96	-78	PDD
W-114	101+60	17.04	19.97	19.5	20.0	24.77	-78	PDD
W-115	102+00	17.12	19.63	19.3	20.0	26.32	-78	PDD
W-116	102+40	17.40	19.78	19.5	20.0	27.87	-78	PDD

References: Dwg. 9Y51 O-H-1161  
Spec. 9Y510HS1002

TABLE 4  
MAIN COOLING RESERVOIR  
RELIEF WELL DATA

Specification No. 9Y510YS1004  
Revision 6  
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Well	MCR Sta.	Top of Well (Elev) Note 1	Manhole (Elev)		Screen Length (Ft)	Well Depth (Ft) Note 2	Year Installed Note 3	Disch. Pipe Location
			Top	Ground				
W-117	102+80	17.47	19.79	19.3	20.0	27.69	-78	PDD
W-118	103+20	17.58	19.85	19.3	20.0	27.16	-78	PDD
W-119	103+60	17.43	19.73	19.5	20.0	26.77	-78	PDD
W-119A	101+30	16.99	23.54	21.9	25.0	31.76	-85, ST	PDD
W-119B	102+30	17.02	23.94	22.1	25.0	36.02	-85, ST	PDD
W-119C	103+30	16.98	23.89	21.9	25.0	31.11	-85, ST	PDD
W-119D	104+30	16.63	23.48	21.4	25.0	35.38	-85, ST	PDD
W-119E	104+80	16.63	23.63	21.8	25.0	34.27	-85, ST	PDD
W-119F	105+30	16.63	23.52	22.0	25.0	33.80	-85, ST	PDD
W-119G	105+80	16.62	23.71	22.1	10.0	17.16	-85, ST	PDD
W-120	104+00	17.54	19.67	19.4	15.0	27.83	-78	PDD
W-121	104+80	17.50	19.70	19.4	15.0	26.89	-78	PDD
W-122	106+00	17.61	19.77	19.3	15.0	25.48	-78	PDD
W-123	108+00	17.53	19.61	19.4	10.0	23.58	-78	PDD
W-124	123+30	16.00	18.22	17.0	15.0	26.70	-79	TD
W-125	125+00	14.35	17.69	16.7	20.0	26.00	-79	TD
W-138	162+00	14.77	18.11	17.9	5.0	13.54	-78	TD
W-138A	162+70	14.78	20.31	18.1	5.0	14.89	-85, S	TD
W-139	164+00	14.12	18.41	17.9	5.0	16.21	-78	TD
W-139A	164+40	14.49	20.43	18.39	5.0	14.80	-85, S	TD
W-140	165+50	14.63	18.48	18.2	5.0	15.29	-78	TD
W-140-1	165+44	14.42	20.02	18.1	5.0	16.45	-85, R	TD
W-141	166+40	14.74	18.94	17.9	5.0	16.63	-78	TD
W-142	167+30	14.01	18.17	18.4	5.0	16.11	-78	TD
W-143	168+20	13.94	18.06	18.0	5.0	16.18	-78	TD

References: Dwg. 9Y51 O-H-1161  
Spec. 9Y51OHS1002

TABLE 4  
MAIN COOLING RESERVOIR  
RELIEF WELL DATA

Specification No. 9Y51OYS1004  
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Well	MCR Sta	Top of Well (Elev) Note 1	Manhole (Elev)		Screen Length (Ft)	Well Depth (Ft) Note 2	Year Installed Note 3	Disch. Pipe Location
			Top	Ground				
W-144	169+10	13.94	18.25	18.7	5.0	15.88	-78	TD
W-145	170+00	13.78	18.06	17.8	5.0	15.00	-78	TD
W-146	170+90	13.60	17.03	18.3	5.0	15.28	-78	TD
W-147	171+80	13.85	16.78	16.8	5.0	15.50	-78	TD
W-148	172+70	13.68	16.25	16.2	5.0	17.23	-78	TD
W-149	173+60	13.11	15.48	15.0	5.0	14.88	-78	TD
W-150	174+50	12.83	14.83	15.3	5.0	19.16	-78	TD
W-151	175+40	12.68	14.10	14.1	5.0	17.20	-78	TD
W-152	176+30	12.43	14.07	13.6	5.0	15.92	-78	TD
W-153	177+00	10.72	13.19	13.0	5.0	13.33	-78	TD
W-154	177+50	11.62	13.25	13.2	5.0	14.29	-78	TD
W-154-1	177+44	12.24	15.03	13.2	5.0	13.99	-85, R	TD
W-155	178+00	11.73	12.98	13.5	5.0	12.29	-78	TD
W-155-1	177+94	11.92	15.01	13.0	5.0	13.82	-85, R	TD
W-156	178+50	11.54	12.73	13.2	5.0	13.30	-78	TD
W-156-1	178+44	11.70	14.62	12.8	5.0	13.64	-85, R	TD
W-157	179+00	10.10	12.76	13.3	10.0	19.01	-78	TD
W-158	179+50	11.43	12.80	12.8	5.0	15.43	-78	TD
W-158-1	179+44	11.11	14.64	12.6	5.0	16.39	-85, R	TD
W-159	180+00	10.91	12.45	13.5	5.0	14.54	-78	TD
W-159-1	179+94	11.22	14.44	12.5	5.0	13.13	-85, R	TD
W-160	180+50	10.73	12.45	12.7	5.0	12.44	-78	TD
W-160-1	180+44	11.11	14.31	12.5	5.0	12.82	-85, R	TD
W-161	181+00	11.11	13.02	13.0	5.0	13.06	-78	TD
W-162	181+50	11.45	13.19	12.7	5.0	15.14	-78	TD

References: Dwg. 9Y51 O-H-1161  
Spec. 9Y51OHS1002

TABLE 4  
MAIN COOLING RESERVOIR  
RELIEF WELL DATA

Specification No. 9Y51OYS1004  
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Well	MCR Sta	Top of Well (Elev) Note 1	Manhole (Elev)		Screen Length (Ft)	Well Depth (Ft) Note 2	Year Installed Note 3	Disch. Pipe Location
			Top	Ground				
W-163	182+00	11.20	13.15	12.7	5.0	15.03	-78	TD
W-164	182+50	11.33	14.12	13.6	5.0	14.74	-78	TD
W-165	183+00	11.01	14.53	14.2	5.0	14.16	-78	TD
W-166	183+50	11.32	15.18	14.2	5.0	16.72	-78	TD
W-167	184+00	11.19	15.44	14.4	5.0	15.80	-78	TD
W-168	184+50	11.04	15.90	15.4	5.0	12.82	-78	TD
W-169	185+00	11.28	16.13	15.6	5.0	12.62	-78	TD
W-170	185+50	11.68	16.42	16.0	5.0	12.74	-78	TD
W-171	186+40	10.70	15.26	14.8	5.0	11.69	-78	TD
W-172	187+30	11.57	14.80	14.3	5.0	12.97	-78	TD
W-173	188+20	11.04	13.33	12.8	5.0	13.12	-78	TD
W-174	189+10	11.13	12.56	12.5	5.0	12.39	-78	TD
W-174-1	189+16	11.23	14.32	12.3	5.0	15.11	-85, R	TD
W-175	190+00	10.67	12.17	13.0	5.0	11.30	-78	TD
W-176	190+90	11.03	12.24	13.2	5.0	11.59	-78	TD
W-177	191+80	10.77	11.89	12.9	5.0	12.73	-78	TD
W-177-1	191+86	11.50	14.43	12.3	5.0	15.36	-85, R	TD
W-178	192+70	11.74	12.66	13.1	5.0	14.16	-78	TD
W-179	193+60	11.91	13.37	13.4	5.0	15.82	-78	TD
W-180	194+50	12.37	14.18	14.2	5.0	16.83	-78	TD
W-181	195+40	13.42	15.05	14.8	5.0	16.41	-78	TD
W-182	196+00	13.73	15.27	15.3	5.0	16.91	-78	TD
W-183	196+40	13.93	16.03	15.8	5.0	17.60	-78	TD
W-184	196+80	14.44	17.02	16.5	5.0	18.48	-78	TD
W-185	197+20	14.46	17.52	17.0	5.0	18.63	-78	TD



References: Dwg. 9Y51 O-H-1161  
Spec. 9Y51OHS1002

TABLE 4  
MAIN COOLING RESERVOIR  
RELIEF WELL DATA

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Well	MCR Sta	Top of Well (Elev) Note 1	Manhole (Elev)		Screen Length (Ft)	Well Depth (Ft) Note 2	Year Installed Note 3	Disch. Pipe Location
			Top	Ground				
W-186	197+60	14.94	17.86	17.4	5.0	16.26	-78	TD
W-187	198+00	15.84	18.76	18.7	5.0	18.68	-78	TD
W-188	198+40	15.40	17.40	17.9	5.0	16.19	-78	TD
W-188A	198+55	15.66	20.46	18.4	10.0	20.27	-85, S	TD
W-189	198+80	15.74	18.07	18.6	5.0	20.25	-78	TD
W-190	199+20	16.21	19.15	19.0	5.0	20.50	-78	TD
W-191	199+60	16.64	19.68	19.5	5.0	21.60	-78	TD
W-192	200+00	17.05	19.76	19.8	5.0	22.13	-78	TD
W-193	200+40	16.90	19.61	19.8	5.0	22.46	-78	TD
W-194	200+80	17.59	20.05	19.8	10.0	27.36	-78	TD
W-195	201+20	17.59	20.42	20.1	10.0	30.40	-78	TD
W-196	201+60	18.04	20.46	20.0	10.0	30.33	-78	TD
W-197	202+00	17.88	20.46	20.4	10.0	31.25	-78	TD
W-198	202+40	17.72	20.43	20.2	10.0	30.39	-78	TD
W-199	202+80	17.39	20.22	20.0	10.0	27.55	-78	TD
W-200	203+20	17.64	20.14	20.1	15.0	31.59	-78	TD
W-201	203+60	17.69	20.17	19.9	10.0	28.20	-78	TD
W-202	204+00	17.75	20.00	20.0	20.0	36.67	-78	TD
W-203	204+40	17.58	19.73	19.4	20.0	37.77	-78	TD
W-204	204+80	17.40	19.50	19.2	20.0	34.42	-78	TD
W-205	205+20	17.59	19.24	18.8	20.0	38.91	-78	TD
W-206	205+60	17.16	18.76	18.5	20.0	36.65	-78	TD
W-207	206+00	17.32	18.22	18.7	10.0	28.02	-78	TD
W-208	206+40	17.25	18.48	18.5	30.0	36.88	-78	TD
W-209	206+80	17.26	18.69	18.7	15.0	34.12	-78	TD

References: Dwg. 9Y51 O-H-1161  
Spec. 9Y51OHS1002

TABLE 4  
MAIN COOLING RESERVOIR  
RELIEF WELL DATA

Specification No. 9Y51OYS1004  
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Well	MCR Sta	Top of Well (Elev) Note 1	Manhole (Elev)		Screen Length (Ft)	Well Depth (Ft) Note 2	Year Installed Note 3	Disch. Pipe Location
			Top	Ground				
W-210	207+20	17.48	19.31	18.8	20.0	31.98	-78	TD
W-211	207+60	17.32	19.55	19.0	20.0	32.69	-78	TD
W-212	208+00	17.43	19.76	19.3	20.0	32.69	-78	TD
W-213	208+40	17.12	19.75	19.2	20.0	32.57	-78	TD
W-214	208+80	17.06	19.56	19.3	20.0	34.52	-78	TD
W-215	209+20	16.85	19.63	19.3	25.0	38.47	-78	TD
W-216	209+60	17.02	19.48	19.2	25.0	35.17	-78	TD
W-217	210+00	16.61	19.40	19.2	25.0	37.31	-78	TD
W-218	210+40	17.01	19.43	19.2	25.0	38.91	-78	TD
W-219	210+80	16.94	19.08	19.1	20.0	33.93	-78	TD
W-220	211+20	16.73	18.76	19.0	20.0	34.93	-78	TD
W-221	211+60	17.45	19.58	19.1	25.0	35.45	-78	TD
W-222	212+00	16.64	18.76	18.7	25.0	35.21	-78	TD
W-223	212+40	16.59	18.42	18.4	25.0	37.03	-78	TD
W-224	212+80	16.55	18.35	18.2	25.0	31.51	-78	TD
W-225	213+20	16.51	18.25	18.2	25.0	33.68	-78	TD
W-225A	213+40	16.01	21.48	18.3	25.0	32.46	-87, S	TD
W-226	213+60	16.59	18.23	18.2	25.0	33.12	-78	TD
W-227	214+00	16.29	17.71	18.0	25.0	34.62	-78	TD
W-228	214+40	16.08	17.71	18.2	25.0	29.09	-78	TD
W-229	214+80	16.11	17.72	18.0	25.0	31.37	-78	TD
W-230	215+20	16.48	17.79	18.1	25.0	32.71	-78	TD
W-231	215+60	16.12	17.68	18.7	25.0	32.30	-78	TD
W-232	216+00	16.20	17.33	19.0	25.0	31.93	-78	TD
W-233	216+40	16.22	17.73	17.5	25.0	31.03	-78	TD
W-234	216+80	16.14	17.79	17.5	25.0	32.14	-78	TD

References: Dwg. 9Y51 O-K-1161  
Spec. 9Y51OHS1002

TABLE 4  
MAIN COOLING RESERVOIR  
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Well	MCR Sta	Top of Well (Elev) Note 1	Manhole (Elev)		Screen Length (Ft)	Well Depth (Ft) Note 2	Year Installed Note 3	Disch. Pipe Location
			Top	Ground				
W-235	217+20	16.15	17.87	17.5	25.0	32.50	-78	TD
W-236	217+60	15.31	17.35	17.3	25.0	32.38	-78	TD
W-237	218+00	16.04	17.80	17.6	25.0	32.74	-78	TD
W-238	218+40	15.91	17.76	17.7	25.0	30.96	-78	TD
W-239	218+80	15.63	17.82	17.8	25.0	33.41	-78	TD
W-240	219+20	15.68	18.27	18.0	25.0	27.98	-78	TD
W-241	219+60	16.73	19.46	18.0	25.0	32.56	-78	TD
W-242	220+00	15.75	18.53	18.5	25.0	31.62	-78	TD
W-243	220+40	16.32	19.20	18.2	25.0	35.09	-78	TD
W-244	220+69	16.07	19.09	18.6	25.0	33.04	-78	TD
W-245	220+98	15.85	19.14	18.6	25.0	32.29	-78	TD
W-246	221+27	15.80	19.01	18.7	25.0	31.39	-78	TD
W-247	221+68	15.93	19.24	18.6	25.0	32.68	-78	TD
W-248	221+85	15.88	19.21	18.5	15.0	25.44	-78	TD
W-249	222+14	15.68	20.35	19.8	25.0	33.36	-78	TD
W-250	222+43	15.73	19.27	18.7	25.0	34.70	-78	TD
W-251	222+72	15.43	19.06	18.7	25.0	33.93	-78	TD
W-252	223+01	15.11	18.90	18.5	15.0	29.77	-78	TD
W-253	223+30	15.48	19.13	18.8	15.0	30.97	-78	TD
W-254	223+59	15.36	18.88	18.5	10.0	26.80	-78	TD
W-255	223+88	15.33	18.83	18.4	10.0	26.83	-78	TD
W-256	224+17	15.48	19.02	18.6	10.0	28.27	-78	TD
W-257	224+45	15.51	19.14	18.7	10.0	26.28	-78	TD
W-258	224+69	15.21	18.96	18.6	10.0	30.06	-78	TD
W-259	224+92	14.95	18.68	18.3	10.0	27.72	-78	TD

References: Dwg. 9Y51 O-H-1161  
Spec. 9Y51OHS1002

TABLE 4  
MAIN COOLING RESERVOIR  
RELIEF WELL DATA

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Well	MCR Sta	Top of Well (Elev) Note 1	Manhole (Elev)		Screen Length (Ft)	Well Depth (Ft) Note 2	Year Installed Note 3	Disch. Pipe Location
			Top	Ground				
W-260	225+15	15.00	18.62	18.2	5.0	23.64	-78	TD
W-261	225+36	17.24	19.29	18.9	20.0	27.97	-78	TD
W-262	225+59	17.40	19.66	19.3	25.0	30.94	-78	SSB
W-263	225+81	17.04	19.32	19.1	20.0	23.70	-78	SSB
W-264	226+15	17.50	19.84	19.0	20.0	35.00	-79	SSB
W-265	226+41	17.80	20.12	18.9	20.0	34.30	-79	SSB
W-266	226+59	17.80	19.90	18.8	20.0	33.50	-79	SSB
W-267	226+75	17.60	19.90	18.6	20.0	31.70	-78	SSB
W-268	226+99	17.10	19.48	19.0	20.0	34.60	-79	SSB
W-269	227+35	17.10	19.58	18.3	20.0	30.60	-79	TD
W-270	227+45	16.10	19.14	18.3	20.0	32.20	-79	TD
W-271	227+69	16.20	19.55	18.4	20.0	29.80	-79	TD
W-272	227+93	16.30	19.39	18.4	20.0	32.30	-79	TD
W-273	228+16	15.80	19.12	18.4	20.0	31.40	-79	TD
W-274	228+50	15.50	19.09	18.4	20.0	31.50	-79	TD
W-275	228+80	15.40	19.40	18.4	20.0	30.90	-79	TD
W-276	229+10	14.70	18.95	18.4	20.0	29.90	-79	TD
W-277	229+40	15.00	19.45	18.5	15.0	26.40	-79	TD
W-278	229+70	15.10	19.88	18.4	15.0	24.50	-79	TD
W-279	229+94	15.00	20.04	18.4	15.0	23.50	-79	TD
W-280	230+30	15.00	19.99	18.4	15.0	27.00	-79	TD
W-281	230+60	15.00	19.69	18.5	20.0	28.80	-79	TD
W-282	230+90	14.80	19.74	18.6	20.0	30.50	-79	TD
W-283	231+20	14.45	19.49	18.9	15.0	28.01	-78	TD
W-284	231+50	14.84	19.74	18.7	20.0	27.70	-78	TD

References: Dwg. 9Y51 O-H-1161  
Spec. 9Y51OHS1002

TABLE 4  
MAIN COOLING RESERVOIR  
RELIEF WELL DATA

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Well	MCR Sta	Top of Well (Elev) Note 1	Manhole (Elev)		Screen Length (Ft)	Well Depth (Ft) Note 2	Year Installed Note 3	Disch. Pipe Location
			Top	Ground				
W-285	231+80	14.92	19.87	18.9	20.0	28.65	-78	TD
W-285-1	231+74	15.51	20.48	18.6	35.0	41.33	-85, R	TD
W-286	232+20	14.97	19.05	18.5	20.0	29.09	-78	TD
W-286-1	232+14	14.78	20.97	18.8	30.0	40.63	-85, R	TD
W-287	232+60	14.46	19.34	18.8	20.0	27.83	-78	TD
W-288	233+00	14.90	19.51	19.0	20.0	29.10	-78	TD
W-289	233+40	14.76	19.46	19.0	20.0	29.14	-78	TD
W-289-1	233+34	15.74	21.22	18.9	25.0	33.55	-85, R	TD
W-290	233+80	14.50	19.50	19.0	20.0	26.09	-78	TD
W-291	234+20	14.64	20.27	19.3	20.0	27.53	-78	TD
W-291A	234+35	15.97	21.32	18.9	25.0	34.61	-85, S	TD
W-292	234+60	14.85	19.27	18.5	20.0	29.51	-78	TD
W-293	235+00	14.64	19.10	18.6	20.0	28.54	-78	TD
W-294	235+40	14.44	18.96	18.6	20.0	28.16	-78	TD
W-295	235+80	14.59	19.19	18.5	20.0	27.71	-78	TD
W-296	236+20	14.54	19.08	18.1	20.0	27.71	-78	TD
W-297	236+60	14.55	19.14	18.4	20.0	27.03	-78	TD
W-298	237+00	14.40	19.01	18.3	20.0	28.46	-78	TD
W-299	237+40	14.54	19.06	18.1	20.0	29.46	-78	TD
W-300	237+80	14.51	19.01	18.0	20.0	29.38	-78	TD
W-301	238+20	14.10	18.83	17.8	20.0	29.48	-78	TD
W-302	238+60	14.62	18.66	17.9	20.0	28.59	-78	TD
W-303	239+00	14.61	18.86	17.9	20.0	29.63	-78	TD
W-304	239+40	13.90	18.25	17.8	20.0	28.98	-78	TD
W-305	239+80	14.40	18.15	17.6	20.0	30.16	-78	TD

References: Dwg. 9Y51 O-H-1161  
Spec. 9Y51OHS1002

TABLE 4  
MAIN COOLING RESERVOIR  
RELIEF WELL DATA

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Well	MCR Sta	Top of Well (Elev) Note 1	Manhole (Elev)		Screen Length (Ft)	Well Depth (Ft) Note 2	Year Installed Note 3	Disch. Pipe Location
			Top	Ground				
W-305-1	239+74	14.66	20.28	17.9	30.0	41.04	-85, R	TD
W-306	240+20	14.45	18.20	17.8	20.0	30.10	-78	TD
W-306-1	240+14	14.46	20.18	18.0	30.0	37.00	-85, R	TD
W-307	240+60	14.28	17.98	17.7	20.0	30.38	-78	TD
W-307-1	240+54	14.42	19.97	17.7	30.0	38.35	-85, R	TD
W-308	241+00	14.72	18.44	17.9	20.0	30.12	-78	TD
W-309	241+40	14.58	18.41	17.9	20.0	30.39	-78	TD
W-309-1	241+34	14.31	20.00	18.0	25.0	34.95	-85, R	TD
W-310	241+80	14.42	18.27	17.9	20.0	31.23	-78	TD
W-311	242+20	14.43	18.15	17.9	20.0	31.51	-78	TD
W-311-1	242+26	14.27	19.98	17.8	25.0	34.70	-85, R	TD
W-312	242+60	14.23	18.05	17.8	20.0	29.52	-78	TD
W-313	243+00	14.22	18.12	18.1	20.0	28.82	-78	TD
W-314	243+40	14.37	18.19	17.9	22.0	28.65	-78	TD
W-315	243+80	14.50	18.20	18.2	20.0	29.36	-78	TD
W-316	244+20	14.48	18.26	17.8	20.0	29.88	-78	TD
W-317	244+60	14.18	18.13	17.9	20.0	29.93	-78	TD
W-317-1	244+66	14.20	19.98	17.8	35.0	32.47	-85, R	TD
W-318	245+00	14.12	18.16	17.9	20.0	30.47	-78	TD
W-319	245+40	14.26	18.17	17.9	20.0	28.60	-78	TD
W-320	245+80	14.42	18.28	17.9	20.0	29.47	-78	TD
W-321	246+20	14.74	18.53	18.1	20.0	29.68	-78	TD
W-321-1	246+14	14.26	19.92	17.8	15.0	23.43	-85, R	TD
W-322	246+60	14.12	18.29	18.0	25.0	30.10	-78	TD
W-323	247+00	14.12	18.38	18.0	25.0	31.06	-78	TD

References: Dwg. 9Y51 O-H-1161  
Spec. 9Y51OHS1002

TABLE 4  
MAIN COOLING RESERVOIR  
RELIEF WELL DATA

Specification No. 9Y51OYS1004  
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Well	MCR Sta	Top of Well (Elev) Note 1	Manhole (Elev)		Screen Length (Ft)	Well Depth (Ft) Note 2	Year Installed Note 3	Disch. Pipe Location
			Top	Ground				
W-324	247+40	14.19	18.20	17.8	20.0	30.57	-78	TD
W-325	247+80	14.15	18.17	17.9	20.0	29.55	-78	TD
W-325A	247+95	14.01	19.62	18.0	20.0	38.01	-85, S	TD
W-326	248+20	14.13	18.17	17.9	20.0	29.20	-78	TD
W-327	248+60	14.25	18.39	17.9	20.0	29.07	-78	TD
W-327A	248+85	14.05	19.92	17.9	20.0	33.47	-85, S	TD
W-328	249+00	14.47	18.41	17.9	20.0	28.86	-78	TD
W-329	249+40	14.17	18.25	17.9	20.0	28.93	-78	TD
W-330	249+80	14.18	18.27	17.9	15.0	28.86	-78	TD
W-331	250+20	14.20	18.53	18.0	15.0	28.87	-78	TD
W-331A	250+35	13.78	19.95	18.0	20.0	23.28	-85, S	TD
W-332	250+60	12.60	18.45	17.7	15.0	27.15	-78	TD
W-333	251+00	13.91	18.31	18.0	15.0	29.01	-78	TD
W-334	251+40	14.18	18.45	18.2	10.0	28.34	-78	TD
W-335	251+80	14.26	18.40	17.9	15.0	28.46	-78	TD
W-336	252+20	13.92	18.15	17.9	15.0	28.37	-78	TD
W-336A	252+45	13.94	19.94	18.0	20.0	26.57	-85, S	TD
W-337	252+60	13.94	18.16	18.1	15.0	28.98	-78	TD
W-338	253+00	13.83	18.11	17.9	20.0	29.91	-78	TD
W-339	253+40	13.75	18.05	17.8	15.0	26.44	-78	TD
W-339-1	253+46	14.04	20.08	18.0	20.0	27.80	-85, R	TD
W-340	253+80	13.95	18.30	17.8	20.0	26.30	-78	TD
W-340A	254+05	13.87	19.87	17.9	20.0	27.13	-85, S	TD
W-341	254+20	14.17	18.43	17.9	20.0	26.99	-78	TD
W-341A	254+35	13.91	20.01	17.9	20.0	26.58	-85, S	TD

References: Dwg. 9Y51 O-H-1161  
Spec. 9Y51OHS1002

TABLE 4  
MAIN COOLING RESERVOIR  
RELIEF WELL DATA

Specification No. 9Y51OYS1004  
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Well	MCR Sta	Top of Well (Elev) Note 1	Manhole (Elev)		Screen Length (Ft)	Well Depth (Ft) Note 2	Year Installed Note 3	Disch. Pipe Location
			Top	Ground				
W-342	254+60	13.98	18.31	17.8	15.0	27.11	-78	TD
W-343	255+23	14.04	18.45	18.0	20.0	30.64	-78	TD
W-344	255+50	13.91	18.26	17.7	20.0	30.30	-78	TD
W-345	256+00	13.69	17.92	17.4	20.0	29.74	-78	TD
W-345A	256+35	14.04	19.73	17.5	20.0	30.98	-85, S	TD
W-346	256+50	13.82	17.91	17.2	15.0	26.65	-78	TD
W-347	257+00	13.80	18.10	17.3	15.0	25.07	-78	TD
W-348	257+50	13.79	18.10	17.6	10.0	20.72	-78	TD
W-349	258+00	13.92	18.13	17.4	10.0	18.82	-78	TD
W-349-1	258+06	13.68	19.42	17.5	10.0	18.17	-85, R	TD
W-350	258+50	13.67	17.83	17.3	10.0	19.19	-78	TD
W-351	259+00	13.11	17.87	17.4	10.0	20.14	-78	TD
W-351-1	259+06	13.75	19.49	17.5	10.0	18.66	-85, R	TD
W-352	259+50	13.73	17.54	17.5	10.0	19.34	-78	TD
W-353	260+00	13.65	18.02	17.0	10.0	20.73	-78	TD
W-353-1	259+94	13.43	19.21	17.2	10.0	17.84	-85, R	TD
W-354	260+50	13.64	17.95	16.9	10.0	21.94	-78	TD
W-355	261+00	13.75	18.03	17.0	15.0	27.57	-78	TD
W-356	261+50	13.72	17.87	16.9	15.0	27.15	-78	TD
W-357	262+00	13.77	17.82	17.1	15.0	28.10	-78	TD
W-358	262+50	13.82	17.50	17.5	15.0	27.97	-78	TD
W-359	263+00	12.97	17.22	17.0	15.0	29.14	-78	TD
W-360	263+50	13.83	17.68	17.2	15.0	29.90	-78	TD
W-361	264+00	13.46	17.49	16.8	15.0	28.79	-78	TD
W-362	265+00	14.00	17.40	16.7	15.0	26.79	-78	TD



References: Dwg. 9Y51 O-H-1161  
Spec. 9Y51OHS1002

TABLE 4  
MAIN COOLING RESERVOIR  
RELIEF WELL DATA

Specification No. 9Y51OYS1004  
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Well	MCR Sta	Top of Well (Elev) Note 1	Manhole (Elev)		Screen Length (Ft)	Well Depth (Ft) Note 2	Year Installed Note 3	Disch. Pipe Location
			Top	Ground				
W-363	266+50	13.33	17.11	17.9	15.0	30.07	-78	TD
W-364	282+60	12.75	15.89	15.5	15.0	24.57	-78	TD
W-364A	283+25	12.74	17.98	15.9	20.0	26.46	-85, S	TD
W-365	284+00	13.27	15.97	16.0	15.0	27.71	-78	TD
W-366	285+00	12.99	16.21	15.8	15.0	26.48	-78	TD
W-367	285+50	12.97	15.77	16.3	15.0	26.93	-78	TD
W-368	286+00	12.73	16.35	16.0	15.0	24.72	-78	TD
W-369	286+50	12.52	15.92	15.9	15.0	25.38	-78	TD
W-370	287+00	12.98	15.94	16.4	15.0	26.12	-78	TD
W-371	287+50	12.44	16.04	16.0	20.0	27.71	-78	TD
W-372	288+00	12.86	16.26	16.3	15.0	28.01	-78	TD
W-373	288+50	12.64	16.04	16.0	20.0	27.70	-78	TD
W-374	289+00	12.94	16.38	16.3	15.0	28.01	-78	TD
W-375	289+50	12.89	16.20	16.2	15.0	27.45	-78	TD
W-376	290+00	12.56	16.15	15.9	15.0	23.78	-78	TD
W-377	290+50	12.84	16.23	15.7	15.0	24.21	-78	TD
W-378	291+00	12.87	16.12	15.8	15.0	26.75	-78	TD
W-379	291+50	12.90	16.13	15.9	15.0	25.28	-78	TD
W-380	292+00	12.64	15.95	16.0	15.0	25.93	-78	TD
W-381	292+50	12.63	15.71	15.7	15.0	24.74	-78	TD
W-382	293+00	12.56	15.60	15.7	15.0	24.80	-78	TD
W-383	293+50	12.70	16.08	16.1	15.0	25.18	-78	TD
W-384	294+00	12.41	15.98	16.1	15.0	24.29	-78	TD
W-385	294+50	12.92	16.53	16.4	15.0	24.79	-78	TD
W-386	295+00	12.68	16.31	15.9	15.0	24.56	-78	TD

References: Dwg. 9Y51 O-H-1161  
Spec. 9Y510HS1002

TABLE 4  
MAIN COOLING RESERVOIR  
RELIEF WELL DATA

Specification No. 9Y510YS1004  
Revision 6  
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Well	MCR Sta	Top of Well (Elev) Note 1	Manhole (Elev)		Screen Length (Ft)	Well Depth (Ft) Note 2	Year Installed Note 3	Disch. Pipe Location
			Top	Ground				
W-387	295+40	12.95	16.59	16.6	15.0	25.56	-78	TD
W-388	295+80	12.75	16.71	16.5	15.0	26.05	-78	TD
W-389	296+20	12.68	16.76	16.4	10.0	25.85	-78	TD
W-390	296+60	12.88	16.81	16.4	10.0	26.19	-78	TD
W-391	297+00	12.52	16.67	16.2	10.0	26.83	-78	TD
W-392	297+40	12.85	17.08	17.1	15.0	27.27	-78	TD
W-393	297+80	12.64	16.82	16.8	15.0	27.23	-78	TD
W-394	298+20	12.49	16.94	16.4	15.0	27.71	-78	TD
W-395	298+60	12.22	16.67	16.4	10.0	23.77	-78	TD
W-396	299+00	13.07	17.18	16.7	15.0	26.37	-78	TD
W-397	299+40	12.53	16.71	16.5	15.0	25.34	-78	TD
W-398	299+80	12.89	16.73	17.5	15.0	25.79	-78	TD
W-399	300+20	12.92	16.59	16.4	15.0	27.51	-78	TD
W-400	300+60	13.32	16.62	16.3	15.0	27.77	-78	TD
W-401	301+00	13.24	16.40	16.2	15.0	26.78	-78	TD
W-402	301+40	12.84	16.08	15.9	20.0	29.39	-78	TD
W-403	301+80	12.13	15.72	15.7	20.0	29.38	-78	TD
W-404	302+20	12.66	15.95	15.7	20.0	30.38	-78	TD
W-405	302+60	12.60	15.86	15.4	15.0	29.16	-78	TD
W-406	303+00	12.21	15.63	15.4	20.0	28.20	-78	TD
W-407	303+40	12.73	15.59	15.4	20.0	29.90	-78	TD
W-408	303+80	12.54	15.87	15.7	20.0	28.94	-78	TD
W-409	304+20	12.41	15.72	15.5	20.0	29.47	-78	TD
W-410	304+60	12.57	15.70	15.5	20.0	30.39	-78	TD
W-411	305+00	12.50	15.57	15.3	20.0	29.51	-78	TD

References: Dwg. 9Y51 O-H-1161  
Spec. 9Y51OHS1002

TABLE 4  
MAIN COOLING RESERVOIR  
RELIEF WELL DATA

Specification No. 9Y51OYS1004  
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Well	MCR Sta	Top of Well (Elev) Note 1	Manhole (Elev)		Screen Length (Ft)	Well Depth (Ft) Note 2	Year Installed Note 3	Disch. Pipe Location
			Top	Ground				
W-412	305+40	12.58	15.74	15.7	20.0	30.67	-78	TD
W-413	305+80	12.40	15.63	15.4	20.0	30.50	-78	TD
W-414	306+20	12.33	15.61	15.4	20.0	24.35	-78	TD
W-415	306+60	12.24	15.55	15.3	20.0	30.30	-78	TD
W-416	307+00	12.43	15.66	15.5	20.0	29.22	-78	TD
W-417	307+40	12.23	15.81	15.8	20.0	30.44	-78	TD
W-418	307+80	11.94	15.69	15.7	20.0	28.70	-78	TD
W-419	308+20	12.17	15.78	15.6	20.0	28.70	-78	TD
W-420	308+60	12.30	15.80	15.6	20.0	29.73	-78	TD
W-421	309+00	12.43	15.89	15.4	20.0	29.64	-78	TD
W-422	309+40	11.54	15.00	15.5	20.0	29.88	-78	TD
W-423	309+80	11.93	15.41	15.0	20.0	29.33	-78	TD
W-424	310+20	11.95	15.37	14.9	20.0	30.51	-78	TD
W-425	310+60	12.07	15.59	15.1	20.0	29.28	-78	TD
W-426	311+00	11.80	15.43	15.0	15.0	24.44	-78	TD
W-427	311+40	12.10	15.28	14.9	20.0	30.13	-78	TD
W-428	311+80	11.83	15.04	14.8	20.0	29.49	-78	TD
W-429	312+20	12.00	15.03	15.0	10.0	21.94	-78	TD
W-430	312+60	11.62	14.58	14.7	15.0	22.89	-78	TD
W-431	313+00	11.82	14.80	14.8	15.0	22.90	-78	TD
W-432	313+40	11.93	14.98	14.5	15.0	23.95	-78	TD
W-433	313+80	11.76	14.92	14.9	20.0	29.16	-78	TD
W-434	314+20	12.03	14.93	14.4	20.0	30.98	-78	TD
W-435	314+60	11.71	14.60	15.1	15.0	24.59	-78	TD
W-436	315+18	11.62	14.46	14.5	20.0	30.61	-78	TD

References: Dwg. 9Y51 O-H-1161  
Spec. 9Y51OHS1002

TABLE 4  
MAIN COOLING RESERVOIR  
RELIEF WELL DATA

Specification No. 9Y51OYS1004  
Revision 6  
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Well	MCR Sta	Top of Well (Elev) Note 1	Manhole (Elev)		Screen Length (Ft)	Well Depth (Ft) Note 2	Year Installed Note 3	Disch. Pipe Location
			Top	Ground				
W-437	315+40	11.85	14.65	14.6	20.0	30.80	-78	TD
W-438	315+80	11.63	14.79	14.8	20.0	30.87	-78	TD
W-439	316+20	11.40	14.75	14.4	20.0	29.60	-78	TD
W-440	316+60	11.47	15.29	15.8	20.0	29.32	-78	TD
W-441	317+00	10.55	14.55	15.0	20.0	29.06	-78	TD
W-442	317+40	11.22	14.46	14.1	15.0	28.92	-78	TD
W-443	317+80	10.65	14.60	14.6	15.0	29.48	-78	TD
W-444	318+20	12.13	15.94	14.4	15.0	29.48	-78	TD
W-445	318+60	10.66	14.67	15.2	15.0	29.71	-78	TD
W-446	319+00	11.21	14.78	15.3	15.0	28.66	-78	TD
W-447	319+40	11.20	14.79	14.5	10.0	26.72	-78	TD
W-447A	319+60	10.87	16.21	14.7	19.4	27.92	-87, S	TD
W-448	319+80	11.54	14.70	14.4	15.0	27.56	-78	TD
W-449	320+20	11.89	14.88	14.6	10.0	26.73	-78	TD
W-450	320+60	12.49	15.42	15.0	10.0	22.73	-78	TD
W-451	321+00	11.71	14.97	14.7	10.0	24.34	-78	TD
W-452	321+40	12.05	15.32	14.8	10.0	22.04	-78	TD
W-453	321+80	11.62	15.01	15.0	10.0	25.41	-78	TD
W-454	322+20	12.22	15.55	15.0	10.0	21.75	-78	TD
W-455	322+60	12.02	15.44	15.2	10.0	24.54	-78	TD
W-456	323+00	11.96	15.46	15.2	15.0	25.20	-78	TD
W-457	323+40	12.22	15.63	15.1	15.0	25.72	-78	TD
W-457A	323+60	11.75	17.09	15.5	14.7	21.75	-87, S	TD
W-458	323+80	12.20	15.62	15.3	15.0	24.54	-78	TD
W-459	324+20	11.99	15.37	15.1	15.0	25.33	-78	TD
W-460	324+60	12.15	15.71	15.3	15.0	25.44	-78	TD
W-461	325+00	12.14	15.88	15.6	15.0	25.28	-78	TD

References: Dwg. 9Y51 O-H-1161  
Spec. 9Y510HS1002

TABLE 4  
MAIN COOLING RESERVOIR  
RELIEF WELL DATA

Specification No. 9Y510YS1004  
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Well	MCR Sta	Top of Well (Elev) Note 1	Manhole (Elev)		Screen Length (Ft)	Well Depth (Ft) Note 2	Year Installed Note 3	Disch. Pipe Location
			Top	Ground				
W-462	325+50	12.69	16.30	15.9	10.0	23.79	-78	TD
W-463	326+00	12.50	16.10	15.7	10.0	24.85	-78	TD
W-464	326+50	12.61	16.04	15.8	10.0	21.42	-78	TD
W-464A	326+80	12.81	17.95	15.7	10.0	28.91	-85, S	TD
W-465	327+00	12.97	16.50	16.0	10.0	20.60	-78	TD
W-466	327+50	12.56	15.99	15.7	15.0	25.99	-78	TD
W-467	328+00	12.80	16.44	16.2	15.0	27.48	-78	TD
W-468	328+50	12.49	16.21	16.0	10.0	26.82	-77	TD
W-469	329+00	12.98	16.69	16.2	15.0	28.52	-77	TD
W-470	329+50	12.74	16.47	16.2	15.0	28.27	-77	TD
W-471	330+18	12.98	16.63	16.1	15.0	28.92	-77	TD
W-472	330+50	13.19	16.92	16.4	15.0	29.40	-77	TD
W-473	331+00	13.01	16.81	16.5	15.0	23.33	-77	TD
W-474	331+50	13.23	16.94	16.5	15.0	29.19	-77	TD
W-475	332+00	13.25	16.78	16.3	15.0	28.42	-77	TD
W-476	332+50	13.63	17.20	17.0	15.0	29.01	-77	TD
W-477	333+00	13.76	17.19	16.7	10.0	27.60	-77	TD
W-478	333+50	13.33	16.86	16.6	15.0	27.55	-77	TD
W-479	334+00	13.75	17.27	16.8	15.0	26.99	-77	TD
W-480	334+50	13.73	17.31	17.0	15.0	26.10	-77	TD
W-481	335+00	13.61	16.92	16.7	15.0	27.80	-77	TD
W-482	336+00	13.92	17.43	17.2	15.0	28.01	-77	TD
W-483	337+50	13.63	16.99	17.0	15.0	29.75	-77	TD
W-483A	338+50	14.24	17.22	16.9	15.0	29.97	-77	TD
W-483B	339+50	14.45	16.80	16.4	20.0	29.90	-77	TD

References: Dwg. 9Y51 O-H-1161  
Spec. 9Y51OHS1002

TABLE 4  
MAIN COOLING RESERVOIR  
RELIEF WELL DATA

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Well	MCR Sta	Top of Well (Elev) Note 1	Manhole (Elev)		Screen Length (Ft)	Well Depth (Ft) Note 2	Year Installed Note 3	Disch. Pipe Location
			Top	Ground				
W-483BB	338+90	14.61	19.16	17.0	30.0	41.54	-85, S	TD
W-483C	340+50	14.79	16.73	16.7	20.0	31.68	-77	TD
W-483D	341+50	14.42	17.02	17.0	15.0	31.64	-77	TD
W-483DD	341+10	14.58	18.93	17.1	30.0	40.68	-85, S	TD
W-483E	342+50	14.95	17.55	17.3	10.0	30.59	-77	TD
W-483F	343+50	15.11	17.62	17.4	10.0	20.81	-77	TD
W-483G	344+50	15.10	17.50	17.5	10.0	23.67	-77	TD
W-483H	345+50	15.33	17.49	17.3	10.0	25.45	-77	TD
W-483I	346+50	15.25	17.43	17.2	10.0	25.51	-77	TD
W-483J	347+50	15.38	17.48	17.4	10.0	26.10	-77	TD
W-483K	348+50	15.38	17.30	17.3	10.0	25.46	-77	TD
W-483L	349+50	15.32	16.95	17.0	10.0	25.67	-77	TD
W-483M	350+50	15.67	17.41	17.2	15.0	26.26	-77	TD
W-483N	351+50	15.31	17.58	17.3	5.0	21.20	-77	TD
W-483O	352+50	15.30	17.63	17.1	10.0	22.75	-77	TD
W-484	353+60	15.31	17.36	17.1	10.0	23.30	-77	TD
W-484-1	353+54	15.28	19.58	17.4	5.0	18.23	-85, R	TD
W-485	354+40	15.13	17.68	17.7	10.0	24.00	-77	TD
W-486	355+20	14.40	17.45	18.0	10.0	22.90	-77	TD
W-487	356+00	14.31	17.32	18.1	15.0	27.71	-77	TD
W-488	356+80	14.23	17.27	17.3	15.0	30.84	-77	TD
W-489	357+60	14.24	17.14	17.4	20.0	28.26	-77	TD
W-490	358+40	13.82	17.02	17.5	25.0	28.90	-77	TD
W-491	359+20	13.96	17.63	17.6	25.0	36.00	-77	TD
W-492	360+00	13.18	17.46	17.5	25.0	35.59	-77	TD

References: Dwg. 9Y51 Q-H-1161  
Spec. 9Y51QHS1002

TABLE 4  
MAIN COOLING RESERVOIR  
RELIEF WELL DATA

Specification No. 9Y51OYS1004  
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Well	MCR Sta	Top of Well (Elev) Note 1	Manhole (Elev)		Screen Length (Ft)	Well Depth (Ft) Note 2	Year Installed Note 3	Disch. Pipe Location
			Top	Ground				
W-493	360+80	12.69	17.03	17.0	25.0	35.94	-77	TD
W-494	361+60	13.05	16.83	17.3	25.0	39.31	-77	TD
W-495	362+40	13.52	17.40	17.9	25.0	39.76	-77	TD
W-496	363+20	12.14	16.22	18.0	20.0	37.10	-77	TD
W-497	364+00	12.37	16.39	18.4	25.0	38.84	-77	TD
W-498	365+50	11.98	16.00	19.0	25.0	38.86	-77	TD
W-499	367+30	11.55	14.62	18.5	20.0	35.65	-77	TD
W-500	369+25	13.39	15.20	17.2	15.0	38.29	-77	TD
W-501	371+20	14.68	18.14	19.1	15.0	40.96	-77	TD
W-502	373+15	16.65	19.16	21.1	15.0	42.08	-77	TD
W-503	375+00	18.95	20.94	20.9	15.0	42.38	-77	TD
W-503A	375+10	7.86	25.43	22.6	17.0	28.86	-87, S	RLRS
W-504	377+00	7.89	21.57	21.6	15.0	22.70	-77	RLRS
W-505	379+00	9.00	22.74	22.2	15.0	23.63	-77	RLRS
W-506	381+00	9.36	22.76	22.5	15.0	20.88	-77	RLRS
W-507	383+00	9.28	22.57	22.2	15.0	17.96	-77	RLRS
W-507-1	383+06	8.28	25.88	24.0	19.3	29.18	-87, R	RLRS
W-508	385+00	9.32	22.48	22.5	15.0	21.93	-77	RLRS
W-509	386+00	8.92	21.73	21.7	15.0	19.20	-77	RLRS
W-509A	387+00	8.38	23.88	22.1	23.4	36.08	-87, S	RLRS
W-510	388+20	9.66	23.85	21.5	20.0	34.12	-85, S	RLRS
W-510A	389+60	8.63	22.19	20.7	25.5	35.73	-87, S	RLRS
W-511	390+40	8.82	19.89	19.9	15.0	23.29	-77	RLRS
W-511A	391+20	8.74	24.26	21.9	19.3	31.54	-87, S	RLRS
W-512	392+40	9.83	22.68	20.4	20.0	33.55	-85, S	RLRS

References: Dwg. 9Y51 O-H-1161  
Spec. 9Y51OHS1002

TABLE 4  
MAIN COOLING RESERVOIR  
RELIEF WELL DATA

Specification No. 9Y51OYS1004  
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Well	MCR Sta	Top of Well (Elev) Note 1	Manhole (Elev)		Screen Length (Ft)	Well Depth (Ft) Note 2	Year Installed Note 3	Disch. Pipe Location
			Top	Ground				
W-513	394+00	9.27	18.49	18.6	15.0	25.20	-77	RLRS
W-514	396+00	10.00	19.60	18.6	15.0	22.80	-77	RLRS
W-515	397+00	9.46	19.10	18.1	5.0	13.08	-77	RLRS
W-515A	397+50	9.09	20.4	18.8	15.0	37.59	-87, S	RLRS
W-516	398+00	9.47	19.52	18.5	5.0	12.88	-77	RLRS
W-517	399+00	9.71	19.16	17.9	5.0	19.44	-77	RLRS
W-518	399+50	10.34	21.22	18.8	20.0	36.35	-85, S	RLRS
W-519	401+00	10.31	19.38	18.6	5.0	15.84	-77	RLRS
W-520	402+00	10.25	18.79	18.0	5.0	18.34	-77	RLRS
W-520-1	401+40	9.26	20.59	18.7	17.0	33.36	-87, R	RLRS
W-521	403+00	10.35	18.33	16.9	25.0	35.44	-77	RLRS
W-522	404+00	9.77	17.29	17.2	20.0	26.06	-77	RLRS
W-523	404+89	10.30	18.50	17.3	20.0	26.05	-77	RLRS
W-524	405+78	9.98	17.74	17.5	20.0	28.40	-77	RLRS
W-525	406+67	9.77	17.80	17.5	10.0	17.22	-77	RLRS
W-526	408+47	10.41	18.67	18.4	15.0	28.94	-77	RLRS
W-526A	409+40	9.74	21.23	19.0	19.4	36.84	-87, S	RLRS
W-527	410+27	10.26	18.64	17.9	15.0	27.80	-77	RLRS
W-528	412+07	10.10	18.90	17.9	15.0	29.08	-77	RLRS
W-529	413+87	10.25	19.85	18.8	15.0	25.48	-77	RLRS
W-530	415+67	12.15	20.58	19.5	25.0	33.35	-77	RLRS
W-531	417+47	10.60	19.09	18.8	15.0	28.40	-77	RLRS
W-532	419+27	10.46	18.42	18.4	15.0	27.54	-77	RLRS



References: Dwg. 9Y51 O-H-1161  
Spec. 9Y51OHS1002

TABLE 4  
MAIN COOLING RESERVOIR  
RELIEF WELL DATA

Specification No. 9Y51OYS1004.  
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Well	MCR Sta	Top of Well (Elev) Note 1	Manhole (Elev)		Screen Length (Ft)	Well Depth (Ft) Note 2	Year Installed Note 3	Disch. Pipe Location
			Top	Ground				
W-532A	420+50	11.45	22.59	20.2	20.0	34.41	-85, S	RLRS
W-533	421+07	11.63	20.03	20.5	15.0	23.13	-77	RLRS
W-534	422+87	12.89	20.75	21.0	15.0	25.74	-77	RLRS
W-535	424+67	10.57	18.62	19.6	15.0	25.64	-77	RLRS
W-536	426+01	10.89	19.36	19.9	15.0	23.93	-77	RLRS
W-537	427+03	10.74	19.23	19.7	15.0	23.09	-77	RLRS
W-538	428+05	11.55	20.77	20.5	15.0	24.67	-77	RLRS
W-539	429+07	11.51	20.47	20.5	15.0	24.45	-77	RLRS
W-540	430+09	11.47	20.34	20.3	10.0	23.56	-77	RLRS
W-541	431+11	11.70	20.93	20.7	10.0	25.72	-77	RLRS
W-542	432+13	11.18	19.85	19.8	10.0	24.62	-77	RLRS
W-542A	432+35	11.59	21.75	19.9	20.0	36.16	-85, S	RLRS
W-543	433+15	11.78	19.33	18.8	10.0	24.94	-77	RLRS
W-544	434+17	11.41	21.01	20.5	10.0	25.09	-77	RLRS
W-545	435+19	11.85	21.31	20.8	5.0	26.72	-77	RLRS
W-546	436+14	11.90	21.75	21.5	10.0	22.85	-77	RLRS
W-547	437+09	11.56	21.33	21.3	15.0	23.31	-77	RLRS
W-547A	437+65	11.87	23.03	20.8	20.0	34.84	-85, S	RLRS
W-548	438+04	12.83	21.04	21.0	5.0	23.32	-77	RLRS
W-548A	438+55	11.61	23.21	21.3	20.0	33.65	-85, S	RLRS
W-549	438+99	11.61	21.46	21.5	10.0	24.96	-77	RLRS
W-549A	439+35	11.80	23.62	21.3	20.0	34.91	-85, S	RLRS
W-550	439+94	11.39	21.29	21.0	10.0	25.51	-78	RLRS
W-551	440+89	11.95	21.90	21.7	5.0	17.05	-77	RLRS
W-551-1	440+83	12.07	23.90	22.0	20.0	36.82	-85, R	RLRS

References: Dwg. 9Y51 O-H-1161  
Spec. 9Y51OHS1002

TABLE 4  
MAIN COOLING RESERVOIR  
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Specification No. 9Y51OYS1004  
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Well	MCR Sta	Top of Well (Elev) Note 1	Manhole (Elev)		Screen Length (Ft)	Well Depth (Ft) Note 2	Year Installed Note 3	Disch. Pipe Location
			Top	Ground				
W-552	441+84	11.69	21.74	24.7	10.0	18.62	-77	RLRS
W-552A	442+35	12.19	24.00	22.4	20.0	34.26	-85, S	RLRS
W-553	442+79	12.22	22.11	21.9	10.0	18.64	-77	RLRS
W-554	443+74	12.80	22.38	21.4	10.0	20.47	-78	RLRS
W-555	444+69	12.46	22.46	22.2	15.0	25.65	-77	RLRS
W-556	445+58	12.41	23.38	23.1	15.0	24.24	-77	RLRS
W-557	446+47	12.05	23.38	23.1	10.0	20.52	-77	RLRS
W-558	447+36	13.45	24.33	24.1	15.0	22.24	-78	RLRS
W-559	448+25	13.03	24.00	23.8	15.0	22.28	-78	RLRS
W-560	449+14	13.18	24.11	23.9	15.0	22.03	-78	RLRS
W-561	450+00	13.59	23.87	23.6	15.0	23.89	-78	RLRS
W-562	451+00	12.53	22.91	22.7	15.0	24.87	-78	RLRS
W-563	452+00	13.23	23.17	22.7	15.0	24.11	-78	RLRS
W-564	452+50	12.76	23.16	22.7	15.0	22.28	-78	RLRS
W-565	453+70	12.89	22.79	22.3	15.0	22.85	-78	RLRS
W-566	455+20	12.99	23.43	23.0	15.0	22.01	-78	RLRS
W-566A	456+00	15.00	27.4	25.0	34.0	39.00	88, ST	RLRS
W-567	457+15	13.35	23.53	22.5	15.0	23.84	-78	RLRS
W-567A	458+00	14.50	27.0	24.5	35.0	39.00	88, ST	RLRS
W-568	459+10	13.81	24.28	23.3	25.0	33.60	-78	RLRS
W-568A	460+00	14.00	26.8	24.5	40.0	40.70	88, ST	RLRS
W-569	461+20	13.59	23.29	23.3	20.0	33.61	-78	RLRS
W-570	463+00	13.40	23.12	23.1	15.0	30.47	-78	RLRS
W-571	464+75	14.03	24.68	23.7	25.0	33.00	-78	RLRS
W-571A	465+40	13.12	26.74	24.6	20.0	32.86	-85, S	RLRS
W-572	466+50	13.61	24.16	23.2	25.0	32.69	-78	RLRS
W-572A	467+25	13.35	25.95	24.0	15.0	32.00	-85, S	RLRS
W-573	468+25	13.55	23.74	23.2	15.0	27.83	-78	RLRS

References: Dwg. 9Y51 O-H-1161  
Spec. 9Y51OHS1002

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MAIN COOLING RESERVOIR  
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Well	MCR Sta	Top of Well (Elev) Note 1	Manhole (Elev)		Screen Length (Ft)	Well Depth (Ft) Note 2	Year Installed Note 3	Disch. Pipe Location
			Top	Ground				
W-574	470+00	13.37	23.44	23.4	15.0	32.33	-78	RLRS
W-575	471+75	14.13	24.07	23.1	15.0	33.46	-78	RLRS
W-576	473+50	14.65	24.49	23.5	15.0	32.72	-78	RLRS
W-577	475+25	14.30	23.62	22.9	15.0	33.06	-78	RLRS
W-578	477+00	14.31	22.89	21.9	10.0	24.70	-78	RLRS
W-578A	478+80	13.65	27.10	24.6	12.4	34.35	-87, S	RLRS
W-578B	480+60	13.72	27.17	24.9	22.7	33.84	-87, S	RLRS
W-578C	482+40	13.84	25.26	23.4	13.4	33.54	-87, S	RLRS
W-579	484+00	14.28	-	22.8	5.0	19.54	-78	RLRS
W-580	486+00	14.68	23.74	23.5	10.0	19.33	-78	RLRS
W-581	488+00	14.68	24.16	24.0	15.0	31.79	-78	RLRS
W-582	490+00	14.93	24.77	24.8	5.0	17.03	-78	RLRS
W-582A	490+55	14.22	27.34	25.1	15.0	36.71	-85, S	RLRS
W-583	492+00	15.11	25.56	24.6	10.0	25.80	-78	RLRS
W-584	494+00	14.96	25.73	25.7	10.0	22.68	-78	RLRS
W-584A	495+45	14.38	27.18	25.3	15.0	35.19	-85, S	RLRS
W-585	496+00	15.39	25.71	24.5	10.0	24.35	-78	RLRS
W-586	498+00	15.35	25.27	24.9	10.0	24.17	-78	RLRS
W-609	543+50	17.60	27.73	26.7	15.0	23.45	-78	RLRS
W-610	545+00	17.65	27.81	26.8	15.0	20.43	-78	RLRS
W-611	546+00	18.81	28.59	27.1	10.0	18.48	-78	RLRS
W-612	547+00	17.73	27.73	26.7	10.0	17.78	-78	RLRS
W-613	548+00	17.83	27.78	26.3	10.0	18.79	-79	RLRS

References: Dwg. 9Y51 O-H-1161  
Spec. 9Y51OHS1002

TABLE 4  
MAIN COOLING RESERVOIR  
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Well	MCR Sta	Top of Well (Elev) Note 1	Manhole (Elev)		Screen Length (Ft)	Well Depth (Ft) Note 2	Year Installed Note 3	Disch. Pipe Location
			Top	Ground				
W-614	549+00	17.58	27.30	26.3	10.0	16.52	-79	RLRS
W-615	550+00	17.95	27.21	26.5	10.0	19.78	-79	RLRS
W-616	551+00	17.26	26.82	26.1	15.0	21.83	-79	RLRS
W-617	552+00	20.43	27.02	26.0	15.0	24.97	-79	RLRS
W-618	553+00	18.02	27.40	25.9	10.0	18.02	-79	RLRS
W-619	554+00	17.00	26.60	25.6	10.0	16.25	-79	RLRS
W-619-1	554+06	17.50	26.98	25.2	10.0	14.63	-85, R	RLRS
W-620	555+00	18.49	28.07	26.1	10.0	17.46	-79	RLRS
W-621	566+00	18.71	28.73	27.7	15.0	24.70	-79	RLRS
W-622	567+00	19.33	28.53	27.5	10.0	20.12	-79	RLRS
W-622-1	567+06	18.55	29.19	27.3	10.0	35.44	-85, R	RLRS
W-623	568+60	19.47	28.45	27.0	15.0	22.42	-79	RLRS
W-624	569+30	19.39	28.44	27.0	15.0	24.36	-79	RLRS
W-625	570+00	19.33	28.57	27.1	15.0	23.51	-79	RLRS
W-625A	570+30	18.20	29.93	27.7	20.0	32.77	-85, S	RLRS
W-626	570+70	19.66	28.57	27.1	15.0	22.57	-79	RLRS
W-627	571+40	19.56	28.59	27.1	10.0	23.08	-79	RLRS
W-628	572+10	19.58	28.60	26.6	15.0	25.83	-79	RLRS
W-629	572+80	19.39	28.44	27.0	10.0	23.78	-79	RLRS
W-630	573+50	19.66	28.61	26.6	10.0	25.23	-79	RLRS
W-631	574+20	19.77	28.41	26.9	10.0	21.95	-79	RLRS
W-632	574+90	19.62	28.42	26.4	10.0	25.92	-79	RLRS
W-633	575+60	19.80	28.52	26.5	10.0	23.36	-79	RLRS
W-634	576+30	19.94	28.91	27.4	10.0	22.94	-79	RLRS
W-635	577+00	19.82	28.59	27.1	10.0	24.89	-79	RLRS

References: Dwg. 9Y51 O-H-1161  
Spec. 9Y51OHS1002

TABLE 4  
MAIN COOLING RESERVOIR  
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Well	MCR Sta	Top of Well (Elev) Note 1	Manhole (Elev)		Screen Length (Ft)	Well Depth (Ft) Note 2	Year Installed Note 3	Disch. Pipe Location
			Top	Ground				
W-636	577+70	20.11	28.73	27.2	10.0	24.00	-79	RLRS
W-637	578+40	20.05	28.35	26.9	10.0	25.55	-79	RLRS
W-638	579+10	20.02	28.34	26.9	15.0	24.41	-79	RLRS
W-639	579+80	19.76	28.42	26.9	15.0	25.58	-79	RLRS
W-640	580+80	24.08	28.73	26.7	15.0	28.79	-79	TD
W-641	582+50	24.85	26.99	28.0	15.0	30.11	-79	TD
W-642	584+20	25.02	26.55	27.6	10.0	31.66	-79	TD
W-643	585+30	22.44	28.74	26.7	10.0	26.98	-79	TD
W-644	586+40	22.08	27.21	27.2	10.0	25.23	-79	TD
W-645	587+30	22.25	27.30	27.0	10.0	28.42	-79	TD
W-646	588+20	22.46	27.33	26.6	10.0	28.15	-79	TD
W-647	589+10	22.54	27.31	26.6	15.0	29.19	-79	TD
W-648	590+00	22.58	26.90	26.1	15.0	29.64	-79	TD
W-648A	590+65	22.21	28.63	27.5	10.0	26.49	-85, S	TD
W-649	590+90	22.98	27.01	26.3	15.0	30.20	-79	TD
W-650	591+80	22.43	26.89	26.1	15.0	29.06	-79	TD
W-650A	592+25	22.10	29.46	28.1	19.1	35.61	-87, S	TD
W-651	592+70	22.90	26.83	26.1	15.0	29.88	-79	TD
W-651A	593+60	22.06	29.64	27.9	17.9	33.01	-87, S	TD
W-652	594+20	23.02	27.15	26.1	15.0	29.59	-79	TD
W-652A	595+10	22.61	29.97	27.8	18.3	38.94	-87, S	TD
W-653	596+00	22.81	26.74	26.2	10.0	25.03	-78	TD
W-653A	597+20	22.69	30.04	27.9	19.9	34.74	-87, S	TD
W-654	598+00	22.90	25.99	26.0	15.0	29.23	-78	TD
W-654A	599+00	22.78	30.12	28.5	19.3	35.67	-87, S	TD

References: Dwg. 9Y51 O-H-1161  
Spec. 9Y51OHS1002

TABLE 4  
MAIN COOLING RESERVOIR  
RELIEF WELL DATA

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Well	MCR Sta	Top of Well (Elev) Note 1	Manhole (Elev)		Screen Length (Ft)	Well Depth (Ft) Note 2	Year Installed Note 3	Disch. Pipe Location
			Top	Ground				
W-655	600+00	23.17	26.63	26.3	15.0	27.81	-78	TD
W-656	602+00	22.86	26.74	26.5	15.0	28.42	-78	TD
W-657	604+00	23.65	26.91	26.2	15.0	29.39	-78	TD
W-657A	605+05	22.93	30.07	27.9	23.0	37.99	-87, S	TD
W-658	606+00	23.81	26.82	26.4	15.0	30.35	-78	TD
W-659	607+60	23.64	26.62	26.3	15.0	29.51	-78	TD
W-659A	608+50	23.11	30.64	28.0	24.5	37.56	-87, S	TD
W-660	609+20	23.87	26.71	26.6	15.0	28.26	-78	TD
W-661	610+80	23.80	27.03	26.5	15.0	29.56	-78	TD
W-661A	611+50	23.42	30.65	28.9	19.4	33.56	-87, S	TD
W-662	612+40	23.60	26.85	26.7	15.0	31.35	-78	TD
W-663	614+00	24.04	27.24	27.0	15.0	28.50	-78	TD
W-663A	614+80	23.47	30.88	28.9	22.9	38.05	-87, S	TD
W-664	616+00	24.00	27.45	27.4	15.0	28.82	-78	TD
W-665	643+00	25.20	29.95	28.2	15.0	25.10	-79	TD
W-666	645+00	25.50	30.22	28.2	15.0	23.60	-79	TD
W-667	647+00	25.50	30.10	28.2	15.0	25.50	-79	TD
W-668	649+00	25.70	29.47	28.2	15.0	23.20	-79	TD
W-668A	650+45	25.32	30.83	29.0	5.0	25.83	-85, S	TD
W-669	651+00	25.70	29.84	28.2	15.0	23.50	-79	TD
W-669A	651+80	25.59	32.34	30.1	5.0	26.08	-85, S	TD
W-670	653+00	26.10	29.02	28.2	15.0	26.20	-79	TD

- NOTES:
1. Depth of well refers to top of well elevation.
  2. Bottom of screen is 2'0" above bottom of well.
  3. R - Replacement wells.  
S - Supplementary wells.  
ST - Supplementary wells along toe with discharge pipe at PDD or RLRS.

DISCHARGE PIPE LOCATIONS

PDD - Plant Discharge Ditch  
TD - Toe Ditch  
RLRS - Relocated Little Robbins Slough  
SSB - Spillway Stilling Basin

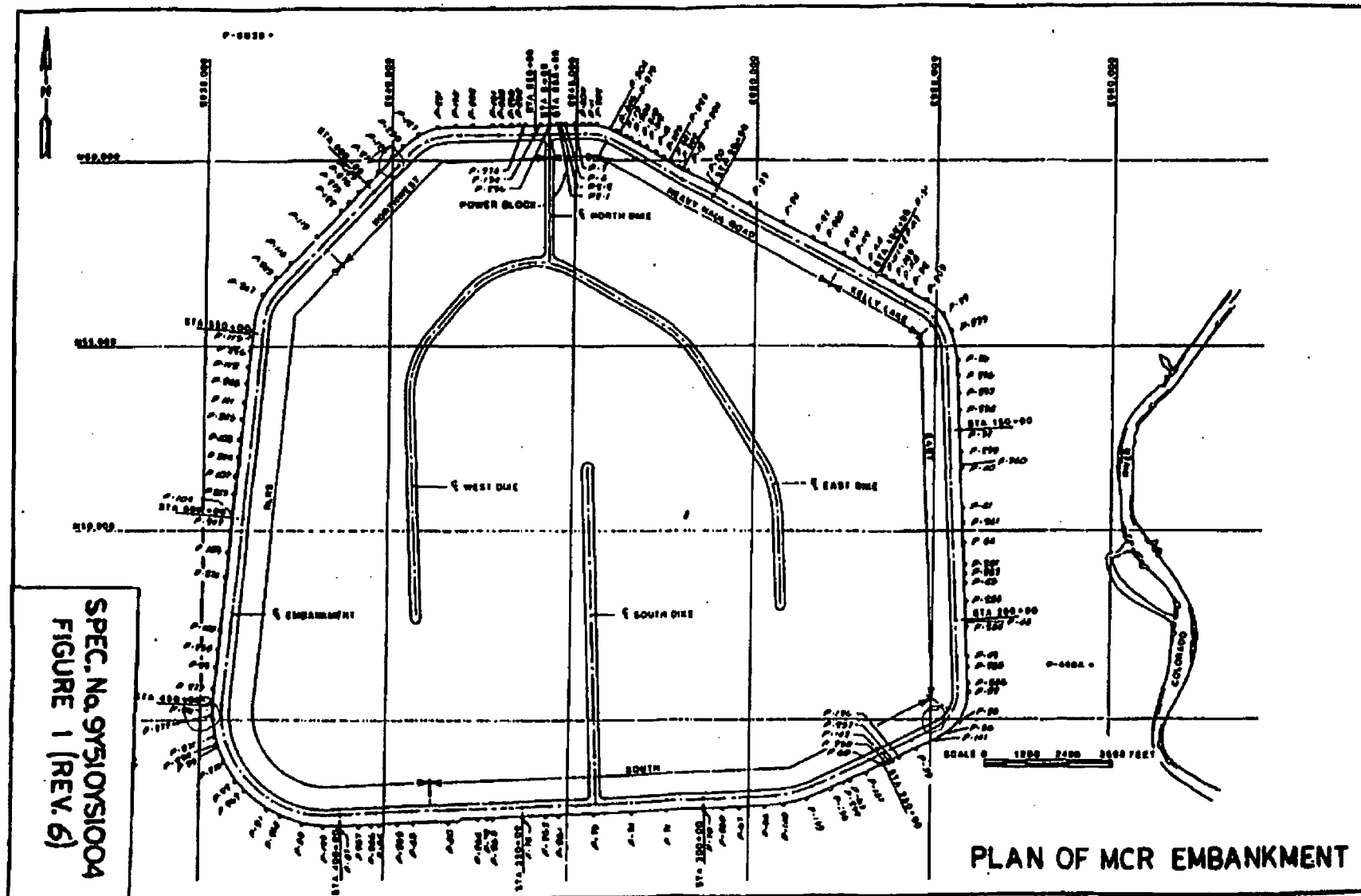
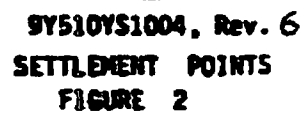


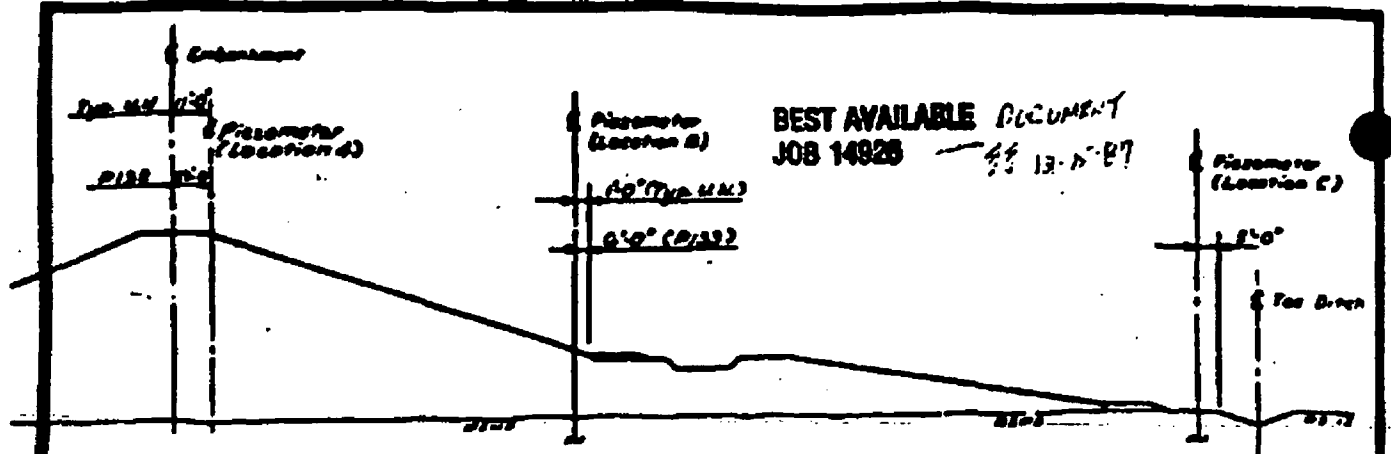
TABLE 5  
MAIN COOLING RESERVOIR INCLINOMETER DATA

Page 1 of 1

<u>Inclinometer No.</u>	<u>Approximate Embankment Station</u>	<u>Location</u>
T1	262 + 00	Crest
T2	262 + 00	Downstream Berm
T3	262 + 00	Upstream Slope
T4	280 + 00	Crest
T5	280 + 00	Downstream Berm
T6	280 + 00	Upstream Slope
T7	318 + 00	Crest
T8	318 + 00	Downstream Berm
T9	318 + 00	Upstream Slope
T10	340 + 00	Crest
T11	340 + 00	Downstream Berm
T12	340 + 00	Upstream Slope

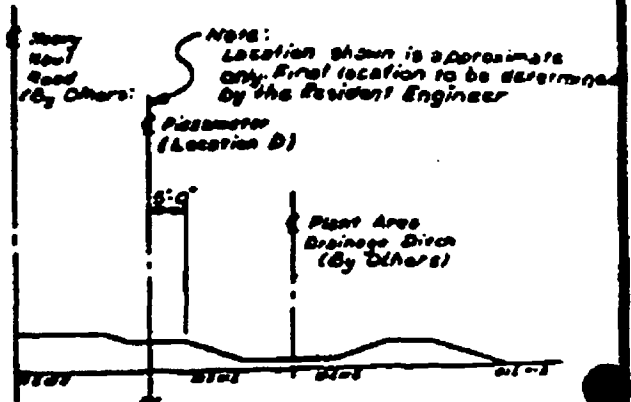






BEST AVAILABLE DOCUMENT  
JOB 14925 — 13-N-87

#### EMBANKMENT LOCATIONS

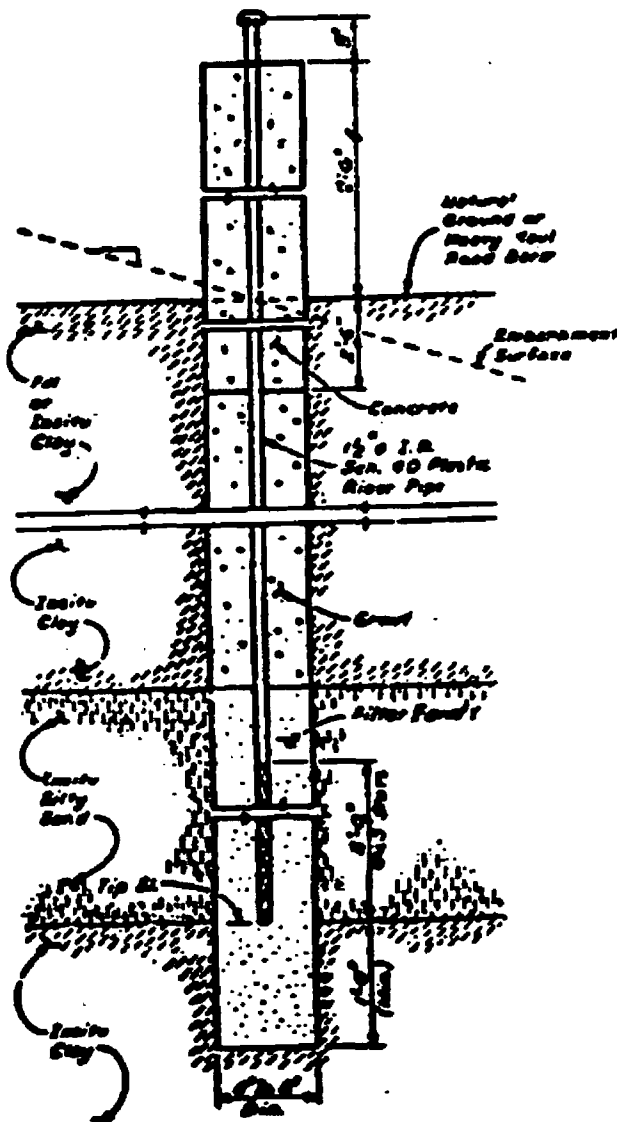


#### NEAR HEAVY HAUL ROAD

#### PIEZOMETER LOCATIONS

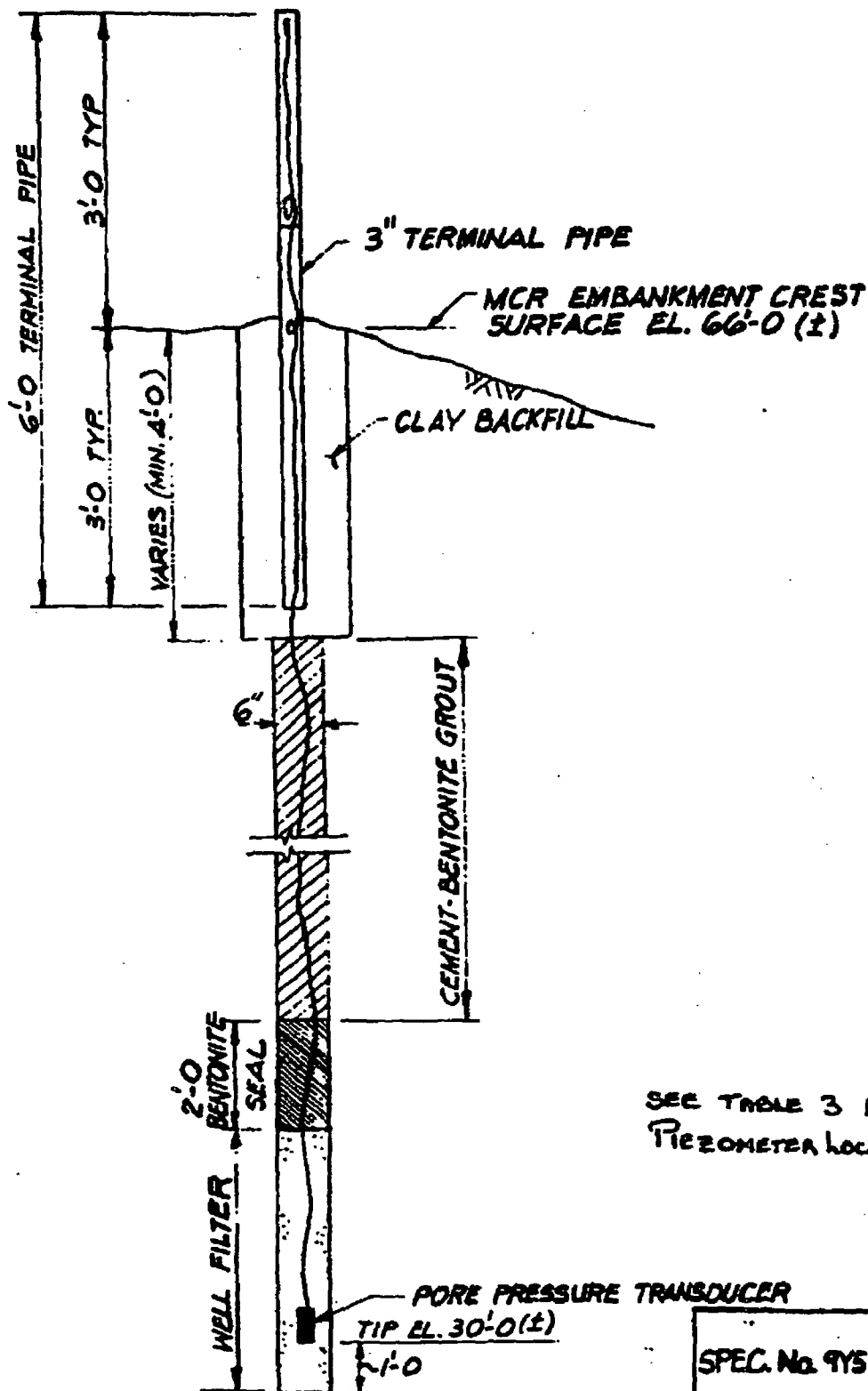
no scale

SEE TABLE 3 FOR  
PIEZOMETER LOCATION



TYPICAL PIEZOMETER DETAIL  
P-1 THRU P-136

Spec. No. 9Y510Y51004  
Figure 3A (Rev. 6)  
Ref. Drawing O-N-1161

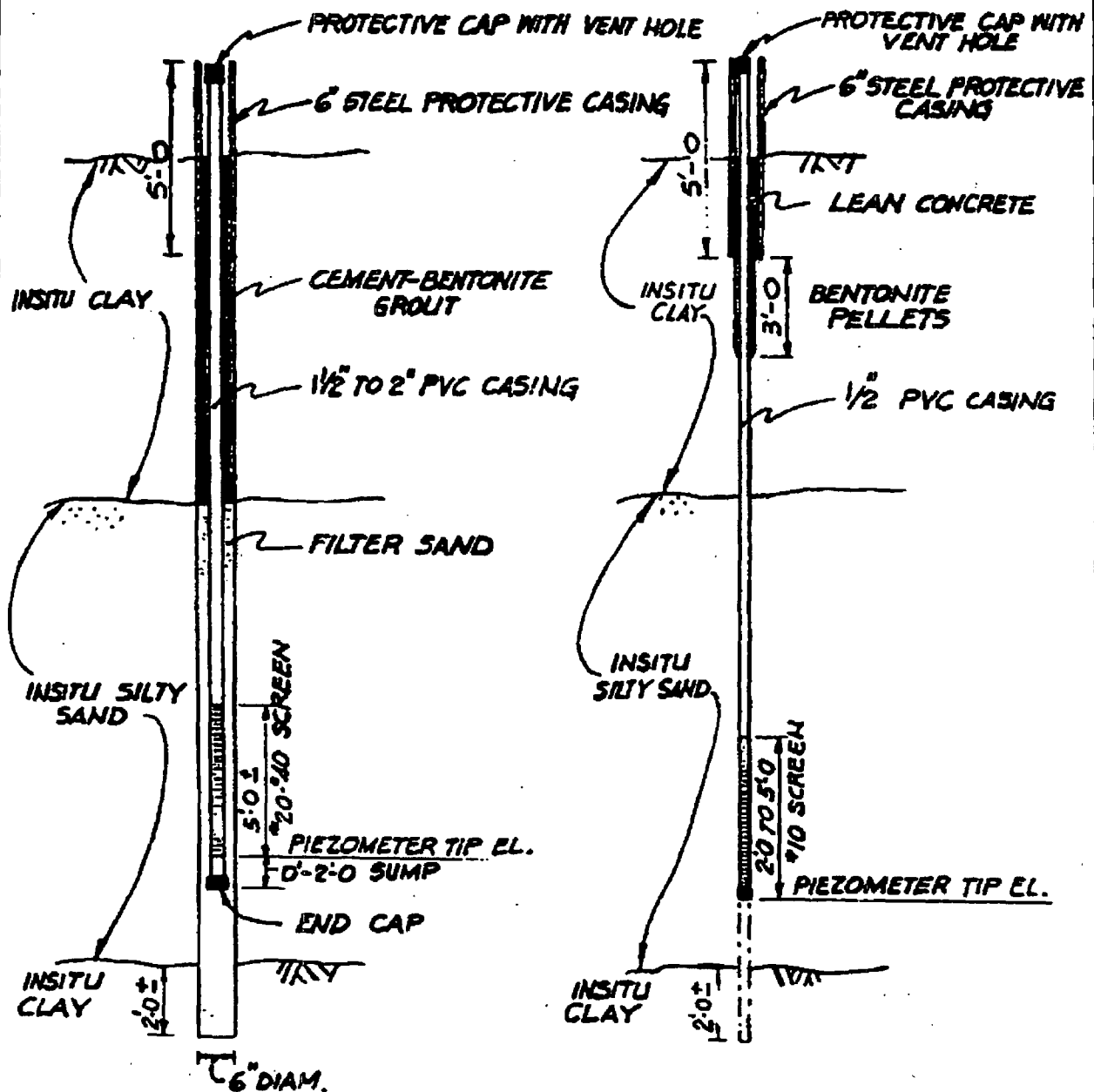


SEE TABLE 3 FOR  
PIEZOMETER LOCATION

TYPICAL PNEUMATIC PIEZOMETER DETAIL  
P454 THRU P470

SPEC. No. 9YS10YS1004  
FIGURE 3D (REV. 6)





#### TYPICAL PIEZOMETER DETAIL

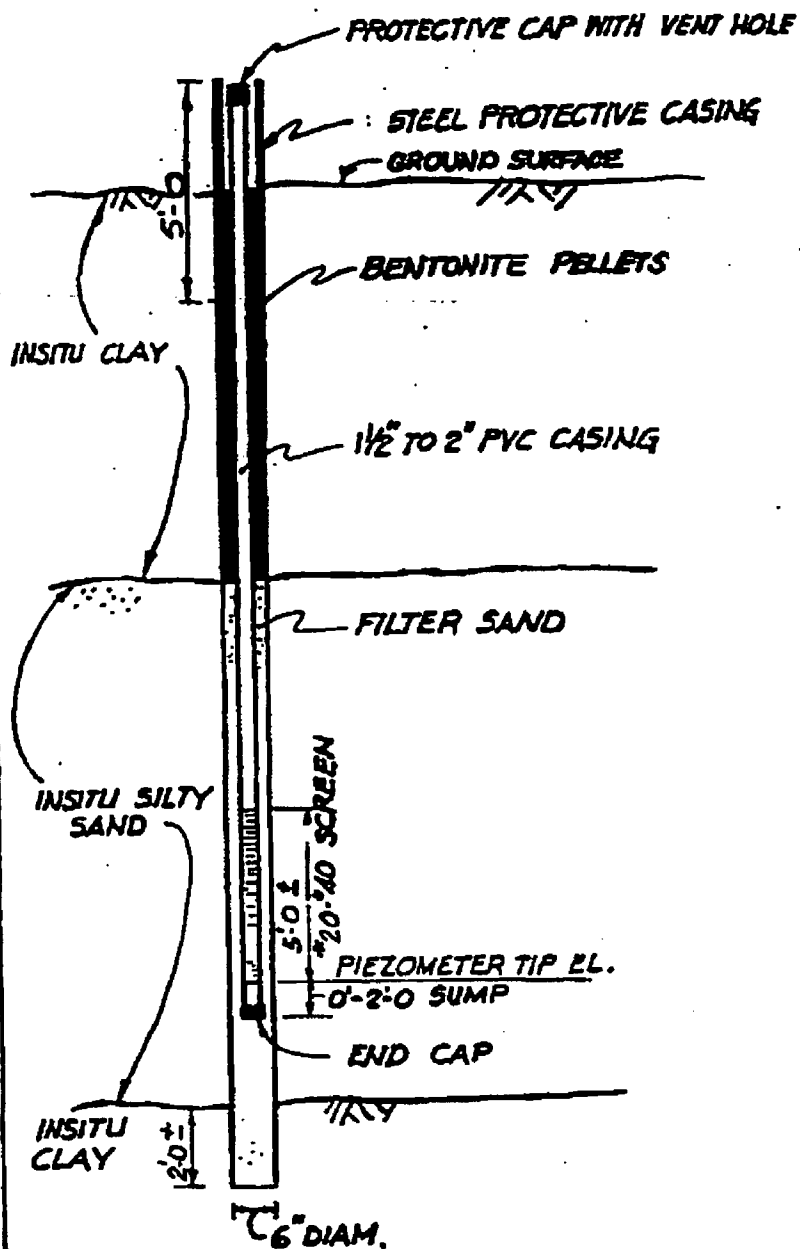
P-137 THRU P-400 AND  
1987 TYPE 1 PIEZOMETERS\*

#### TYPICAL PIEZOMETER DETAIL

1987 TYPE 2 PIEZOMETERS\*

\* REFER TO TABLE 3, PAGE 8 OF 8,  
NOTE 14 FOR LOCATION.

SPEC. No. 9YS10YS1004  
FIGURE 3B (REV.6)



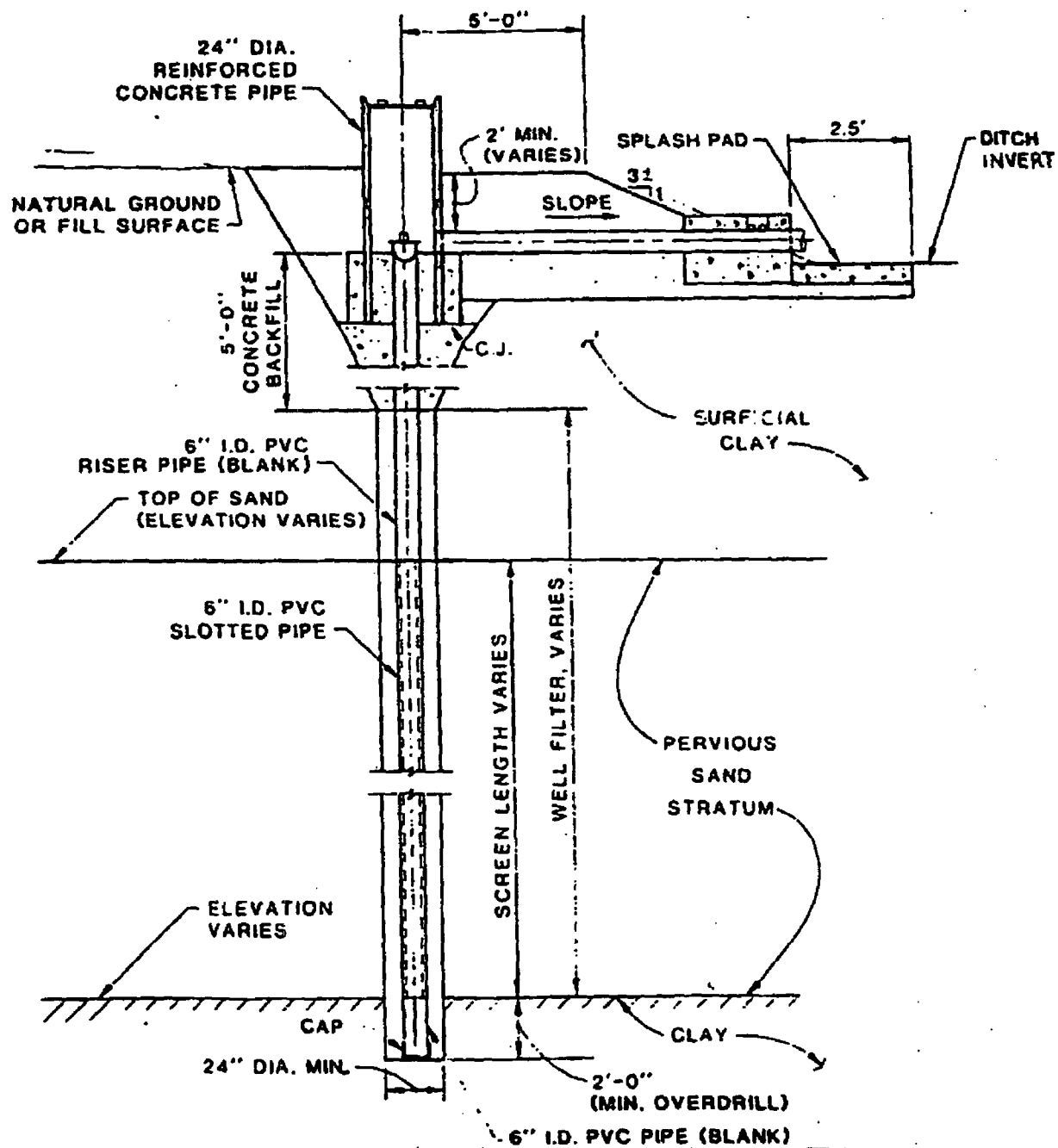
# TYPICAL PIEZOMETER DETAIL

P479 THRU P484

## 1988 PIEZOMETERS

SEE TABLE 3 FOR PIEZOMETER LOCATION.

SPEC. No. 9Y510YS1004  
FIGURE 3C (REV. 6)

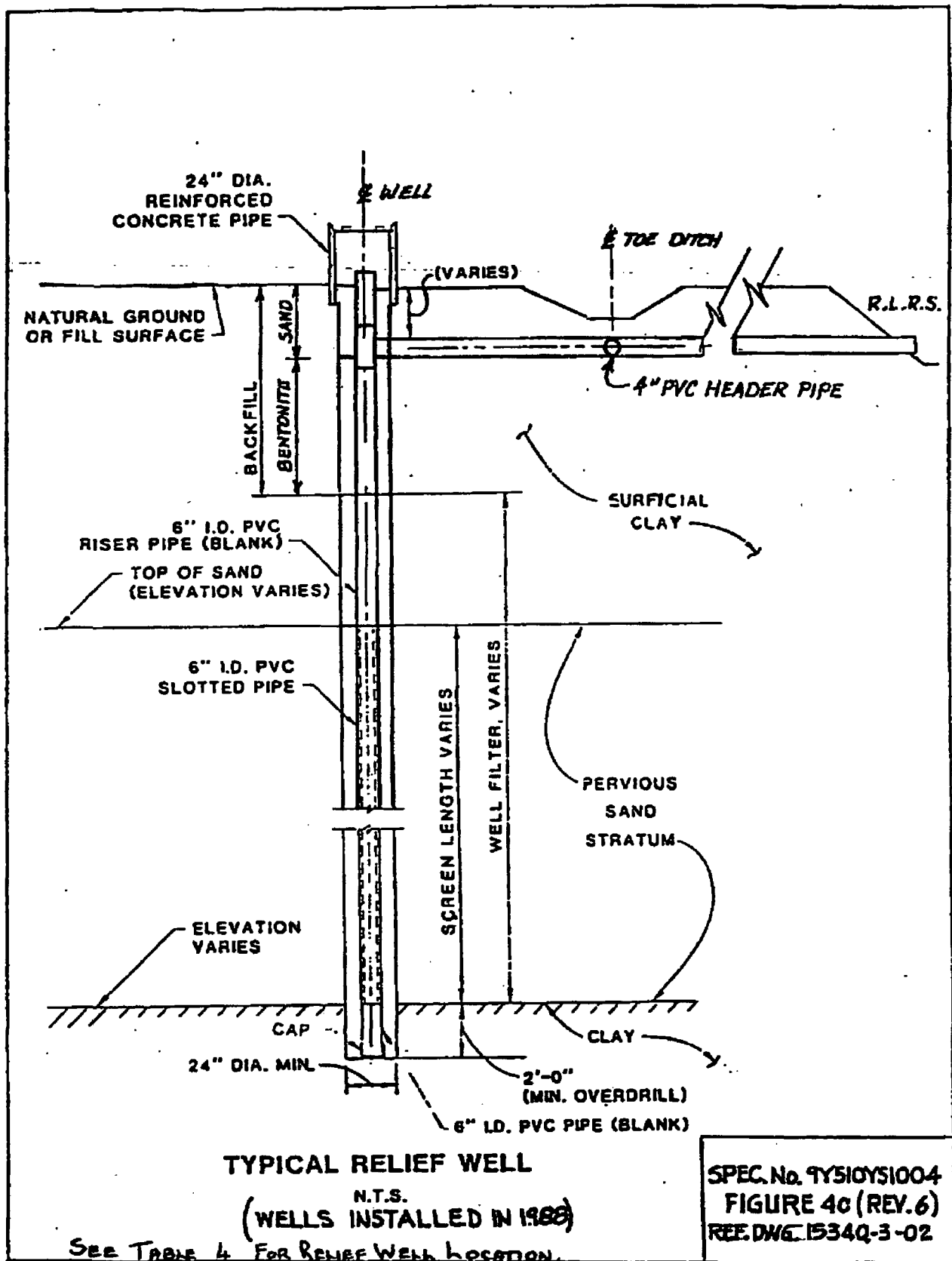


# **TYPICAL RELIEF WELL**

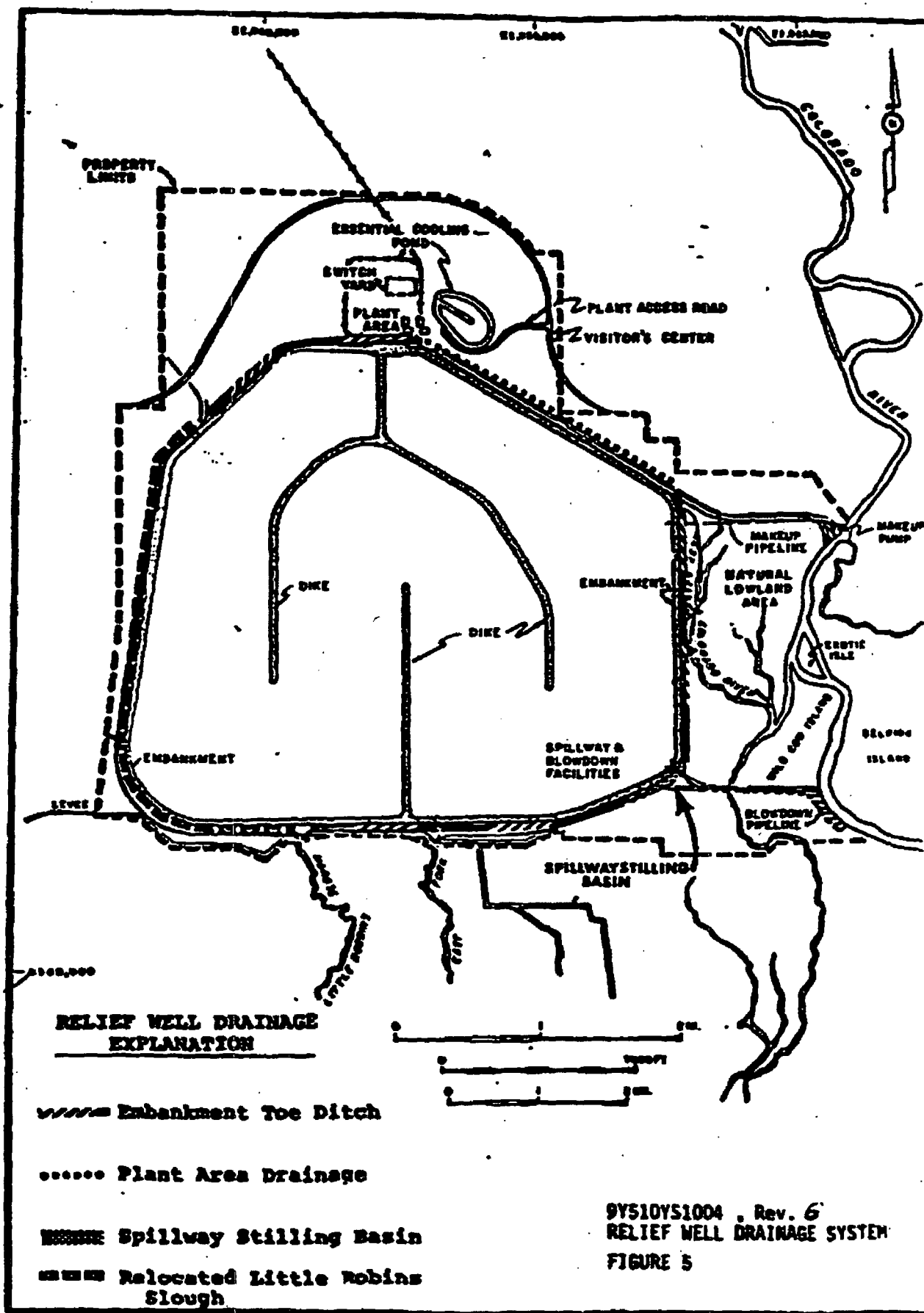
N.T.S.  
(WELLS INSTALLED IN 1987)

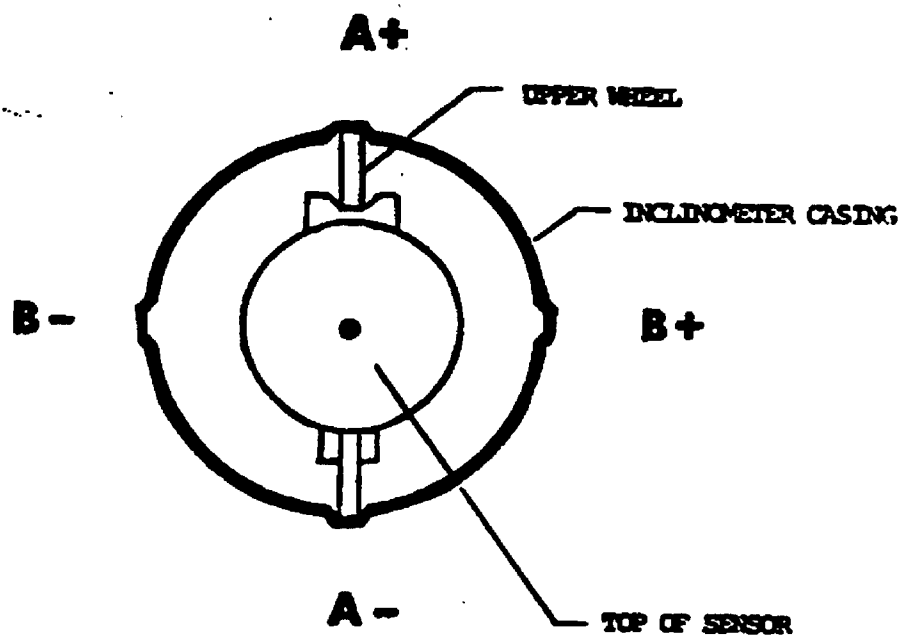
SEE TABLE 4 FOR RELIEF WELL LOCATION

SPEC. No. 9YSIOYS1004  
FIGURE 48 (REV.6)  
REF. DWG. 1534Q-3-02









9Y510YS1004, Rev. 6  
INCLINOMETER DETAILS  
FIGURE 6

**SOUTH TEXAS PROJECT**  
**GEOTECHNICAL MONITORING PROGRAM**  
**MAIN COOLING RESERVOIR**  
**DATA CONTROL FORM**

DATA PACKAGE NO. R\_\_\_\_

To,  
Site Engineering Manager,

Package Contents:

\_\_\_\_\_  
-0-  
\_\_\_\_\_

Period: From -0- to -0-  
\_\_\_\_\_

This Data Package has been reviewed for completeness, documentation  
of checking and proper identification.

Date: -0-  
\_\_\_\_\_

\_\_\_\_\_  
Resident Engineer  
HARZA ENGINEERING COMPANY

Received:

\_\_\_\_\_  
Site Engineering Manager

\_\_\_\_\_  
Date

9Y510Y51004, REV. 6  
FIGURE 7

9Y510YS1004, Rev. 6  
Figure 8

MAIN COOLING RESERVOIR  
PIEZOMETER DATA  
Piezometers on 'A' Level - Crest  
Sheet 1 of 5  
Reservoir El. \_\_\_\_\_

Package No. R\_\_\_\_  
Page \_\_\_\_ of \_\_\_\_

Date	Piezometer Number	Station	Reading	Top of Riser Elevation	Water Elevation (Riser)-(Reading)	Comments
-0-	P299	4 + 87	-0- Ft.	67.2 Ft.	-0- Ft.	-0-
-0-	P5	7 + 0	-0- Ft.	68.7 Ft.	-0- Ft.	-0-
-0-	P163	7 + 0	-0- Ft.	67.4 Ft.	-0- Ft.	-0-
-0-	P301	9 + 0	-0- Ft.	67.9 Ft.	-0- Ft.	-0-
-0-	P9	11 + 0	-0- Ft.	68.8 Ft.	-0- Ft.	-0-
-0-	P165	11 + 0	-0- Ft.	67.8 Ft.	-0- Ft.	-0-
-0-	P303	13 + 25	-0- Ft.	67.8 Ft.	-0- Ft.	-0-
-0-	P305	15 + 50	-0- Ft.	68.4 Ft.	-0- Ft.	-0-
-0-	P307	17 + 75	-0- Ft.	67.5 Ft.	-0- Ft.	-0-
-0-	P13	20 + 20	-0- Ft.	67.5 Ft.	-0- Ft.	-0-
-0-	P167	20 + 20	-0- Ft.	67.9 Ft.	-0- Ft.	-0-
-0-	P309	22 + 50	-0- Ft.	67.7 Ft.	-0- Ft.	-0-
-0-	P311	25 + 0	-0- Ft.	67.9 Ft.	-0- Ft.	-0-
-0-	P313	27 + 50	-0- Ft.	67.7 Ft.	-0- Ft.	-0-
-0-	P314	30 + 0	-0- Ft.	67.6 Ft.	-0- Ft.	-0-
-0-	P316	32 + 55	-0- Ft.	68.0 Ft.	-0- Ft.	-0-
-0-	P318	35 + 0	-0- Ft.	68.3 Ft.	-0- Ft.	-0-
-0-	P320	37 + 65	-0- Ft.	67.7 Ft.	-0- Ft.	-0-
-0-	P17	40 + 20	-0- Ft.	67.6 Ft.	-0- Ft.	-0-
-0-	P169	40 + 20	-0- Ft.	67.5 Ft.	-0- Ft.	-0-
-0-	P21	59 + 60	-0- Ft.	67.5 Ft.	-0- Ft.	-0-
-0-	P171	59 + 60	-0- Ft.	67.7 Ft.	-0- Ft.	-0-

MAIN COOLING RESERVOIR  
PIEZOMETER DATA  
Piezometers on 'A' Level - Crest  
Sheet 2 of 5  
Reservoir El. \_\_\_\_\_

Package No. R\_\_\_\_  
Page \_\_\_\_ of \_\_\_\_

Date	Piezometer Number	Station	Reading	Top of Riser Elevation	Water Elevation (Riser)-(Reading)	Comments
-0-	P25	79 + 80	-0- Ft.	67.6 Ft.	-0- Ft.	-0-
-0-	P173	79 + 80	-0- Ft.	67.1 Ft.	-0- Ft.	-0-
-0-	P29	100 + 20	-0- Ft.	66.7 Ft.	-0- Ft.	-0-
-0-	P175	100 + 20	-0- Ft.	67.5 Ft.	-0- Ft.	-0-
-0-	P143	105 + 0	-0- Ft.	66.5 Ft.	-0- Ft.	-0-
-0-	P34	130 + 40	-0- Ft.	66.7 Ft.	-0- Ft.	-0-
-0-	P341	130 + 69	-0- Ft.	68.3 Ft.	-0- Ft.	-0-
-0-	P342	130 + 62	-0- Ft.	68.4 Ft.	-0- Ft.	-0-
-0-	P343	130 + 95	-0- Ft.	68.2 Ft.	-0- Ft.	-0-
-0-	P177	132 + 65	-0- Ft.	67.9 Ft.	-0- Ft.	-0-
-0-	P146	135 + 0	-0- Ft.	67.3 Ft.	-0- Ft.	-0-
-0-	P148	153 + 70	-0- Ft.	66.7 Ft.	-0- Ft.	-0-
-0-	P36	160 + 0	-0- Ft.	67.1 Ft.	-0- Ft.	-0-
-0-	P179	160 + 0	-0- Ft.	67.5 Ft.	-0- Ft.	-0-
-0-	P42	180 + 25	-0- Ft.	67.5 Ft.	-0- Ft.	-0-
-0-	P181	180 + 25	-0- Ft.	67.9 Ft.	-0- Ft.	-0-
-0-	P46	200 + 20	-0- Ft.	67.8 Ft.	-0- Ft.	-0-
-0-	P183	200 + 20	-0- Ft.	68.0 Ft.	-0- Ft.	-0-
-0-	P50	219 + 80	-0- Ft.	69.1 Ft.	-0- Ft.	-0-
-0-	P185	219 + 80	-0- Ft.	67.9 Ft.	-0- Ft.	-0-
-0-	P33	226 + 40	-0- Ft.	68.7 Ft.	-0- Ft.	-0-
-0-	P57	240 + 0	-0- Ft.	68.4 Ft.	-0- Ft.	-0-

MAIN COOLING RESERVOIR  
PIEZOMETER DATA  
Piezometers on 'A' Level - Crest  
Sheet 3 of 5  
Reservoir El. \_\_\_\_\_

Package No. R\_\_\_\_  
Page \_\_\_\_ of \_\_\_\_

Date	Piezometer Number	Station	Reading	Top of Riser Elevation	Water Elevation (Riser)-(Reading)	Comments
-0-	P189	240 + 0	-0- Ft.	67.7 Ft.	-0- Ft.	-0-
-0-	F152	250 + 0	-0- Ft.	67.6 Ft.	-0- Ft.	-0-
-0-	P61	260 + 25	-0- Ft.	68.7 Ft.	-0- Ft.	-0-
-0-	P191	260 + 25	-0- Ft.	68.4 Ft.	-0- Ft.	-0-
-0-	P150	270 + 0	-0- Ft.	67.7 Ft.	-0- Ft.	-0-
-0-	F64	283 + 6	-0- Ft.	66.6 Ft.	-0- Ft.	-0-
-0-	P173	283 + 0	-0- Ft.	68.5 Ft.	-0- Ft.	-0-
-0-	P68	300 + 0	-0- Ft.	67.7 Ft.	-0- Ft.	-0-
-0-	P195	300 + 0	-0- Ft.	69.3 Ft.	-0- Ft.	-0-
-0-	P156	316 + 0	-0- Ft.	68.3 Ft.	-0- Ft.	-0-
-0-	P72	320 + 0	-0- Ft.	68.5 Ft.	-0- Ft.	-0-
-0-	P197	320 + 0	-0- Ft.	68.2 Ft.	-0- Ft.	-0-
-0-	P77	359 + 50	-0- Ft.	68.6 Ft.	-0- Ft.	-0-
-0-	P199	359 + 60	-0- Ft.	67.6 Ft.	-0- Ft.	-0-
-0-	P158	355 + 10	-0- Ft.	67.1 Ft.	-0- Ft.	-0-
-0-	P61	366 + 0	-0- Ft.	68.5 Ft.	-0- Ft.	-0-
-0-	P201	380 + 0	-0- Ft.	67.8 Ft.	-0- Ft.	-0-
-0-	P85	400 + 50	-0- Ft.	68.7 Ft.	-0- Ft.	-0-
-0-	F203	400 + 50	-0- Ft.	68.4 Ft.	-0- Ft.	-0-
-0-	P67	420 + 0	-0- Ft.	68.8 Ft.	-0- Ft.	-0-
-0-	P295	420 + 0	-0- Ft.	68.6 Ft.	-0- Ft.	-0-
-0-	P93	440 + 20	-0- Ft.	66.5 Ft.	-0- Ft.	-0-

MAIN COOLING RESERVOIR  
PIEZOMETER DATA  
Piezometers on 'A' Level - Crest  
Sheet 4 of 5  
Reservoir El. \_\_\_\_\_

Package No. R\_\_\_\_  
Page \_\_\_\_ of \_\_\_\_

Date	Piezometer Number	Station	Reading	Top of Riser Elevation	Water Elevation (Riser)-(Reading)	Comments
-0-	P207	440 + 20	-0- Ft.	68.3 Ft.	-0- Ft.	-0-
-0-	P97	460 + 10	-0- Ft.	67.6 Ft.	-0- Ft.	-0-
-0-	P209	460 + 10	-0- Ft.	68.4 Ft.	-0- Ft.	-0-
-0-	P101	491 + 0	-0- Ft.	69.5 Ft.	-0- Ft.	-0-
-0-	P211	491 + 0	-0- Ft.	68.3 Ft.	-0- Ft.	-0-
-0-	P105	511 + 0	-0- Ft.	67.6 Ft.	-0- Ft.	-0-
-0-	P213	511 + 0	-0- Ft.	67.9 Ft.	-0- Ft.	-0-
-0-	P109	531 + 0	-0- Ft.	68.4 Ft.	-0- Ft.	-0-
-0-	P215	531 + 0	-0- Ft.	67.9 Ft.	-0- Ft.	-0-
-0-	P113	550 + 50	-0- Ft.	68.3 Ft.	-0- Ft.	-0-
-0-	P217	550 + 50	-0- Ft.	67.9 Ft.	-0- Ft.	-0-
-0-	P154	559 + 50	-0- Ft.	67.6 Ft.	-0- Ft.	-0-
-0-	P116	570 + 35	-0- Ft.	68.3 Ft.	-0- Ft.	-0-
-0-	P219	570 + 35	-0- Ft.	67.7 Ft.	-0- Ft.	-0-
-0-	P120	590 + 40	-0- Ft.	68.9 Ft.	-0- Ft.	-0-
-0-	P221	590 + 40	-0- Ft.	67.9 Ft.	-0- Ft.	-0-
-0-	P124	610 + 0	-0- Ft.	68.7 Ft.	-0- Ft.	-0-
-0-	P223	610 + 0	-0- Ft.	68.0 Ft.	-0- Ft.	-0-
-0-	P128	629 + 0	-0- Ft.	67.7 Ft.	-0- Ft.	-0-
-0-	P225	629 + 0	-0- Ft.	67.7 Ft.	-0- Ft.	-0-
-0-	P287	639 + 0	-0- Ft.	68.3 Ft.	-0- Ft.	-0-
-0-	P289	641 + 60	-0- Ft.	67.1 Ft.	-0- Ft.	-0-



MAIN COOLING RESERVOIR  
PIEZOMETER DATA  
Piezometers on 'A' Level - Crest  
Sheet 5 of 5  
Reservoir El. \_\_\_\_\_

Package No. R\_\_\_\_  
Page \_\_\_\_ of \_\_\_\_

Date	Piezometer Number	Station	Reading	Top of Riser Elevation	Water Elevation (Riser)-(Reading)	Comments
-0-	P291	644 + 20	-0- Ft.	67.5 Ft.	-0- Ft.	-0-
-0-	P293	646 + 80	-0- Ft.	67.4 Ft.	-0- Ft.	-0-
-0-	P295	649 + 40	-0- Ft.	67.1 Ft.	-0- Ft.	-0-
-0-	P227	652 + 50	-0- Ft.	67.8 Ft.	-0- Ft.	-0-
-0-	P297	655 + 0	-0- Ft.	68.9 Ft.	-0- Ft.	-0-

9Y510YS1004, REV. 6  
FIGURE 9  
Sheet \_\_\_\_ of 22

**MAIN COOLING RESERVOIR**  
**PIEZOMETER DATA**  
 Piezometers on 'B' Level - Downstream Berm  
 Sheet 1 of 4  
 Reservoir El. \_\_\_\_\_

Package No. R\_\_\_\_  
 Page \_\_\_\_ of \_\_\_\_

Date	Piezometer Number	Station	Reading	Top of Riser Elevation	Water Elevation (Riser)-(Reading)	Comments
-0-	P355	0 + 39	-0- Ft.	42.7 Ft.	-0- Ft.	-0-
-0-	P356	0 + 57	-0- Ft.	45.8 Ft.	-0- Ft.	-0-
-0-	P357	0 + 69	-0- Ft.	42.2 Ft.	-0- Ft.	-0-
-0-	P358	0 + 89	-0- Ft.	42.1 Ft.	-0- Ft.	-0-
-0-	P359	0 + 89	-0- Ft.	42.6 Ft.	-0- Ft.	-0-
-0-	P360	1 + 21	-0- Ft.	43.1 Ft.	-0- Ft.	-0-
-0-	P361	1 + 37	-0- Ft.	42.0 Ft.	-0- Ft.	-0-
-0-	P362	1 + 89	-0- Ft.	44.8 Ft.	-0- Ft.	-0-
-0-	P363	2 + 39	-0- Ft.	40.9 Ft.	-0- Ft.	-0-
-0-	P1-1	2 + 65	-0- Ft.	45.4 Ft.	-0- Ft.	-0-
-0-	P1-2	2 + 70	-0- Ft.	45.5 Ft.	-0- Ft.	-0-
-0-	P1-3	2 + 75	-0- Ft.	45.5 Ft.	-0- Ft.	-0-
-0-	P364	3 + 20	-0- Ft.	43.1 Ft.	-0- Ft.	-0-
-0-	P365	3 + 70	-0- Ft.	41.1 Ft.	-0- Ft.	-0-
-0-	P366	4 + 15	-0- Ft.	41.9 Ft.	-0- Ft.	-0-
-0-	P367	4 + 70	-0- Ft.	38.5 Ft.	-0- Ft.	-0-
-0-	P368	5 + 20	-0- Ft.	40.4 Ft.	-0- Ft.	-0-
-0-	P369	5 + 20	-0- Ft.	37.0 Ft.	-0- Ft.	-0-
-0-	P370	5 + 70	-0- Ft.	34.9 Ft.	-0- Ft.	-0-
-0-	P371	6 + 20	-0- Ft.	38.4 Ft.	-0- Ft.	-0-
-0-	P372	6 + 69	-0- Ft.	33.4 Ft.	-0- Ft.	-0-
-0-	P6	7 + 0	-0- Ft.	38.9 Ft.	-0- Ft.	-0-

**MAIN COOLING RESERVOIR**  
**PIEZOMETER DATA**  
 Piezometers on 'B' Level - Downstream Berm  
 Sheet 2 of 4  
 Reservoir E1. \_\_\_\_\_

Package No. R\_\_\_\_  
 Page \_\_\_\_ of \_\_\_\_

Date	Piezometer Number	Station	Reading	Top of Riser Elevation	Water Elevation (Riser)-(Reading)	Comments
-0-	P373	7 + 15	-0- Ft.	36.0 Ft.	-0- Ft.	-0-
-0-	P374	7 + 69	-0- Ft.	32.4 Ft.	-0- Ft.	-0-
-0-	P375	8 + 20	-0- Ft.	37.4 Ft.	-0- Ft.	-0-
-0-	P376	9 + 1	-0- Ft.	32.7 Ft.	-0- Ft.	-0-
-0-	P377	9 + 39	-0- Ft.	37.6 Ft.	-0- Ft.	-0-
-0-	P10	11 + 0	-0- Ft.	40.3 Ft.	-0- Ft.	-0-
-0-	P14	20 + 6	-0- Ft.	40.3 Ft.	-0- Ft.	-0-
-0-	P18	40 + 20	-0- Ft.	40.2 Ft.	-0- Ft.	-0-
-0-	P22	57 + 00	-0- Ft.	29.6 Ft.	-0- Ft.	-0-
-0-	P26	79 + 00	-0- Ft.	40.0 Ft.	-0- Ft.	-0-
-0-	P327	92 + 50	-0- Ft.	37.0 Ft.	-0- Ft.	-0-
-0-	P30	100 + 20	-0- Ft.	39.9 Ft.	-0- Ft.	-0-
-0-	P232	102 + 50	-0- Ft.	37.2 Ft.	-0- Ft.	-0-
-0-	P144	105 + 0	-0- Ft.	36.6 Ft.	-0- Ft.	-0-
-0-	P35	130 + 40	-0- Ft.	40.2 Ft.	-0- Ft.	-0-
-0-	P147	135 + 0	-0- Ft.	36.3 Ft.	-0- Ft.	-0-
-0-	P149	153 + 50	-0- Ft.	35.8 Ft.	-0- Ft.	-0-
-0-	P39	160 + 0	-0- Ft.	40.1 Ft.	-0- Ft.	-0-
-0-	P43	180 + 25	-0- Ft.	39.1 Ft.	-0- Ft.	-0-
-0-	P47	200 + 20	-0- Ft.	40.5 Ft.	-0- Ft.	-0-
-0-	P51	219 + 50	-0- Ft.	40.9 Ft.	-0- Ft.	-0-
-0-	P54	226 + 40	-0- Ft.	41.6 Ft.	-0- Ft.	-0-

**MAIN COOLING RESERVOIR**  
**PIEZOMETER DATA**  
 Piezometers on 'B' Level - Downstream Berm  
 Sheet 3 of 4  
 Reservoir El. \_\_\_\_\_

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Date	Piezometer Number	Station	Reading	Top of Riser Elevation	Water Elevation (Riser)-(Reading)	Comments
-0-	P58	240 + 0	-0- Ft.	39.9 Ft.	-0- Ft.	-0-
-0-	P153	250 + 0	-0- Ft.	37.2 Ft.	-0- Ft.	-0-
-0-	P62	260 + 25	-0- Ft.	40.3 Ft.	-0- Ft.	-0-
-0-	P151	269 + 80	-0- Ft.	35.5 Ft.	-0- Ft.	-0-
-0-	P65	283 + 0	-0- Ft.	40.3 Ft.	-0- Ft.	-0-
-0-	P69	300 + 0	-0- Ft.	39.5 Ft.	-0- Ft.	-0-
-0-	P157	318 + 0	-0- Ft.	36.9 Ft.	-0- Ft.	-0-
-0-	P73	320 + 0	-0- Ft.	39.8 Ft.	-0- Ft.	-0-
-0-	P78	359 + 60	-0- Ft.	38.6 Ft.	-0- Ft.	-0-
-0-	P82	386 + 0	-0- Ft.	40.0 Ft.	-0- Ft.	-0-
-0-	P86	400 + 50	-0- Ft.	40.4 Ft.	-0- Ft.	-0-
-0-	P90	420 + 0	-0- Ft.	40.5 Ft.	-0- Ft.	-0-
-0-	P94	440 + 20	-0- Ft.	40.1 Ft.	-0- Ft.	-0-
-0-	P98	460 + 10	-0- Ft.	40.2 Ft.	-0- Ft.	-0-
-0-	P102	491 + 0	-0- Ft.	41.6 Ft.	-0- Ft.	-0-
-0-	P106	511 + 0	-0- Ft.	39.9 Ft.	-0- Ft.	-0-
-0-	P110	531 + 0	-0- Ft.	39.7 Ft.	-0- Ft.	-0-
-0-	P114	530 + 50	-0- Ft.	39.7 Ft.	-0- Ft.	-0-
-0-	P155	559 + 50	-0- Ft.	36.2 Ft.	-0- Ft.	-0-
-0-	P117	570 + 35	-0- Ft.	39.4 Ft.	-0- Ft.	-0-
-0-	P121	590 + 40	-0- Ft.	39.8 Ft.	-0- Ft.	-0-
-0-	P125	610 + 0	-0- Ft.	39.7 Ft.	-0- Ft.	-0-

MAIN COOLING RESERVOIR  
 PIEZOMETER DATA  
 Piezometers on 'B' Level - Downstream Berm  
 Sheet 4 of 4  
 Reservoir El. \_\_\_\_\_

Package No. R\_\_\_\_  
 Page \_\_\_\_ of \_\_\_\_

Date	Piezometer Number	Station	Reading	Top of Riser Elevation	Water Elevation (Riser)-(Reading)	Comments
-0-	P129	629 + 0	-0- Ft.	39.9 Ft.	-0- Ft.	-0-
-0-	P345	651 + 59	-0- Ft.	42.4 Ft.	-0- Ft.	-0-
-0-	P346	651 + 90	-0- Ft.	42.0 Ft.	-0- Ft.	-0-
-0-	P347	652 + 46	-0- Ft.	41.5 Ft.	-0- Ft.	-0-
-0-	P348	652 + 94	-0- Ft.	41.5 Ft.	-0- Ft.	-0-
-0-	P349	652 + 95	-0- Ft.	45.2 Ft.	-0- Ft.	-0-
-0-	P350	653 + 40	-0- Ft.	41.8 Ft.	-0- Ft.	-0-
-0-	P351	653 + 94	-0- Ft.	41.9 Ft.	-0- Ft.	-0-
-0-	P352	653 + 96	-0- Ft.	42.6 Ft.	-0- Ft.	-0-
-0-	P353	654 + 44	-0- Ft.	40.8 Ft.	-0- Ft.	-0-
-0-	P354	654 + 90	-0- Ft.	44.7 Ft.	-0- Ft.	-0-

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MAIN COOLING RESERVOIR  
PIEZOMETER DATA  
Piezometers on 'C' Level - Toe Ditch  
Sheet 1 of 8  
Reservoir El. -----

Package No. R\_\_\_\_  
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Date	Piezometer Number	Station	Reading	Top of Riser Elevation	Water Elevation (Riser)-(Reading)	Comments
-0-	P2-1	2 + 55	-0- Ft.	31.8 Ft.	-0- Ft.	-0-
-0-	P2-2	2 + 60	-0- Ft.	31.7 Ft.	-0- Ft.	-0-
-0-	P2-3	2 + 65	-0- Ft.	31.7 Ft.	-0- Ft.	-0-
-0-	P4	3 + 80	-0- Ft.	31.0 Ft.	-0- Ft.	-0-
-0-	P295	6 + 0	-0- Ft.	29.2 Ft.	-0- Ft.	-0-
-0-	P7	7 + 0	-0- Ft.	31.4 Ft.	-0- Ft.	-0-
-0-	P300	9 + 0	-0- Ft.	30.3 Ft.	-0- Ft.	-0-
-0-	P11	11 + 0	-0- Ft.	32.1 Ft.	-0- Ft.	-0-
-0-	P302	13 + 25	-0- Ft.	36.8 Ft.	-0- Ft.	-0-
-0-	P304	15 + 50	-0- Ft.	34.1 Ft.	-0- Ft.	-0-
-0-	P306	17 + 75	-0- Ft.	30.4 Ft.	-0- Ft.	-0-
-0-	P15	20 + 22	-0- Ft.	31.6 Ft.	-0- Ft.	-0-
-0-	P308	22 + 50	-0- Ft.	30.1 Ft.	-0- Ft.	-0-
-0-	P310	25 + 0	-0- Ft.	29.5 Ft.	-0- Ft.	-0-
-0-	P312	27 + 50	-0- Ft.	29.9 Ft.	-0- Ft.	-0-
-0-	P16	30 + 0	-0- Ft.	31.9 Ft.	-0- Ft.	-0-
-0-	P315	32 + 55	-0- Ft.	29.2 Ft.	-0- Ft.	-0-
-0-	P317	35 + 0	-0- Ft.	28.7 Ft.	-0- Ft.	-0-
-0-	P319	37 + 65	-0- Ft.	28.8 Ft.	-0- Ft.	-0-
-0-	P19	40 + 20	-0- Ft.	29.2 Ft.	-0- Ft.	-0-
-0-	P20	49 + 80	-0- Ft.	29.5 Ft.	-0- Ft.	-0-
-0-	P23	59 + 60	-0- Ft.	28.1 Ft.	-0- Ft.	-0-

MAIN COOLING RESERVOIR  
PIEZOMETER DATA  
Piezometers on 'C' Level - Toe Ditch  
Sheet 2 of 8  
Reservoir El. \_\_\_\_\_

Package No. R\_\_\_\_  
Page \_\_\_\_ of \_\_\_\_

Date	Piezometer Number	Station	Reading	Top of Riser Elevation	Water Elevation (Riser)-(Reading)	Comments
-0-	P24	70 + 20	-0- Ft.	26.3 Ft.	-0- Ft.	-0-
-0-	P27	79 + 80	-0- Ft.	28.3 Ft.	-0- Ft.	-0-
-0-	P28	89 + 20	-0- Ft.	27.4 Ft.	-0- Ft.	-0-
-0-	P328	92 + 50	-0- Ft.	25.9 Ft.	-0- Ft.	-0-
-0-	P330	97 + 50	-0- Ft.	24.8 Ft.	-0- Ft.	-0-
-0-	P333	102 + 50	-0- Ft.	23.6 Ft.	-0- Ft.	-0-
-0-	P339	102 + 50	-0- Ft.	24.3 Ft.	-0- Ft.	-0-
-0-	P145	105 + 25	-0- Ft.	22.9 Ft.	-0- Ft.	-0-
-0-	P334	107 + 50	-0- Ft.	24.8 Ft.	-0- Ft.	-0-
-0-	P253	115 + 0	-0- Ft.	25.5 Ft.	-0- Ft.	-0-
-0-	P33	129 + 20	-0- Ft.	23.2 Ft.	-0- Ft.	-0-
-0-	P235	125 + 50	-0- Ft.	19.5 Ft.	-0- Ft.	-0-
-0-	P36	130 + 40	-0- Ft.	21.1 Ft.	-0- Ft.	-0-
-0-	P473	132 + 70	-0- Ft.	21.4 Ft.	-0- Ft.	-0-
-0-	P479	132 + 80	-0- Ft.	21.4 Ft.	-0- Ft.	-0-
-0-	P236	135 + 0	-0- Ft.	21.6 Ft.	-0- Ft.	-0-
-0-	P474	127 + 50	-0- Ft.	20.7 Ft.	-0- Ft.	-0-
-0-	P237	140 + 0	-0- Ft.	21.6 Ft.	-0- Ft.	-0-
-0-	P238	145 + 0	-0- Ft.	20.2 Ft.	-0- Ft.	-0-
-0-	P37	150 + 0	-0- Ft.	21.5 Ft.	-0- Ft.	-0-
-0-	P475	152 + 75	-0- Ft.	21.7 Ft.	-0- Ft.	-0-
-0-	P480	152 + 85	-0- Ft.	21.8 Ft.	-0- Ft.	-0-

MAIN COOLING RESERVOIR  
PIEZOMETER DATA  
Piezometers on 'C' Level - Toe Ditch  
Sheet 3 of 8  
Reservoir El. -----

Package No. R\_\_\_\_  
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Date	Piezometer Number	Station	Reading	Top of Riser Elevation	Water Elevation (Riser)-(Reading)	Comments
-0-	P239	155 + 50	-0- Ft.	20.6 Ft.	-0- Ft.	-0-
-0-	P240	159 + 80	-0- Ft.	20.9 Ft.	-0- Ft.	-0-
-0-	P40	160 + 0	-0- Ft.	20.4 Ft.	-0- Ft.	-0-
-0-	P404	165 + 0	-0- Ft.	20.5 Ft.	-0- Ft.	-0-
-0-	P41	170 + 40	-0- Ft.	21.5 Ft.	-0- Ft.	-0-
-0-	P405	172 + 3	-0- Ft.	17.5 Ft.	-0- Ft.	-0-
-0-	P241	175 + 0	-0- Ft.	18.0 Ft.	-0- Ft.	-0-
-0-	P406	177 + 25	-0- Ft.	17.3 Ft.	-0- Ft.	-0-
-0-	P44	180 + 25	-0- Ft.	17.3 Ft.	-0- Ft.	-0-
-0-	P379	180 + 93	-0- Ft.	15.0 Ft.	-0- Ft.	-0-
-0-	P380	181 + 18	-0- Ft.	14.9 Ft.	-0- Ft.	-0-
-0-	P281	185 + 24	-0- Ft.	17.9 Ft.	-0- Ft.	-0-
-0-	P282	187 + 75	-0- Ft.	15.8 Ft.	-0- Ft.	-0-
-0-	P45	190 + 40	-0- Ft.	15.2 Ft.	-0- Ft.	-0-
-0-	P283	194 + 0	-0- Ft.	15.0 Ft.	-0- Ft.	-0-
-0-	P407	197 + 50	-0- Ft.	20.5 Ft.	-0- Ft.	-0-
-0-	P48	200 + 20	-0- Ft.	22.5 Ft.	-0- Ft.	-0-
-0-	P284	201 + 80	-0- Ft.	21.7 Ft.	-0- Ft.	-0-
-0-	P408	205 + 40	-0- Ft.	20.5 Ft.	-0- Ft.	-0-
-0-	P49	209 + 80	-0- Ft.	22.3 Ft.	-0- Ft.	-0-
-0-	P285	212 + 80	-0- Ft.	19.9 Ft.	-0- Ft.	-0-
-0-	P409	213 + 40	-0- Ft.	21.0 Ft.	-0- Ft.	-0-

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FIGURE 9  
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MAIN COOLING RESERVOIR  
PIEZOMETER DATA  
Piezometers on 'C' Level - Toe Ditch  
Sheet 4 of 8  
Reservoir El. \_\_\_\_\_

Package No. R\_\_\_\_  
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Date	Piezometer Number	Station	Reading	Top of Riser Elevation	Water Elevation (Riser)-(Reading)	Comments
-0-	P286	217 + 0	-0- Ft.	19.3 Ft.	-0- Ft.	-0-
-0-	P52	219 + 80	-0- Ft.	21.4 Ft.	-0- Ft.	-0-
-0-	P53	226 + 40	-0- Ft.	21.9 Ft.	-0- Ft.	-0-
-0-	P56	230 + 45	-0- Ft.	21.5 Ft.	-0- Ft.	-0-
-0-	P141	233 + 95	-0- Ft.	20.7 Ft.	-0- Ft.	-0-
-0-	P410	236 + 75	-0- Ft.	21.7 Ft.	-0- Ft.	-0-
-0-	P39	240 + 0	-0- Ft.	21.3 Ft.	-0- Ft.	-0-
-0-	P136	245 + 0	-0- Ft.	20.1 Ft.	-0- Ft.	-0-
-0-	P257	248 + 0	-0- Ft.	19.8 Ft.	-0- Ft.	-0-
-0-	P142	248 + 40	-0- Ft.	19.5 Ft.	-0- Ft.	-0-
-0-	P258	248 + 80	-0- Ft.	19.9 Ft.	-0- Ft.	-0-
-0-	P60	250 + 0	-0- Ft.	21.3 Ft.	-0- Ft.	-0-
-0-	P411	252 + 75	-0- Ft.	21.2 Ft.	-0- Ft.	-0-
-0-	P137	255 + 5	-0- Ft.	19.6 Ft.	-0- Ft.	-0-
-0-	P412	257 + 25	-0- Ft.	20.7 Ft.	-0- Ft.	-0-
-0-	P63	260 + 25	-0- Ft.	20.6 Ft.	-0- Ft.	-0-
-0-	P259	262 + 25	-0- Ft.	19.1 Ft.	-0- Ft.	-0-
-0-	P138	265 + 95	-0- Ft.	18.2 Ft.	-0- Ft.	-0-
-0-	P413	269 + 0	-0- Ft.	19.2 Ft.	-0- Ft.	-0-
-0-	P139	272 + 5	-0- Ft.	18.2 Ft.	-0- Ft.	-0-
-0-	P414	275 + 0	-0- Ft.	19.8 Ft.	-0- Ft.	-0-
-0-	P140	278 + 0	-0- Ft.	18.6 Ft.	-0- Ft.	-0-

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FIGURE 9  
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MAIN COOLING RESERVOIR  
PIEZOMETER DATA  
Piezometers on 'C' Level - Toe Ditch  
Sheet 5 of 8  
Reservoir El. \_\_\_\_\_

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Date	Piezometer Number	Station	Reading	Top of Riser Elevation	Water Elevation (Riser)-(Reading)	Comments
-0-	P415	280 + 50	-0- Ft.	18.9 Ft.	-0- Ft.	-0-
-0-	P66	283 + 0	-0- Ft.	19.2 Ft.	-0- Ft.	-0-
-0-	P416	286 + 25	-0- Ft.	19.0 Ft.	-0- Ft.	-0-
-0-	P67	290 + 25	-0- Ft.	19.2 Ft.	-0- Ft.	-0-
-0-	P260	294 + 75	-0- Ft.	17.7 Ft.	-0- Ft.	-0-
-0-	P417	297 + 20	-0- Ft.	19.4 Ft.	-0- Ft.	-0-
-0-	P70	309 + 0	-0- Ft.	19.5 Ft.	-0- Ft.	-0-
-0-	P418	305 + 20	-0- Ft.	19.2 Ft.	-0- Ft.	-0-
-0-	P71	310 + 0	-0- Ft.	18.4 Ft.	-0- Ft.	-0-
-0-	P419	314 + 90	-0- Ft.	17.5 Ft.	-0- Ft.	-0-
-0-	P381	319 + 70	-0- Ft.	16.6 Ft.	-0- Ft.	-0-
-0-	P382	319 + 86	-0- Ft.	16.3 Ft.	-0- Ft.	-0-
-0-	P74	320 + 0	-0- Ft.	17.8 Ft.	-0- Ft.	-0-
-0-	P420	322 + 60	-0- Ft.	17.3 Ft.	-0- Ft.	-0-
-0-	P421	327 + 25	-0- Ft.	18.6 Ft.	-0- Ft.	-0-
-0-	P75	330 + 25	-0- Ft.	19.4 Ft.	-0- Ft.	-0-
-0-	P422	335 + 50	-0- Ft.	20.1 Ft.	-0- Ft.	-0-
-0-	P261	340 + 0	-0- Ft.	18.9 Ft.	-0- Ft.	-0-
-0-	P262	344 + 0	-0- Ft.	19.6 Ft.	-0- Ft.	-0-
-0-	P423	347 + 0	-0- Ft.	20.4 Ft.	-0- Ft.	-0-
-0-	P76	350 + 0	-0- Ft.	20.2 Ft.	-0- Ft.	-0-
-0-	P476	352 + 0	-0- Ft.	21.1 Ft.	-0- Ft.	-0-

MAIN COOLING RESERVOIR  
PIEZOMETER DATA  
Piezometers on 'C' Level - Toe Ditch  
Sheet 6 of 8  
Reservoir El. \_\_\_\_\_

Package No. R\_\_\_\_  
Page \_\_\_\_ of \_\_\_\_

Date	Piezometer Number	Station	Reading	Top of Riser Elevation	Water Elevation (Riser)-(Reading)	Comments
-0-	P424	354 + 0	-0- Ft.	20.7 Ft.	-0- Ft.	-0-
-0-	P263	358 + 0	-0- Ft.	19.0 Ft.	-0- Ft.	-0-
-0-	P79	359 + 60	-0- Ft.	20.0 Ft.	-0- Ft.	-0-
-0-	P264	362 + 0	-0- Ft.	19.2 Ft.	-0- Ft.	-0-
-0-	P477	364 + 80	-0- Ft.	23.4 Ft.	-0- Ft.	-0-
-0-	P80	370 + 20	-0- Ft.	18.8 Ft.	-0- Ft.	-0-
-0-	P83	380 + 0	-0- Ft.	26.1 Ft.	-0- Ft.	-0-
-0-	P84	389 + 50	-0- Ft.	24.0 Ft.	-0- Ft.	-0-
-0-	P87	400 + 50	-0- Ft.	22.6 Ft.	-0- Ft.	-0-
-0-	P159	405 + 0	-0- Ft.	22.7 Ft.	-0- Ft.	-0-
-0-	P88	410 + 0	-0- Ft.	21.8 Ft.	-0- Ft.	-0-
-0-	P91	420 + 0	-0- Ft.	22.4 Ft.	-0- Ft.	-0-
-0-	P92	430 + 0	-0- Ft.	23.6 Ft.	-0- Ft.	-0-
-0-	P95	440 + 20	-0- Ft.	24.5 Ft.	-0- Ft.	-0-
-0-	P96	450 + 50	-0- Ft.	26.1 Ft.	-0- Ft.	-0-
-0-	P481	455 + 50	-0- Ft.	27.4 Ft.	-0- Ft.	-0-
-0-	P482	457 + 0	-0- Ft.	27.6 Ft.	-0- Ft.	-0-
-0-	P483	459 + 0	-0- Ft.	27.2 Ft.	-0- Ft.	-0-
-0-	P99	460 + 10	-0- Ft.	26.8 Ft.	-0- Ft.	-0-
-0-	P484	469 + 50	-0- Ft.	27.5 Ft.	-0- Ft.	-0-
-0-	P100	470 + 90	-0- Ft.	26.3 Ft.	-0- Ft.	-0-
-0-	P103	491 + 0	-0- Ft.	28.2 Ft.	-0- Ft.	-0-

MAIN COOLING RESERVOIR  
PIEZOMETER DATA  
Piezometers on 'C' Level - Toe Ditch  
Sheet 7 of 8  
Reservoir El. \_\_\_\_\_

Package No. R\_\_\_\_  
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Date	Piezometer Number	Station	Reading	Top of Riser Elevation	Water Elevation (Riser)-(Reading)	Comments
-0-	P104	502 + 0	-0- Ft.	26.7 Ft.	-0- Ft.	-0-
-0-	P107	511 + 0	-0- Ft.	24.5 Ft.	-0- Ft.	-0-
-0-	P108	522 + 0	-0- Ft.	26.2 Ft.	-0- Ft.	-0-
-0-	P111	531 + 0	-0- Ft.	26.9 Ft.	-0- Ft.	-0-
-0-	P112	542 + 0	-0- Ft.	30.0 Ft.	-0- Ft.	-0-
-0-	P115	550 + 50	-0- Ft.	30.0 Ft.	-0- Ft.	-0-
-0-	P118	570 + 35	-0- Ft.	29.6 Ft.	-0- Ft.	-0-
-0-	P119	580 + 40	-0- Ft.	30.9 Ft.	-0- Ft.	-0-
-0-	P122	590 + 40	-0- Ft.	28.5 Ft.	-0- Ft.	-0-
-0-	P442	592 + 3	-0- Ft.	29.8 Ft.	-0- Ft.	-0-
-0-	P275	593 + 45	-0- Ft.	30.4 Ft.	-0- Ft.	-0-
-0-	P443	594 + 65	-0- Ft.	29.8 Ft.	-0- Ft.	-0-
-0-	P276	597 + 0	-0- Ft.	31.0 Ft.	-0- Ft.	-0-
-0-	P444	598 + 50	-0- Ft.	29.4 Ft.	-0- Ft.	-0-
-0-	P123	602 + 0	-0- Ft.	28.6 Ft.	-0- Ft.	-0-
-0-	P445	603 + 0	-0- Ft.	28.9 Ft.	-0- Ft.	-0-
-0-	P277	605 + 0	-0- Ft.	30.4 Ft.	-0- Ft.	-0-
-0-	P446	608 + 5	-0- Ft.	29.4 Ft.	-0- Ft.	-0-
-0-	P126	610 + 0	-0- Ft.	28.6 Ft.	-0- Ft.	-0-
-0-	P447	611 + 15	-0- Ft.	31.3 Ft.	-0- Ft.	-0-
-0-	P448	613 + 20	-0- Ft.	30.9 Ft.	-0- Ft.	-0-
-0-	P449	614 + 40	-0- Ft.	30.9 Ft.	-0- Ft.	-0-

MAIN COOLING RESERVOIR  
PIEZOMETER DATA  
Piezometers on 'C' Level - Toe Ditch  
Sheet 8 of 8  
Reservoir El. -----

Package No. R\_\_\_  
Page \_\_\_ of \_\_\_\_

Date	Piezometer Number	Station	Reading	Top of Riser Elevation	Water Elevation (Riser)-(Reading)	Comments
-0-	P250	615 + 0	-0- Ft.	29.8 Ft.	-0- Ft.	-0-
-0-	P127	619 + 0	-0- Ft.	30.6 Ft.	-0- Ft.	-0-
-0-	P251	623 + 0	-0- Ft.	30.4 Ft.	-0- Ft.	-0-
-0-	P130	629 + 0	-0- Ft.	32.3 Ft.	-0- Ft.	-0-
-0-	P252	634 + 0	-0- Ft.	29.9 Ft.	-0- Ft.	-0-
-0-	P131	639 + 0	-0- Ft.	31.0 Ft.	-0- Ft.	-0-
-0-	P288	641 + 60	-0- Ft.	30.8 Ft.	-0- Ft.	-0-
-0-	P290	644 + 20	-0- Ft.	31.0 Ft.	-0- Ft.	-0-
-0-	P292	646 + 80	-0- Ft.	30.3 Ft.	-0- Ft.	-0-
-0-	P278	648 + 0	-0- Ft.	30.2 Ft.	-0- Ft.	-0-
-0-	P274	649 + 40	-0- Ft.	35.8 Ft.	-0- Ft.	-0-
-0-	P134	652 + 20	-0- Ft.	32.0 Ft.	-0- Ft.	-0-
-0-	P296	655 + 0	-0- Ft.	35.4 Ft.	-0- Ft.	-0-

9Y510YS1004, REV. 6  
FIGURE 9  
Sheet \_\_\_ of 22

**MAIN COOLING RESERVOIR**  
**PIEZOMETER DATA**  
 Piezometers on 'D' Level - PADD, RLRS, Other  
 Sheet 1 of 4  
 Reservoir El. \_\_\_\_\_

Package No. R\_\_\_\_  
 Page \_\_\_\_ of \_\_\_\_

Date	Piezometer Number	Station	Reading	Top of Riser Elevation	Water Elevation (Riser)-(Reading)	Comments
-0-	P3-1	2 + 55	-0- Ft.	32.8 Ft.	-0- Ft.	-0-
-0-	P3-2	2 + 60	-0- Ft.	34.0 Ft.	-0- Ft.	-0-
-0-	P3-3	2 + 65	-0- Ft.	34.1 Ft.	-0- Ft.	-0-
-0-	P8	7 + 0	-0- Ft.	30.2 Ft.	-0- Ft.	-0-
-0-	P160	18 + 0	-0- Ft.	30.0 Ft.	-0- Ft.	-0-
-0-	P279	19 + 0	-0- Ft.	29.1 Ft.	-0- Ft.	-0-
-0-	P161	25 + 0	-0- Ft.	28.1 Ft.	-0- Ft.	-0-
-0-	P401	25 + 0	-0- Ft.	28.5 Ft.	-0- Ft.	-0-
-0-	P162	32 + 0	-0- Ft.	27.6 Ft.	-0- Ft.	-0-
-0-	P325	32 + 55	-0- Ft.	27.2 Ft.	-0- Ft.	-0-
-0-	P323	34 + 40	-0- Ft.	27.9 Ft.	-0- Ft.	-0-
-0-	P321	35 + 10	-0- Ft.	27.6 Ft.	-0- Ft.	-0-
-0-	P322	37 + 50	-0- Ft.	27.4 Ft.	-0- Ft.	-0-
-0-	P324	38 + 80	-0- Ft.	27.4 Ft.	-0- Ft.	-0-
-0-	P394	40 + 20	-0- Ft.	27.2 Ft.	-0- Ft.	-0-
-0-	P395	40 + 20	-0- Ft.	27.2 Ft.	-0- Ft.	-0-
-0-	P396	49 + 80	-0- Ft.	26.2 Ft.	-0- Ft.	-0-
-0-	P398	59 + 60	-0- Ft.	26.1 Ft.	-0- Ft.	-0-
-0-	P397	59 + 60	-0- Ft.	25.8 Ft.	-0- Ft.	-0-
-0-	P399	70 + 20	-0- Ft.	24.8 Ft.	-0- Ft.	-0-
-0-	P400	79 + 70	-0- Ft.	27.6 Ft.	-0- Ft.	-0-
-0-	P280	83 + 45	-0- Ft.	27.4 Ft.	-0- Ft.	-0-

MAIN COOLING RESERVOIR  
PIEZOMETER DATA  
Piezometers on 'D' Level - PADD, RLRS, Other  
Sheet 2 of 4  
Reservoir E1. \_\_\_\_\_

Package No. R\_\_\_\_  
Page \_\_\_\_ of \_\_\_\_

Date	Piezometer Number	Station	Reading	Top of Riser Elevation	Water Elevation (Riser)-(Reading)	Comments
-0-	P402	89 + 40	-0- Ft.	26.3 Ft.	-0- Ft.	-0-
-0-	P329	92 + 50	-0- Ft.	20.6 Ft.	-0- Ft.	-0-
-0-	P331	97 + 50	-0- Ft.	19.4 Ft.	-0- Ft.	-0-
-0-	P378	99 + 93	-0- Ft.	21.4 Ft.	-0- Ft.	-0-
-0-	P338	100 + 0	-0- Ft.	17.9 Ft.	-0- Ft.	-0-
-0-	P31	100 + 20	-0- Ft.	22.2 Ft.	-0- Ft.	-0-
-0-	P337	102 + 50	-0- Ft.	16.6 Ft.	-0- Ft.	-0-
-0-	P340	102 + 56	-0- Ft.	21.8 Ft.	-0- Ft.	-0-
-0-	P403	105 + 0	-0- Ft.	21.7 Ft.	-0- Ft.	-0-
-0-	P335	107 + 50	-0- Ft.	20.2 Ft.	-0- Ft.	-0-
-0-	P32	110 + 0	-0- Ft.	22.5 Ft.	-0- Ft.	-0-
-0-	P471	110 + 0	-0- Ft.	22.8 Ft.	-0- Ft.	-0-
-0-	P472	115 + 0	-0- Ft.	24.3 Ft.	-0- Ft.	-0-
-0-	P336	117 + 50	-0- Ft.	16.5 Ft.	-0- Ft.	-0-
-0-	P425	375 + 5	-0- Ft.	24.9 Ft.	-0- Ft.	-0-
-0-	P265	384 + 0	-0- Ft.	25.5 Ft.	-0- Ft.	-0-
-0-	P426	386 + 50	-0- Ft.	25.1 Ft.	-0- Ft.	-0-
-0-	P427	389 + 90	-0- Ft.	24.1 Ft.	-0- Ft.	-0-
-0-	P266	391 + 40	-0- Ft.	23.3 Ft.	-0- Ft.	-0-
-0-	P267	395 + 0	-0- Ft.	21.8 Ft.	-0- Ft.	-0-
-0-	P428	397 + 25	-0- Ft.	21.9 Ft.	-0- Ft.	-0-
-0-	P429	400 + 50	-0- Ft.	22.7 Ft.	-0- Ft.	-0-

**MAIN COOLING RESERVOIR**  
**PIEZOMETER DATA**  
 Piezometers on 'D' Level - PADD, RLRS, Other  
 Sheet 3 of 4  
 Reservoir El. \_\_\_\_\_

Package No. R\_\_\_\_  
 Page \_\_\_\_ of \_\_\_\_

Date	Piezometer Number	Station	Reading	Top of Riser Elevation	Water Elevation (Riser)-(Reading)	Comments
-0-	P450	400 + 51	-0- Ft.	22.2 Ft.	-0- Ft.	-0-
-0-	P451	400 + 52	-0- Ft.	21.2 Ft.	-0- Ft.	-0-
-0-	P430	405 + 30	-0- Ft.	21.5 Ft.	-0- Ft.	-0-
-0-	P431	402 + 90	-0- Ft.	22.7 Ft.	-0- Ft.	-0-
-0-	P268	416 + 55	-0- Ft.	21.6 Ft.	-0- Ft.	-0-
-0-	P432	420 + 0	-0- Ft.	22.6 Ft.	-0- Ft.	-0-
-0-	P269	427 + 50	-0- Ft.	21.3 Ft.	-0- Ft.	-0-
-0-	P270	435 + 60	-0- Ft.	22.6 Ft.	-0- Ft.	-0-
-0-	P254	440 + 80	-0- Ft.	24.4 Ft.	-0- Ft.	-0-
-0-	P271	443 + 25	-0- Ft.	24.6 Ft.	-0- Ft.	-0-
-0-	P272	446 + 90	-0- Ft.	27.3 Ft.	-0- Ft.	-0-
-0-	P383	448 + 18	-0- Ft.	25.6 Ft.	-0- Ft.	-0-
-0-	P354	448 + 42	-0- Ft.	26.1 Ft.	-0- Ft.	-0-
-0-	P385	448 + 85	-0- Ft.	26.7 Ft.	-0- Ft.	-0-
-0-	P433	450 + 50	-0- Ft.	26.8 Ft.	-0- Ft.	-0-
-0-	P273	454 + 45	-0- Ft.	25.5 Ft.	-0- Ft.	-0-
-0-	P434	460 + 10	-0- Ft.	27.0 Ft.	-0- Ft.	-0-
-0-	P235	465 + 80	-0- Ft.	26.6 Ft.	-0- Ft.	-0-
-0-	P435	479 + 70	-0- Ft.	26.5 Ft.	-0- Ft.	-0-
-0-	P436	481 + 50	-0- Ft.	26.5 Ft.	-0- Ft.	-0-
-0-	P274	485 + 0	-0- Ft.	26.1 Ft.	-0- Ft.	-0-
-0-	P437	491 + 0	-0- Ft.	28.1 Ft.	-0- Ft.	-0-



MAIN COOLING RESERVOIR  
PIEZOMETER DATA  
Piezometers on 'D' Level - PADD, RLRS, Other  
Sheet 4 of 4  
Reservoir El. \_\_\_\_\_

Package No. R\_\_\_\_  
Page \_\_\_\_ of \_\_\_\_

Date	Piezometer Number	Station	Reading	Top of Riser Elevation	Water Elevation (Riser)-(Reading)	Comments
-0-	P242	497 + 0	-0- Ft.	27.3 Ft.	-0- Ft.	-0-
-0-	P243	506 + 50	-0- Ft.	27.0 Ft.	-0- Ft.	-0-
-0-	P438	511 + 0	-0- Ft.	27.5 Ft.	-0- Ft.	-0-
-0-	PE44	516 + 50	-0- Ft.	25.3 Ft.	-0- Ft.	-0-
-0-	PE45	526 + 50	-0- Ft.	25.6 Ft.	-0- Ft.	-0-
-0-	P439	531 + 0	-0- Ft.	27.9 Ft.	-0- Ft.	-0-
-0-	P246	536 + 50	-0- Ft.	29.6 Ft.	-0- Ft.	-0-
-0-	P256	545 + 0	-0- Ft.	30.7 Ft.	-0- Ft.	-0-
-0-	P440	550 + 50	-0- Ft.	28.6 Ft.	-0- Ft.	-0-
-0-	PE47	555 + 50	-0- Ft.	30.2 Ft.	-0- Ft.	-0-
-0-	P248	559 + 50	-0- Ft.	30.1 Ft.	-0- Ft.	-0-
-0-	P249	565 + 0	-0- Ft.	29.3 Ft.	-0- Ft.	-0-
-0-	F478	568 + 0	-0- Ft.	30.2 Ft.	-0- Ft.	-0-
-0-	P386	570 + 35	-0- Ft.	29.6 Ft.	-0- Ft.	-0-
-0-	P387	570 + 77	-0- Ft.	30.3 Ft.	-0- Ft.	-0-
-0-	P368	570 + 86	-0- Ft.	29.6 Ft.	-0- Ft.	-0-
-0-	P441	579 + 45	-0- Ft.	30.6 Ft.	-0- Ft.	-0-
-0-	P135	632 + 20	-0- Ft.	30.3 Ft.	-0- Ft.	-0-

9Y510YS1004, REV. 6.  
FIGURE 9  
Sheet \_\_\_\_ of 22

**MAIN COOLING RESERVOIR**  
**PIEZOMETER DATA**  
 Piezometers on 'S' Level - MCR Spillway  
 Sheet 1 of 1  
 Reservoir El. \_\_\_\_\_

Package No. R\_\_\_\_  
 Page \_\_\_\_ of \_\_\_\_

Date	Piezometer Number	Station	Reading	Top of Riser Elevation	Water Elevation (Riser)-(Reading)	Comments
-0-	P392	225 + 25	-0- Ft.	14.8 Ft.	-0- Ft.	-0-
-0-	P391	225 + 50	-0- Ft.	30.1 Ft.	-0- Ft.	-0-
-0-	P389	225 + 50	-0- Ft.	15.2 Ft.	-0- Ft.	-0-
-0-	P390	225 + 50	-0- Ft.	24.9 Ft.	-0- Ft.	-0-
-0-	P393	226 + 20	-0- Ft.	13.8 Ft.	-0- Ft.	-0-
-0-	P452	226 + 40	-0- Ft.	22.5 Ft.	-0- Ft.	-0-
-0-	P453	226 + 40	-0- Ft.	22.1 Ft.	-0- Ft.	-0-

9YS10YS1004, REV. 6  
 FIGURE 9  
 Sheet \_\_\_\_ of 22

Package No. R\_\_\_\_  
Page \_\_\_\_ of \_\_\_\_

HT - Highly Turbid      LT - Lightly Turbid  
T - Turbid      C - Clear

[illegible]

9Y510YS1004, REV. 6  
FIGURE 10

Package No. R\_\_\_\_  
Page \_\_\_ of \_\_\_\_

**Date:** \_\_\_\_\_

[illegible]

**\*NOTES:**

- 1) Readings in two (2) foot intervals, use additional sheets if required
- 2) Numbers recorded are instrument readings multiplied by 10,000
- 3) + and - are 180 degree separations of respective groove axis letters

MAIN COOLING RESERVOIR  
PNEUMATIC PIEZOMETER DATA  
Piezometers on 'A' Level - Crest  
Sheet 1 of 1  
Reservoir El. \_\_\_\_\_

Package No. R\_\_\_\_  
Page \_\_\_ of \_\_\_\_

Date	Piezometer Number	Station	Reading (PSI)	Piezometer Tip El., asl	Piezometric El. Elevation, asl	Comments
-0-	P454	7 + 0	-0-	31.1 Ft.	-0-	-0-
-0-	P455	20 + 0	-0-	29.9 Ft.	-0-	-0-
-0-	P456	59 + 60	-0-	30.0 Ft.	-0-	-0-
-0-	P457	100 + 20	-0-	30.1 Ft.	-0-	-0-
-0-	P458	160 + 0	-0-	30.0 Ft.	-0-	-0-
-0-	P459	200 + 20	-0-	30.2 Ft.	-0-	-0-
-0-	P460	226 + 40	-0-	30.2 Ft.	-0-	-0-
-0-	P461	260 + 25	-0-	30.0 Ft.	-0-	-0-
-0-	P462	300 + 0	-0-	30.0 Ft.	-0-	-0-
-0-	P463	357 + 60	-0-	29.9 Ft.	-0-	-0-
-0-	P464	400 + 50	-0-	31.0 Ft.	-0-	-0-
-0-	P465	440 + 20	-0-	30.5 Ft.	-0-	-0-
-0-	P466	471 + 0	-0-	30.0 Ft.	-0-	-0-
-0-	P467	531 + 0	-0-	30.1 Ft.	-0-	-0-
-0-	P468	570 + 35	-0-	30.0 Ft.	-0-	-0-
-0-	P469	610 + 0	-0-	30.1 Ft.	-0-	-0-
-0-	P470	640 + 0	-0-	30.0 Ft.	-0-	-0-

9Y510YS1004, REV. 6  
FIGURE 12

10CFR50.59 EVALUATION FORM - TYPICAL

(PAGE 1 OF 2)

UNIT # 1+2

ORIGINATING DOCUMENT NO. 9Y510Y81004 REV. 5

☐ PROCEDURE ☐ PLANT MODIFICATION ☐ ECNP  
☒ OTHER SPECIFICATION

TITLE SPECIFICATION FOR GEOTECHNICAL MONITORING AND INSPECTION OF MAIN COOLING RESERVOIR

DESCRIPTION REVERSE RESPONSIBILITIES, UPDATE FILLING PLAN, ADD SIX (6) PIEZOMETERS AND THREE (3) RELIEF WELLS TO THOSE IDENTIFIED IN THE SPECIFICATION AND INCORPORATE HSCN No. 8

- |   | YES                      | NO                                  |
|---|--------------------------|-------------------------------------|
| 1. DOES THE SUBJECT OF THE REVIEW INVOLVE A CHANGE TO THE FACILITY AS DESCRIBED IN THE SAFETY ANALYSIS REPORT?  | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2. DOES THE SUBJECT OF THIS REVIEW INVOLVE A CHANGE TO THE PROCEDURES AS DESCRIBED IN THE SAFETY ANALYSIS REPORT?   | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 3. DOES THE SUBJECT OF THIS REVIEW PROPOSE THE CONDUCT OF TESTS OR EXPERIMENTS NOT DESCRIBED IN THE SAFETY ANALYSIS REPORT?                                     | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 4. DOES THE SUBJECT OF THIS REVIEW REQUIRE A CHANGE TO THE PLANT TECHNICAL SPECIFICATIONS?  | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 5. DOES THE PROPOSED CHANGE, ALTHOUGH NOT DESCRIBED IN THE SAFETY ANALYSIS REPORT, AFFECT ITEMS OR ACTIVITIES THAT ARE DESCRIBED IN THE SAFETY ANALYSIS REPORT? | <input type="checkbox"/> | <input checked="" type="checkbox"/> |

IF ANY ANSWER IS AFFIRMATIVE, PERFORM AN UNREVIEWED SAFETY QUESTION EVALUATION.

IF ALL ANSWERS ARE NEGATIVE, NO UNREVIEWED SAFETY QUESTION EVALUATION IS REQUIRED, AND PROVIDE ADEQUATE TECHNICAL JUSTIFICATION ON PAGE 2.

NOTE: "SAFETY ANALYSIS REPORT" INCLUDES THE FSAR, SAFETY ANALYSIS SUBMITTED TO THE NRC IN SUPPORT OF THEIR REVIEW OF THE APPLICATION FOR AN OPERATING LICENSE AND SUBSEQUENT AMENDMENTS TO THE OPERATING LICENSE AND OTHER LICENSE COMMITMENTS MADE TO THE NRC.

THIS FORM, WHEN COMPLETED, SHALL BE RETAINED FOR THE LIFE OF THE PLANT.

## 10CFR50.59 EVALUATION FORM - TYPICAL

(PAGE 2 OF 2)

UNIT# 1+2

ORIGINATING DOCUMENT NUMBER 9Y510YS1004REV. 5

TECHNICAL JUSTIFICATION SHOULD INCLUDE THE SAFETY IMPLICATIONS OF THE CHANGE, APPLICABLE SECTIONS OF THE SAR AND TECHNICAL SPECIFICATIONS, AND OTHER INFORMATION SUPPORTING THE "NO" ANSWERS.

## TECHNICAL JUSTIFICATION/DOCUMENTS REVIEWED:

Documents reviewed: FSAR Section 2.5.6.8.1SER Section 2.5.6.4.2 andSER Appendix J.

The purpose of the proposed change is to incorporate into the Specification newly installed geotechnical instruments, revisions to the monitoring and inspection responsibilities, revision to the reservoir filling plan, and HSCN No 8.

New piezometers (3) and relief wells (6) have been installed to provide better monitoring and control of underseepage during MCR under filling and operation.

The MCR filling plan has been updated to present details of the recently completed Stage III Filling and revisions to the monitoring and inspection responsibilities have been made to reflect HSCN partial takeover of this aspect of the program.

Regarding questions 1 through 5 on page 1 and in light of the above discussion, the following justifications are provided:

\* 1) The FSAR section discusses the extent of the geotechnical instrumentation which has been installed around the MCR site on early stages of reservoir filling. As the filling has progressed, supplementary instrumentation has been installed to provide better monitoring and underseepage control. SER Appendix J.

\* See attached sheet for item 9 response justification.

INTERDISCIPLINE COORDINATION REQUIRED? ☐ YES ☒ NO

IF YES, CIRCLE APPROPRIATE DISCIPLINE, THEN OBTAIN THEIR CONCURRENCE (INITIAL)

☐ CIVIL ☐ MECH ☐ ELEC ☐ I&C ☐ EQ ☐ OTHER

IMPACT TO OTHER DEPARTMENT? ☐ YES ☒ NO

IF YES, THEN IDENTIFY: \_\_\_\_\_

PREPARED BY: R. B. Schulman

RESPONSIBLE ENGINEER

15/19/89

DATE

CONCURRENCE: R. M. Attar

MANAGER, SUPPORT ENGINEERING

DATE

APPROVAL: [Signature]

P&amp;SA

19/7/89

DATE

~~acknowledges that such modifications to the system may be made during filling. For this reason, the incorporation of new instrumentation into the Specification does not involve a change to the system as described in the Safety Analysis Report.~~

~~The updating of the HCR filling plan provides the actual data on <sup>FSAR 6-9-8</sup> Stage III Filling (to 22. + 40 ft. HSL) and the revisions to the monitoring and inspection responsibilities detail the partial takeover of the HCR monitoring and inspection by H&P. Neither of these revisions to the Specification involves a change to the system as described in the Safety Analysis Report <sup>and adds reference to the Main Plant Operating Level</sup> as neither subject is discussed in the SAR.~~

2). Although the changes proposed to be incorporated into the Specification involve changes to the number of instruments to be monitored <sup>FSAR 5-11-88</sup> and to the, for the reasons given in 1) above these changes do not result in changes to the procedures as described in the Safety Analysis Report. Similarly, the updated filling plan and the change in monitoring and inspection responsibilities do not result in a change to any procedure discussed in the applicable SAR sections.

3) The Specification changes under review do not propose the conduct of any tests or experiments.

4) Plant Technical Specifications do not cover this area of the Facility and no systems described in the Technical Specifications are affected.

5) No other items or activities described in the Safety Analysis Report are affected by the Specification changes under review. FSAR Section 2.5.6.8.1, DER Section 2.5.6.4.2 and SER Appendix J are the sections of the SAR which contain descriptions of the Main Cooling Reservoir instrumentation and monitoring program. The proposed changes to responsibilities and to the geotechnical instrumentation are limited to these sections of the Safety Analysis Report.



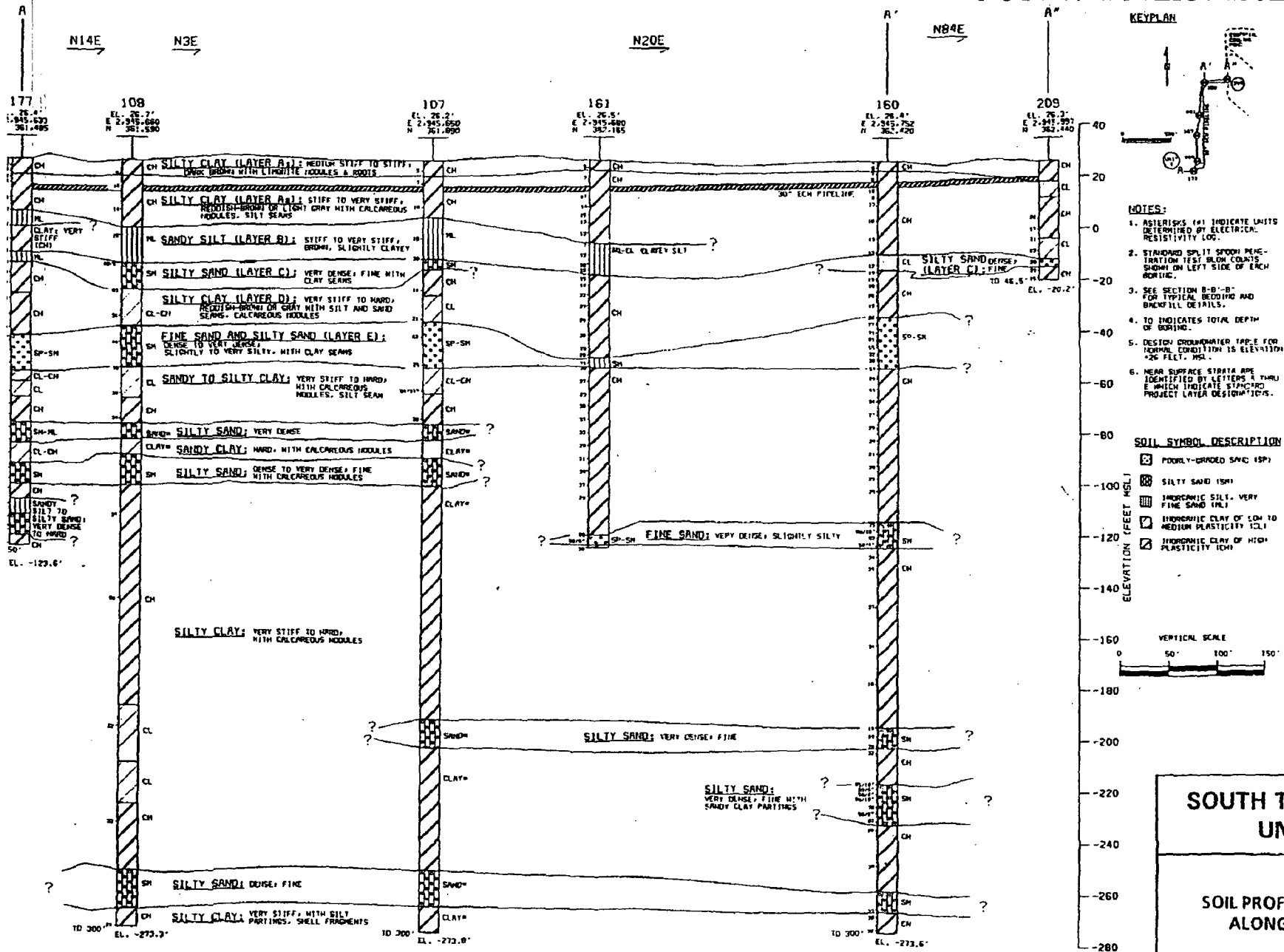
**JUSTIFICATION FOR RESPONSE TO QUESTION 1 OF THE 10CFR50.59**

The changes to this specification include changes to the number of piezometers, relief wells and changes in MCR completion schedule and areas of responsibilities shared by HL&P, Bechtel and other contract organizations. These changes do not represent a change to the facility as described in the FSAR. FSAR CN #1515 has deleted descriptions of MCR piezometers and relief wells from section 2.5.6. MCR completion schedule and delegation of responsibilities are not included in FSAR text. The CN above was evaluated by USQ 89-147 and approved on August 1, 1989.



**APPENDIX B**  
**GEOLOGIC CROSS SECTIONS**

NOT FOR PUBLIC DISCLOSURE



NOT FOR PUBLIC DISCLOSURE

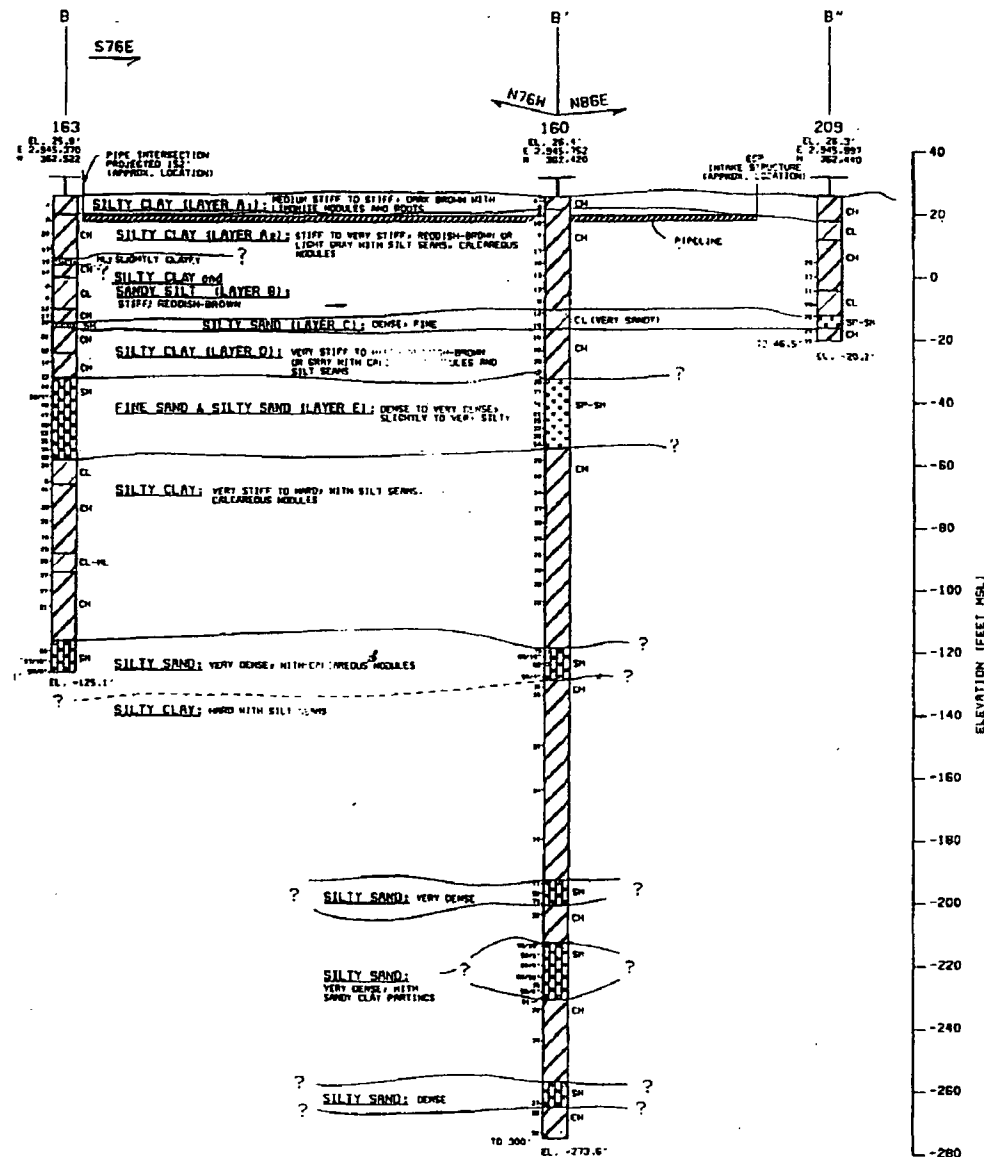
## SOUTH TEXAS PROJECT UNITS 1 & 2

### SOIL PROFILE FOR ECW PIPELINE ALONG SECTION A-A'-A"

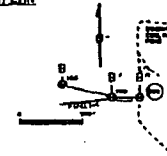
Figure 2.5.A.3-1

Revision 0

NOT FOR PUBLIC DISCLOSURE



# KEY PLAN



## NOTES:

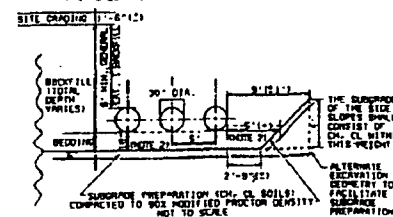
1. ASTERISKS (\*) INDICATE UNITS DETERMINED BY ELECTRICAL RESISTIVITY LOG.
2. STANDARD SPILL SPREAD PENETRATION TEST BLOCK COUNTS SHOWN ON LEFT SIDE OF EACH BORING.
3. SEE SECTION B-B'-B" FOR TYPICAL BEDDING AND BACKFILL DETAILS.
4. TO INDICATE TOTAL DEPTH OF BORING.
5. DESIGN CIRCUMFERENTIAL TABLE FOR NORMAL CONDITION IS ELEVATION +24 FEET, MSL.
6. NEAR SURFACE STRATA ARE IDENTIFIED BY LETTERS A THRU E WHICH INDICATE STANDARD PROJECT LAYER DESIGNATIONS.

## SOIL SYMBOL DESCRIPTION

- POORLY-SORTED SAND (SP)
- SILTY SAND (SM)
- INORGANIC SILT, VERY FINE SAND (ML)
- INORGANIC CLAY OF LOW TO MEDIUM PLASTICITY (CL)
- INORGANIC CLAY OF HIGH PLASTICITY (CH)

## TYPICAL BEDDING AND BACKFILL DETAILS

(FROM SPECIFICATION - DIVISIONS ISSUED FOR CONSTRUCTION)



### NOTE 1:

BEDDING AND BACKFILL SHALL CONSIST OF CATEGORY I STRUCTURAL BACKFILL COMPACTED TO 90% RELATIVE DENSITY TO AN ELEVATION AT LEAST 6 FT. ABOVE THE TOP OF THE PIPES. GENERAL BACKFILL, OR AS OTHERWISE REQUIRED TO MEET SURFACE CONDITIONS, SHALL BE PLACED AT ELEVATIONS NOT LESS THAN 6 FT. ABOVE THE PIPES.

### NOTE 2:

DIMENSIONS SHOWN APPLY TO 30" DIAMETER PIPES. THE BEDDING THICKNESS SHALL BE 10" AND THE DISTANCE TO THE EXCAVATION SLOPE SHALL BE 2'-10" FOR 10" DIAMETER PIPES.

## SOUTH TEXAS PROJECT UNITS 1 & 2

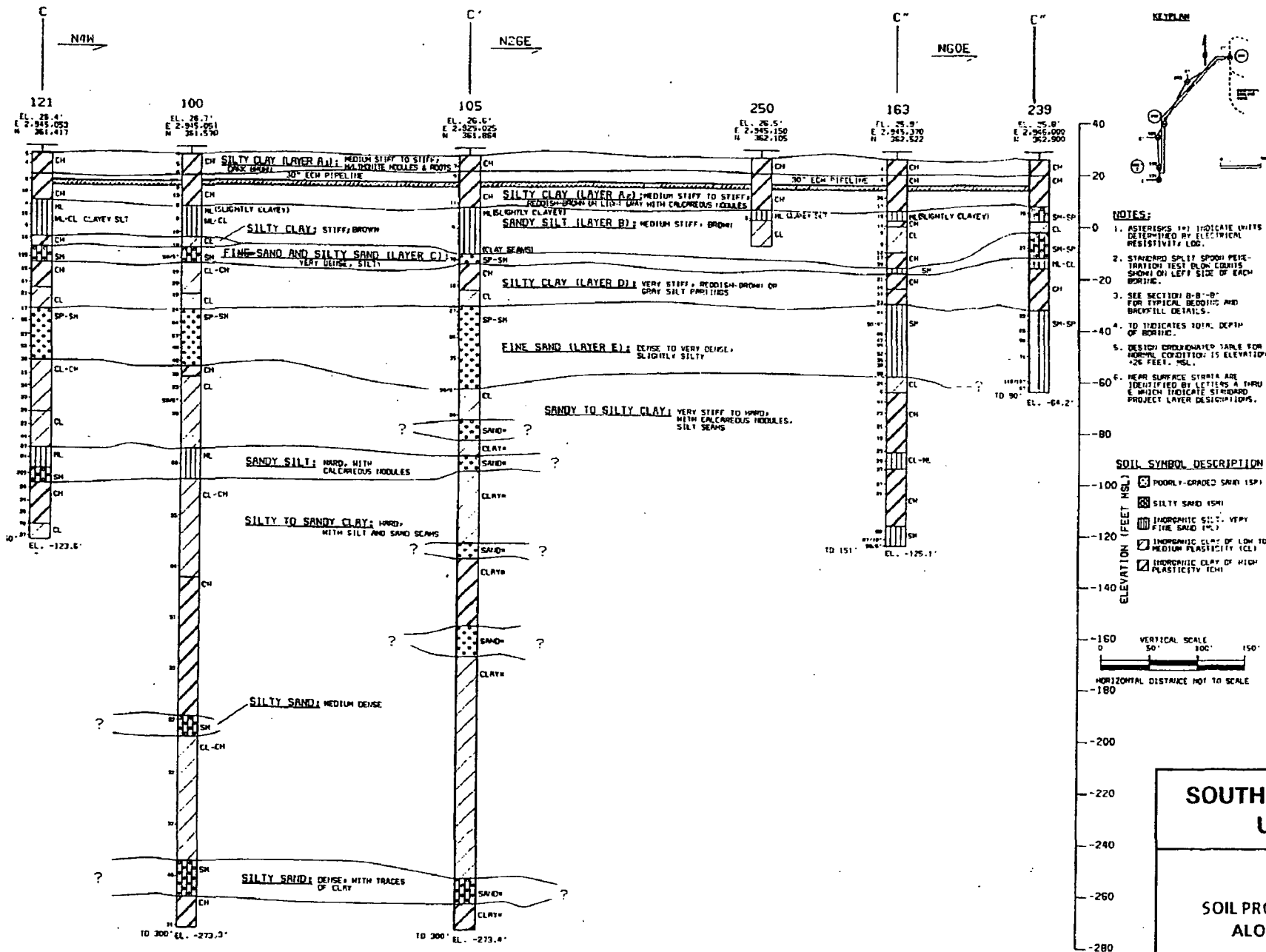
## SOIL PROFILE FOR ECW PIPELINE ALONG SECTION B-B'-B"

Figure 2.5.A.3-2

Revision 0

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**SOUTH TEXAS PROJECT  
UNITS 1 & 2**

**SOIL PROFILE FOR ECW PIPELINE  
ALONG SECTION C-C'-C''**

Figure 2.5.A.3-3

Revision 0

## APPENDIX C



**APPENDIX C**  
**EPRI PIPING ASSESSMENT**



**APPENDIX C-1**

**GROUNDWATER PROTECTION INITIATIVE:  
THE MATERIALS DEGRADATION MASTER MATRIX(MDMM)**

## **Groundwater Protection Initiative: The Materials Degradation Master Matrix (MDMM)**

**1016235**

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# **Groundwater Protection Initiative: The Materials Degradation Master Matrix (MDMM)**

**1016235**

**Technical Update, December 2007**

**EPRI Project Manager  
G. Ilievbare**

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## **PRODUCT DESCRIPTION**

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Experience at numerous operating and decommissioned commercial nuclear power plants (NPPs) has positively identified unintentional releases of small quantities of radionuclides from plant structures. Component, system, and structural integrity failures have ultimately led to unmonitored activity being released to both the site and local environment. This, in turn, has resulted in a major challenge to utilities in identifying and controlling such sources, and in remediation and monitoring of groundwater and environmental contamination over the life of the plant. A Materials Degradation Matrix (MDM) is needed to assist in groundwater protection and degradation management. The first step in formulating the MDM is documented in this report, with development of a Materials Degradation Master Matrix (MDMM), listing 100 degradation mechanisms impacting buried components.

### **Results & Findings**

The MDMM is a summary of all possible degradation mechanisms for the materials being evaluated. Included are those used in the construction and fabrication of buried piping, storage tanks, sumps and spent fuel pools. These components possess a high potential to leak radionuclides into groundwater based on industry experience, and thus present the greatest concern.

The MDMM is a valuable tool for use as a "first screen" for the determination of potentially operative degradation mechanisms for buried components. Its primary virtues lie in its relative ease of use, the conservative nature of the logic employed, and the comprehensive list of degradation mechanisms evaluated.

### **Challenges & Objective(s)**

At present, additional EPRI support is needed for long-term implementation of industry groundwater protection programs, with emphasis on prevention and effective remediation. One aspect of effective prevention is to improve materials reliability for buried piping, storage tanks, sumps, and spent fuel pools that have the potential to leak radioactive materials into the groundwater. Improved materials' reliability will lead to more effective leakage prevention. A necessary step in achieving this goal is to understand material degradation mechanisms for the systems and components of concern. This will be accomplished through a comprehensive MDM focused on the materials and conditions critical to groundwater protection. The objective of this project was to take the first step toward the MDM by developing the MDMM.

### **Applications, Values & Use**

The creation of the MDMM endeavors to help system owners by giving them a tool to focus resources on those buried piping components that are most susceptible to material degradation

and may pose a groundwater contamination risk. Such a matrix will ultimately help NPP owners focus resources on buried (as well as selected aboveground) components susceptible to material degradation and posing a groundwater contamination risk.

### **EPRI Perspective**

Best practices in low level waste (LLW) management serve not only to enhance environmental and public acceptance of nuclear power, but also to optimize utility costs as well. Long-term research and development is critical to address a number of current industry LLW issues, such as groundwater contamination. EPRI hopes that continued development of the MDMM, along with other related initiatives under the EPRI Groundwater Protection Initiative, will help owners to eventually develop inspection and/or mitigation programs for comprehensive life-cycle management of these critical components. Such groundwater protection guidance should reduce regulatory risk and improve public perception through the development of safe and efficient contamination risk management strategies.

### **Approach**

The nuclear power industry has undertaken a Groundwater Protection Initiative at the Direction of the Nuclear Energy Institute (NEI) Nuclear Strategic Issues Advisory Committee (NSIAC). This initiative makes provision for essential technical guidance to utilities on the necessary elements of a sound groundwater protection program. Investigators modeled the MDMM after the American Society of Mechanical Engineers (ASME) screening table for materials degradation. It was designed to serve as a conservative "first screen" for all possible degradation mechanisms, including those with no known NPP history. Not included in the MDMM are data on mechanism rates, load characteristics, barrier thicknesses, or time to failure evaluations. What the MDMM does provide are susceptibility criteria for a total of 100 degradation mechanisms that could potentially affect buried components—33 general corrosion mechanisms, 9 erosion/wear mechanisms, 4 fatigue mechanisms, 8 localized corrosion mechanisms, 4 embrittlement mechanisms, 11 metallurgical/material effect mechanisms, 10 environmentally assisted cracking mechanisms, 3 high-temperature mechanisms, and 18 types of fabrication defects. The goal was to be as thorough as possible in listing all possible mechanisms as well as the associated criteria. Mechanism susceptibility was evaluated as potentially operative or non-operative, and was based upon the materials of construction, the internal and external environment, operating conditions (temperature, flow rate), and the nature of any loading (static, dynamic, or thermal).

### **Keywords**

Groundwater Protection Initiative  
Materials Degradation Master Matrix (MDMM)  
Materials Degradation Matrix (MDM)  
Groundwater Contamination  
Material Degradation Mechanisms  
Low Level Waste

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# **1**

## **INTRODUCTION**

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### **1.1 Background**

Experience at numerous operating and decommissioned commercial nuclear power plants (NPPs) has positively identified unintentional releases of small quantities of radionuclides from plant structures. Component, system, and structural integrity failures have ultimately led to unmonitored activity being released to both the site and local environment. This, in turn, has resulted in a major challenge to utilities in identifying and controlling such sources, and in remediation and monitoring of the contamination over the life of the plant.

The level of effort required for monitoring and/or recovering of structures, soil, and hydrogeological formations due to tritium and other radioactive contamination is very significant and costly. A standardized approach to groundwater control will aid in optimizing both the effort and costs of an environmental monitoring process.

EPRI is providing technical support for the Industry Groundwater Protection Initiative, approved by the Nuclear Strategic Issues Advisory Committee (NSIAC) in 2006. Undocumented releases of tritium and other nuclides from existing nuclear power plants (NPPs) have resulted in significant negative public and regulatory pressure to correct this problem for both operating and future nuclear plants. The Nuclear Energy Institute (NEI) has successfully implemented interim guidance to the industry for implementing the Groundwater Initiative [NEI 07-07] which describes the communications protocol and the general features of a groundwater monitoring program. The EPRI Groundwater Protection Guidelines [EPRI Report 1015118] provides further detailed technical guidance to the industry for implementing a groundwater monitoring program.

Current activities in Groundwater Protection have been focused on producing a set of EPRI guidelines which provide the basis for a successful and optimized groundwater monitoring program. However, there is currently a gap in the EPRI support needed for the long term

implementation of the industry groundwater protection programs. Longer term efforts need to focus on prevention and effective remediation.

One aspect of effective prevention is to improve materials reliability for the buried piping, storage tanks, sumps, and spent fuel pools that have the potential to leak radioactive materials into the groundwater. Improved materials reliability will lead to more effective leakage prevention. A first step in achieving this goal is to understand the degradation mechanisms of the materials of the systems and components of concern through the development of a comprehensive materials degradation matrix (MDM) focused on the materials and conditions critical to groundwater protection.

Such a matrix will help NPP owners focus resources on buried (as well as selected above-ground) components susceptible to material degradation which pose a groundwater contamination risk, as well as assist in developing inspection and/or mitigation programs for life-cycle management of these components. The development efforts on these inspection and/or mitigation programs are aimed at:

- 1) Assisting with defining standards for the development of a robust nuclear plant groundwater protection program that will define routine monitoring and characterization of the hydrogeology as well as groundwater quality at a reactor site.
- 2) Provision of a framework for NSSS vendors and future operators of commercial NPPs that will reduce the potential for unplanned radioactive releases. Such a framework is in accord with 10.CFR20.1406, "Minimization of Contamination," which stipulates that "design and operating procedures will minimize, to the extent practicable, contamination of the facility and the environment..." for new plants.

## 1.2 Objectives

The overall objective of this effort is to develop a detailed materials degradation matrix (MDM) for materials associated with groundwater protection.

This present work represents the first step in this effort, which is the development of a Materials Degradation Master Matrix (MDMM). The MDMM is a summary of all possible degradation

mechanisms for the materials being evaluated. These include those used in the construction and fabrication of buried piping, storage tanks, sumps and spent fuel pools. These components possess a high potential to leak radionuclides into groundwater based on industry experiences, and thus present the greatest concern.

# 2

## MATRIX DEVELOPMENT AND DESIGN INPUTS

The Materials Degradation Master Matrix (MDMM) was modeled after the ASME screening table for materials degradation [1]. It was designed to serve as a conservative "first screen" for all possible degradation mechanisms including those with no known history at NPP. The MDMM does not include data on mechanism rates, load characteristics, barrier thicknesses, or time to failure evaluations.

The MDMM, shown in Appendix A, was designed to include susceptibility criteria for a total of 100 degradation mechanisms that could potentially affect buried components<sup>1</sup>. The goal was to be as thorough as possible in listing all possible mechanisms as well as the associated criteria. The degradation mechanisms listed include:

- 33 General Corrosion mechanisms

Acid Dew Point Corrosion	High Temp H <sub>2</sub> /H <sub>2</sub> S Corrosion
Ammonia Grooving	Hydrochloric Acid Corrosion
Amine Corrosion	Hydrofluoric Acid Corrosion
Caustic Corrosion (Caustic Gouging)	Liquid (Molten) Slag Attack
Chelant Corrosion	Napthenic Acid Corrosion
CO <sub>2</sub> Corrosion	General Corrosion
Corrosion Under Insulation (CUI)	High Temperature Oxidation
Dissolved O <sub>2</sub> Attack	Phenol (Carbolic Acid)
Erosion/Corrosion	Phosphate Attack
Filiform Corrosion	Phosphoric Acid Corrosion
Flow-Accelerated Corrosion (FAC)	Selective Leaching (Dealloying of Metals)
Flue Gas Dew Point Corrosion	Selective Leaching of Concrete (e.g., Carbonation)
Fuel Ash Corrosion	Sour Water Corrosion (Acidic)
Galvanic Corrosion	Stray Current Corrosion
Graphitization	Sulfidation
High Temp H <sub>2</sub> /H <sub>2</sub> S Corrosion	Sulfuric Acid Corrosion
Hydrochloric Acid Corrosion	Tuberculation
	Uniform Corrosion

<sup>1</sup> Some above-ground storage tanks were also included in this study, as they had the potential to leak contaminants into the groundwater; the term "buried components" in this report refers to these tanks as well.

- **9 Erosion/Wear mechanisms**

Abrasive Wear  
Adhesive Wear  
Cavitation  
Electrical Discharge  
Erosion

Erosion – Droplets  
Erosion – Solids  
Fretting  
Sliding Wear

- **4 Fatigue mechanisms**

Fatigue-Cracking  
Contact Fatigue

Thermal Fatigue  
Vibrational Fatigue

- **8 Localized Corrosion mechanisms**

Crevice Corrosion  
Intergranular Corrosion  
Knife-Line Attack  
Liquid Metal Embrittlement

Microbiologically Influenced Corrosion (MIC),  
Pitting Corrosion  
Under Deposit Corrosion  
Weld Decay

- **4 Embrittlement mechanisms**

885 °F (474 °C) Embrittlement  
Hydrogen Embrittlement

Hydrogen-Induced Cracking (HIC)  
Temper Embrittlement

- **11 Metallurgical/Material Effect mechanisms**

Brittle Fracture  
Carburization  
Metal Dusting (Catastrophic  
Carburization)  
Decarburization  
Hydrogen Damage (HTHA)  
Sensitization

Sigma Phase  
Sigma and Chi Phase  
Softening (Over Aging)

Spheroidization  
Strain Aging

- **10 Environmentally Assisted Cracking mechanisms**

Amine Cracking  
Ammonia Stress Corrosion  
Cracking  
Carbonate Stress Corrosion  
Cracking  
High Purity Water SCC  
Caustic Cracking

Chloride Stress Corrosion Cracking  
Nitrate Stress Corrosion Cracking

Corrosion-Fatigue

Polythionic Acid Cracking  
Sulfide-Stress Cracking (SSC)

- 3 High Temperature mechanisms

Overtemperature  
Creep  
Creep-Fatigue

- 18 types of Fabrication Defects

Cold Cracking (Metals)	Porosity
Cold Cracking (Non-metallics)	Weld Metal Crater Cracking
Dissimilar Metal Weld Cracking (DMW)	Weld Metal Fusion Line Cracking
Hot Cracking/Ductility Dip Cracking	Weld Metal Longitudinal Cracking
Lack-of-Fusion, Lack-of-Penetration	Weld Metal Root Cracking
Installation Issues (Cold Bends; Localized Deformation)	Weld Metal Toe Cracking
Fit-up Issues (Root Gap; Backing Rings Counterbores/Chamfers)	Weld Metal Transverse Cracking
End Grain / Lamellar Tearing	Weld Metal Underbead Cracking
Improper Heat Treatment	

Mechanism susceptibility was designed to be binary in nature (potentially operative or non-operative), and was based upon the materials of construction, the internal and external environment, operating conditions (temperature, flow rate), and the nature of any loading (static, dynamic, thermal, etc.). These were broken down into:

- 22 material classes

Concrete	Alloy Steels (e.g., P22)
Rebar (Carbon Steel) in Concrete	300 Series Stainless Steel
Prestressed Concrete Cylinder Pipe (PCCP)	"Super" Austenitics (High Cr & Mo)
Coatings & Linings	400 Series Stainless Steel
High Density Polyethylene (HDPE)	"Super" Ferritics (High Cr & Mo)
Non-metallics (including Polyvinyl Chloride, ABS, fiberglass)	Duplex Stainless Steels
Grey Iron	Iron Nickel Alloys (0.6 to 1.3 Fe to Ni ratios),
Ductile Iron	Nickel-Based Alloys (>50% Nickel)
Galvanized Steel	Copper/Copper Alloys
Carbon Steel	Titanium / Titanium Alloys
Low Alloy Steel	Aluminum / Aluminum Alloys

- 7 temperature ranges from below 32 °F (0 °C) to over 1000 °F (538 °C)

- 33 environments

- **17 aqueous (internal/external)<sup>2</sup>**

These are environments, internal or external to the component in question, containing liquid water. The water may constitute all or only a portion of the environment including:

Controlled-Purity Water (may contain Boron/Boric Acid Corrosion Inhibitors)	Contains Acid
Raw Water	Contains Sulfur or Sulfate
Waste Water (Blow down, Grey Water, Sewage),	Contains Amines
Fully Deaerated Water	Contains Ammonia
Oxidizing Solutions	Contains Chloride
(e.g., Sodium Hypochlorite, Hydrogen Peroxide)	
Contains Nitrites or Nitrates	Contains Phosphoric Acid
Contains Sodium	Contains HF
Contains Carbonate	Contains Particulates
Contains Caustic	

- **11 non-aqueous (internal/external)**

These are environments, internal or external to the component in question, containing non-aqueous fluids, and may contain aqueous components. The fluid may constitute all or only a portion of the environment. These include process mixtures containing:

Water	Crude Oil
Gas (Chlorine, Hydrogen, Methane, Air)	Hydrogen
Gasoline	Carbon
Hydrazine	Particulates
Oil (Crude Oil, Fuel Oil, Lube Oil)	Other
Phenol	

- **5 soils (external):**

Sandy  
Clay  
Loam  
Chloride Containing Chlorides  
Other Soils

<sup>2</sup> Note that in "external environments," the fluid present (either flowing through or stagnant) in the environment (where applicable as in soils and aggregates) is just as important (if not more) as the solid contacting the component. In many cases, the chemistry of the fluid in the solid aggregates is either wholly or partially derived from the aggregates they surround.



- 3 air environments (external):

Indoor Air  
Outdoor Air – Coastal  
Outdoor Air – Non-coastal

- 4 flow categories

Stagnant (Normally)  
Flow < 5 fps (<1.5 m/s)  
Flow > 5 fps (>1.5 m/s)  
Intermittent Flow

- 6 types of loading

Static Stress (including Residual Stress)	Thermal Gradients or Shock
Pressure Test (Hydro)/Overpressure	Cyclic Stress
Installation Stresses	
Dynamic Effects (High Strain Rate)	Peak Stresses

The MDMM is color-coded to indicate whether each mechanism requires an internal environment (blue), an external environment (gold), or a load (green) to be active. Those mechanisms falling under the category of manufacturing defects were also color-coded (lavender). The MDMM logic was arranged such that an "X" (indicating the specific criterion was met) or an "N" (indicating the specific criteria was not a requirement) must exist in all applicable fields for each degradation mechanism to be considered potentially operative. Thus, starting from the material of choice, the user would then go down the table for a list of possible active mechanisms. Each mechanism would then be scrutinized (horizontally), checking that there is an "X" in the field for each of the environmental conditions of the component being screened. A single blank space (no "X") invalidates the mechanism being scrutinized.

Versions of the materials degradation matrix were generated for each type of buried component; buried piping, storage tanks, sumps and spent fuel pools. Each component specific matrix contains only the materials, criteria and degradation mechanisms potentially operable for that component, and allows for a more focused approach in evaluating mechanisms on a component specific basis. These component matrices are also included in Appendix A.

# 3

## PILOT STUDY

---

### 3.1 Identification of Plants for Pilot Study

In order to test the practicality of the MDMM, a number of plants were identified as potential sources of data on buried components. In selecting plants, an effort was made to include both main reactor types (BWR and PWR) and a variety of NSSS vendors (B&W, CE, Westinghouse and GE). Aside from these criteria, plants were selected based upon the ease with which data could be obtained quickly (due to the short duration of the work), either by virtue of good plant contacts or prior buried piping work performed. This process resulted in the majority of data being collected for Westinghouse PWRs, primarily since buried piping information for many of these plants had been previously obtained. Only one BWR was able to provide information on the required schedule, hence the low BWR sampling. The selected plants included:

- Arkansas Nuclear One (ANO) Units 1&2 (B&W and CE, PWR)
- South Texas Units 1&2 (Westinghouse, PWR)
- Byron Units 1&2 (Westinghouse, PWR)
- Dresden Units 2&3 (GE, BWR)
- Diablo Canyon Units 1&2 (Westinghouse, PWR)
- Comanche Peak Units 1&2 (Westinghouse, PWR)
- Wolf Creek (Westinghouse, PWR)
- Callaway (Westinghouse, PWR)

### 3.2 Inventory of Components Evaluated

Data was collected for 1) buried piping, 2) storage tanks, 3) sumps, and 4) spent fuel pools. Data for all four component groups was collected from ANO and South Texas only. Only buried piping data (pipe and fittings, welds) was available from the other NPPs. Only data for the major passive buried components was obtained. As such, no data was collected on valves, vacuum

breakers or any other active components in these systems. Data collected included construction and fabrication material type, temperature, flow rates, internal and external environments, and loading information.

### **3.3 Limitations Associated with Plant Data Collection**

Data quality was limited by the incomplete nature of the available design and service history of the components in question. This was due to a variety of factors, including the fact that the components were not typically safety-related, associated data was often spread across a number of systems and system managers, and root cause evaluations were seldom performed (or if performed, inadequate). Loading data in particular proved difficult to obtain, and ended up being excluded from the scope of the evaluation.

# 4

## EVALUATION AND RESULTS

---

### 4.1 Data Summary

The data on all buried components obtained from ANO and South Texas, as well as the buried piping data obtained from the other NPPs, has been summarized in Tables 4-1 through 4-5 according to material, temperature, flow rate, process fluid, and external environment, respectively.

The data collected for the pilot plants was used to verify that the MDMM criteria covered all materials, operating conditions and environments existing in the plants. Where criteria were initially lacking in the MDMM, but present in the data, new criteria were added to reflect actual conditions. This process ensured that the MDMM was comprehensive for the purposes of the pilot study.

Common buried piping materials include carbon steel, stainless steel, polyvinyl chloride (PVC), ductile iron, and galvanized steel. Carbon steel, stainless steel and concrete were most common for storage tanks, while sumps and spent fuel pools were typically concrete with a stainless steel liner. Most buried components operated at ambient temperature; however, there were some high-temperature exceptions in certain buried piping systems (such as a 160 °F (71 °C) operating temperature in the Condensate Storage and Transfer System and a 325 °F (163 °C) operating temperature in the Service Air system, both at South Texas). A wide range of flow rates and flow conditions were encountered in buried piping, while other buried components (tanks, sumps) typically encounter intermittent or stagnant flow conditions.

Buried components encounter numerous process fluids, making for a wide range of internal environments. Those process fluids known to pose a groundwater contamination risk include radiologically-contaminated water, diesel fuel oil, condensate polisher regeneration discharge, water (with acid, caustics, and/or sodium), organic and inorganic chemical waste, sodium hypochlorite, hydrazine, butane, hydrogen gas, gasoline, natural gas, lubricants, and oily waste.

## **4.2 Data Evaluation and Analyses Using the MDMM**

The specific combination of material, temperature, flow rate and internal and external environment for each buried component was separately run through each of the 100 mechanisms of the MDMM. Where data for a certain criterion was unknown or unclear, the most conservative assumption was used. The result was an associated list of degradation mechanisms that were potentially operable for each buried component. As might be expected, the number of active mechanisms ranged widely, depending upon each particular set of conditions, but on average around 25 of the 100 total mechanisms were determined to be operative for each case. A more detailed screening process will be required to narrow the number of possible operative mechanisms down to a few based on probability, rates, etc. Such a screen is beyond the capability of the MDMM which is intended to be a "coarse" screen. Better screening will be achieved in the course of developing the MDM.

## **4.3 Comparison to Inspection and Failure Data**

An additional objective of this evaluation was to use actual plant service history inspection and failure data to validate the MDMM logic. The primary obstacle to this approach was that few plants have comprehensive and effective inspection and groundwater protection programs. Therefore, it is often the case that data regarding buried components is often scarce, and can be spread across many systems managed by different individuals. In addition, since buried components are typically non-safety related equipment, root cause analyses (RCA) of failures are seldom performed. Instead, the component or affected area is patched or replaced and returned to service. Even in those rare cases where they are performed, the RCA often do not rigorously evaluate the physical evidence and other related factors to properly diagnose the cause(s) due to budgetary constraints and other issues. The factors cited lead to the conclusion that, even when failures are recorded and RCA performed, data on present component condition is often lacking. In addition, attention to mitigation approaches (e.g., cathodic protection) was generally poor, and also considered low-priority in budgeting.

Despite these challenges, some service history failure data was obtained for ANO buried components. The systems with known failures were primarily Fire Water and Domestic Water. There were also a small number of failures in the Compressed Air,

High Pressure Nitrogen, Diesel Fuel and Fuel Oil systems. The documented failures include leaks, failed hydrotests, corrosion/debris plugging and sludge buildup. The root causes of failure were seldom established. It was therefore not considered a useful exercise to compare these failures to the active degradation mechanisms predicted for these buried components by the MDMM other than to confirm that the MDMM was sufficiently thorough to have included the mechanisms identified for those components. A larger plant study is necessary in order to gather enough data to compare active plant degradation mechanisms to those predicated by the MDMM.

Table 4-1. Summary – Materials of Buried Components

	Buried Piping	Storage Tanks	Sumps	Spent Fuel Pools
ANO 1&2	Carbon steel, stainless steel, PVC, cast iron, galvanized steel, copper	Carbon steel, stainless steel, concrete	Concrete with stainless steel liner	Concrete with stainless steel liner
STP 1&2	Carbon steel, stainless steel, PVC, cast iron, prestressed concrete cylinder pipe, cement-lined ductile iron, ABS, glass-fiber reinforced epoxy resin	Carbon steel, fiberglass	Concrete with stainless steel liner	Concrete with stainless steel liner
Byron 1&2	Carbon steel, stainless steel	Carbon steel, stainless steel, concrete with stainless steel liner, aluminum	N/A	
Dresden 2&3	Carbon steel, stainless steel, PVC, aluminum, ductile iron	N/A		
DCPP 1&2	Carbon steel, reinforced concrete, cement-lined ductile iron, aluminum-bronze, galvanized steel	N/A		
CPSES 1&2	Carbon steel, reinforced concrete, cement-lined ductile iron	N/A		
WCNOC	Carbon steel, cement-lined ductile iron	N/A		
Callaway	Carbon steel	N/A		

Table 4-2. Summary – Temperatures of Burled Components

	Buried Piping	Storage Tanks	Sumps	Spent Fuel Pools
ANO 1&2	Temp < 32 °F, 32 < Temp < 150 °F <sup>a</sup> (Temp < 0 °C, 0 < Temp < 66 °C)	32 < Temp < 150 °F (0 < Temp < 66 °C)	32 < Temp < 150 °F (0 < Temp < 66 °C)	32 < Temp < 150 °F (0 < Temp < 66 °C)
STP 1&2	32 < Temp < 550 °F (0 < Temp < 66 °C)	N/A		
Byron 1&2	32 < Temp < 150 °F (0 < Temp < 66 °C)	N/A		
Dresden 2&3	32 < Temp < 150 °F (0 < Temp < 66 °C)	N/A		
DCPP 1&2	32 < Temp < 150 °F (0 < Temp < 66 °C)	N/A		
CPSES 1&2	N/A			
WCNOC	N/A			
Callaway	N/A			



Table 4-3. Summary – Flow rates of Buried Components

	Buried Piping	Storage Tanks	Sumps	Spent Fuel Pools
ANO 1&2	Stagnant, intermittent, wide range of fluid velocities	N/A		
STP 1&2	Stagnant, intermittent, wide range of fluid velocities	N/A		
Byron 1&2	Stagnant, intermittent, wide range of fluid velocities	N/A		
Dresden 2&3	N/A			
DCPP 1&2	N/A			
CPSES 1&2	N/A			
WCNOC	N/A			
Callaway	N/A			

Table 4-4. Summary – Process Fluids of Buried Components

	Buried Piping	Storage Tanks	Sumps	Spent Fuel Pools
ANO 1&2	Air, argon, raw water, butane, chlorine gas, water, demineralized water, diesel fuel oil, hydrogen gas, natural gas, potable water, sewage	Demineralized water, city water, fuel oil, polisher regen discharge, waste water, radiologically contaminated reactor quality water, gasoline	Waste water	Borated controlled-purity water
STP 1&2	Water, controlled purity water with acid and caustic, condensate, controlled purity deaerated water, air, nitrogen, chemical waste, oily waste, fuel oil, sodium hypochlorite, boric acid	Water, liquid waste, condensate polisher regeneration, bisulfate, brackish water, demineralized water, water with caustic and sodium, reactor quality water, ammonium hydroxide, oily waste, hydrazine, fuel oil, diesel fuel oil, salt, acid, caustic, sodium hypochlorite,	Condensate polisher regeneration, water, oily waste, radiological waste, evaporator reagent, boron, boric acid, condensate, reactor quality fluid, chemical waste, sodium hypochlorite, caustic, acid, demineralized water, inorganic waste, hydrazine, organic waste, chiller lubricant, emergency diesel lubricant, condenser vacuum pump oil	Borated controlled-purity water
Byron 1&2	Water, diesel fuel oil, hydrogen gas	Water, borated water, diesel fuel oil	N/A	
Dresden 2&3	Water, diesel fuel oil, hydrogen gas	N/A		
DCPP 1&2	Sea water, air, diesel fuel oil, demineralized water, water, well water	N/A		
CPSES 1&2	Raw water	N/A		
WCNOC	Raw water	N/A		
Callaway	Water	N/A		

Table 4-5. Summary - External Environments of Buried Components

	Buried Piping	Storage Tanks	Sumps	Spent Fuel Pools
ANO 1&2	Granular backfill, soil, concrete	Oiled sand, air, concrete, soil	Concrete	Concrete
STP 1&2	Compacted sand, concrete	Compacted sand, concrete	Concrete	Concrete
Byron 1&2	Gravel, rock	N/A		
Dresden 2&3	Concrete, sandy soil	N/A		
DCPP 1&2	N/A			
CPSES 1&2	N/A			
WCNOC	N/A			
Callaway	N/A			

# 5

## CONCLUSIONS AND RECOMMENDATIONS

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### 5.1 MDMM

The MDMM is a valuable tool for use as a "first screen" for the determination of potentially operative degradation mechanisms for buried components. Its primary virtues lie in its relative ease of use, the conservative nature of the logic employed, and the comprehensive list of degradation mechanisms evaluated. SI recommends that the MDMM be made even more valuable by pursuing the initiatives discussed in Section 5.2.

### 5.2 Future Development

The usefulness of the MDMM can be greatly enhanced through several related follow-on initiatives described below

- Indicating on the MDMM those degradation mechanisms with either a known history or logical credibility in a NPP environment. A larger plant study (than the pilot) is required for this purpose.
- Developing additional "finer screens" (of single or multiple levels) for all degradation mechanisms to render a more definitive and quantitative judgment on potentially operative degradation in order to provide guidance in determining the approach to characterize and/or mitigate the mechanism
- Developing an Expert System to automate the screening process (user would simply enter information on material, environment, operating conditions, and loading, and the expert system would run multiple screening determinations for all mechanisms and determine the final list of potentially active mechanisms)
- Collecting and evaluating data on mechanism rates, load magnitudes and frequencies, and barrier thicknesses so that time to failure can be evaluated

### **5.3 Longer-Term Goals**

The creation of the MDMM endeavors to help system owners by giving them a tool to focus resources on those buried piping components that are susceptible to material degradation and may pose a groundwater contamination risk. It is the hope that continued development of the MDMM, along with other related initiatives under the EPRI Groundwater Protection Initiative, will help owners to eventually develop inspection and/or mitigation programs for comprehensive life-cycle management of these critical components.

# 6

## REFERENCES

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1. ASME Post-Construction Code PCC-3 Inspection Planning Screening Table.
- 2.
- 3.

# **A**

## **APPENDIX**

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### **MATRICES**

# **Material Degradation Master Matrix**

MDMM\_Rev 3.xls



### Material Degradation Master Matrix

[illegible]



## Buried Piping Matrix

Piping.xls



#### Materials Degradation Matrix - Buried Pipes

[illegible]



## Storage Tank Matrix

Tanks.xls

11th Examples and Suggested Values - DRAFT 03-12-2007

Area	Potential Failure Mode	Mitigating Action (optional)	Potential Causes (Justify Likelihood)	LIKELIHOOD				Potential Failure Effect (Justify Severity)	CONSEQUENCE				PRIORITY INDEX
				History	Condition	Design	Pre-Release Detection		Inventory	Hazard	Mobility	Post-Release Detection	
Oil tank	Catastrophic Failure		Environmental	0	1	2	3	Overflow berm onto soil	2	3	3	1	38
	Overflow		Operator error	2	2	2	2	Low level, flow into grnd	1	2	3	1	38
Underground	Torn liner		Equip. failure	2	3	2	3	Low level, into grnd	1	1	3	2	48
Underground pipe	Corrosion		Existing contam.	3	2	3	3	Already leaked to grnd	2	2	3	2	68
Underground traps	Work Practice		Contam of secondary side water	1	0	2	3	Water drained to soil	2	2	3	1	33
Underground piping	Work Practice		Hydroblaster wand immersed & unattended	1	0	3	3	Water drained to soil	2	3	3	1	44
Underground pipe	Corrosion	Pre-mitigation	Equip. failure	2	3	3	3	Leak into soil	2	2	3	2	68
Underground pipe	Corrosion	Replace pipe	Equip. failure	2	1	1	3	Leak into soil	2	2	3	2	44
Process (Specify)	Work Practice		(Specify)										
Oil Tank	Bulging Catastrophic Failure Corrosion Cracked welds Implosion Overfills Pitting Tank Cracks Other (specify)		Over Pressurization Equipment failure Human performance error Environmental (i.e., Earth Quakes, Tornadoes etc.) Other (specify)										
Pipe	Catastrophic Failure Cracked welds Corrosion Join leak Pitting Other (specify)		Over Pressurization Equipment failure Human performance error Environmental (i.e., Earth Quakes, Tornadoes etc.) Other (specify)										
	Corrosion Cracked welds Joint leaks Liner Cracks Overfills Pitting Other (specify)		Over Pressurization Equipment failure Human performance error Environmental (i.e., Earth Quakes, Tornadoes etc.) Other (specify)										
	Corrosion Cracked welds Cracked concrete Overfills Pitting Permeable bottom Other (specify)		Over Pressurization Equipment failure Human performance error Environmental (i.e., Earth Quakes, Tornadoes etc.) Other (specify)										
	Corrosion Cracked welds Cracked concrete Overfills Pitting Permeable bottom Other (specify)		Over Pressurization Equipment failure Human performance error Environmental (i.e., Earth Quakes, Tornadoes etc.) Other (specify)										

with Examples and Suggested Values - DRAFT 03-12-2007

Area	Potential Failure Mode	Mitigating Action (optional)	Potential Causes (Justify Likelihood)	LIKELIHOOD				Potential Failure Effect (Justify Severity)	CONSEQUENCE				PRIORITY INDEX
				History	Condition	Design	Pre-Release Detection		Inventory	Hazard	Mobility	Post-Release Detection	
id tank	Catastrophic Failure		Environmental	0	1	2	3	Overflow berm onto soil	2	3	3	1	38
	Overflow		Operator error	2	2	2	2	Low level, flow into grnd	1	2	3	1	38
undment	Torn liner		Equip. failure	2	3	2	3	Low level, into grnd	1	1	3	2	48
f pipe	Corrosion		Existing contam.	3	2	3	3	Already leaked to grnd	2	2	3	2	68
traps	Work Practice		Contam of secondary side water	1	0	2	3	Water drained to soil	2	2	3	1	33
ng	Work Practice		Hydroblaster wand immersed & unattended	1	0	3	3	Water drained to soil	2	3	3	1	44
pipe	Corrosion	Pre-mitigation	Equip. failure	2	3	3	3	Leak into soil	2	2	3	2	68
pipe	Corrosion	Replace pipe	Equip. failure	2	1	1	3	Leak into soil	2	2	3	2	44
undment	Bulging		Over Pressurization										
	Catastrophic Failure		Equipment failure										
	Corrosion		Human performance error										
	Cracked welds		Environmental (i.e., Earth Quakes,										
	Implosion		Tornadoes etc.)										
s	Overfills		Other (specify)										
	Pitting												
	Containment Cracks												
	Other (specify)												
	Cracked liner		Over Pressurization										
undment	Overfills		Equipment failure										
	Torn liner		Human performance error										
	No liners		Environmental (i.e., Earth Quakes,										
	Bank failure		Tornadoes etc.)										
	Dam failure		Other (specify)										
s	Other (specify)												
	Overfills		Over Pressurization										
	Torn liner		Equipment failure										
	No liners		Human performance error										
	Bank failure		Environmental (i.e., Earth Quakes,										
undment	Dam failure		Tornadoes etc.)										
	Other (specify)		Other (specify)										

**APPENDIX C-2**  
**PRIORITY INDEX WORKSHEET MAY 2009**

Item No.	System ID	Risk Area	Potential Failure Mode	Mitigating Action (prevents)	Potential Causes (Mostly Likelihood)	LIKELIHOOD			Potential Failure Effect (Likely Consequence)	CONSEQUENCE				PRIORITY INDEX	LIKELIHOOD			CONSEQUENCE		
						History	Condition	Design		Inventory	Hazard	Morbidity	Post Release Decision		History	Condition	Design	Inventory	Hazard	Morbidity
Work Practices																				
1	N/A	Radioactive Material Handling/Transport	Radioactive Material Storage Area Outside Equipment Hatch during Outages	Packages wrapped and surveyed prior to loading in storage areas. Reference: OPR-03-250003, Step 7.3.13, and 7.4.2 regarding temporary radioactive material areas.	Potential spread of contamination to the ground from work activities (spill from rain, etc.)	0	0	1	Low level contamination of soil	1	1	2	1	6	no recorded events	work practice = 0	packaging should prevent spread	low specific activity solids	< 10% Co-60; balance H-63, Fe-55, & short lived nuclides not listed	activity dom 2 nuclides
			Radioactive Material transfer between buildings	Packages wrapped and surveyed prior to transport. Reference: OPR-04-250004, items > 5 mSv are secured by RP Technicians.	Potential spread of contamination to the ground from package leakage.	0	0	1	Low level contamination of soil	1	1	2	1	6	no recorded events	work practice = 0	packaging should prevent spread	low specific activity solids	< 10% Co-60; balance H-63, Fe-55, & short lived nuclides not listed	activity dom 2 nuclides
			Radioactive Materials Storage in Rack area (South of Unit 1 and 2)	Packages in robust containers. Packages inspected monthly. Reference: OPR-01-24-0010, Version 02	Potential leak of contamination to the ground from package degradation.	0	0	0	Low level contamination of storm sewer system	1	1	2	1	6	no recorded events	work practice = 0	packaging should prevent spread & gear prevents contact with soil	low specific activity solids	< 10% Co-60; balance H-63, Fe-55, & short lived nuclides not listed	activity dom 2 nuclides
			High Rad CAW casting process	Waste packaged and surveyed prior to transfer to storage container	package spill to soil outside equipment hatch	0	0	1	Moderate, local soil contamination	2	1	2	1	6	no recorded events	work practice = 0	packaging should prevent spread	intermediate activity solids	< 10% Co-60; balance H-63, Fe-55, & short lived nuclides not listed	activity dom 2 nuclides
			area of leaking package	Survey within 3 hours of release. Reference: OPR-03-250013	spread of contamination to soil	0	0	1	Low level soil contamination	2	1	2	1	6	no recorded events	work practice = 0	packaging should prevent spread	intermediate activity solids	< 10% Co-60; balance H-63, Fe-55, & short lived nuclides not listed	activity dom 2 nuclides
			HEPA vacuum parked between buildings	Packages wrapped and surveyed prior to transport. Items > 6 mSv are secured by RP Technicians.	package failure and subsequent contamination spread to road	0	0	0	Moderate, local soil contamination	2	1	2	1	6	no recorded events	work practice = 0	packaging should prevent spread & also prevents contact with soil	intermediate activity solids	< 10% Co-60; balance H-63, Fe-55, & short lived nuclides not listed	activity dom 2 nuclides
2	N/A	Secondary water control	Leaks to ground during draining operations - CR rain pits	Periodic training with operations on spill prevention response and environmental compliance. Reference: POR 054 and POR 0541	Water Failure resulting in container overflow	2	0	2	Low level soil contamination	1	1	3	1	23	recorded events	work practice = 0	over flow vent to soil outside building	secondary water	stream dominated	stream dom 3 nuclides
			Leakage of storage tank hoses outside PGB	RPT hose couplings inspected by standard procedure (Appendix E) and preoperational leak checks performed per step B.42 of Wastingshouse procedure M95 OS-PI 180 TGA.	Leak at joint or catastrophic hose failure	0	0	2	Low level soil contamination	1	1	3	1	11	no recorded events	work practice = 0	over flow vent to soil outside building	secondary water	stream dominated	stream dom 3 nuclides
			Leakage outside facility of contaminated water	Periodic training with operations on spill prevention response and environmental compliance. Reference: POR 054 and POR 0541	Leak at joint or catastrophic hose failure (see CR 07-4505)	0	0	2	Low level soil contamination	1	1	3	1	11	no recorded events	work practice = 0	over flow vent to soil outside building	secondary water	stream dominated	stream dom 3 nuclides
			Secondary system process structures calibrations - fill and vent activities	Periodic training with operations on spill prevention response and environmental compliance. Reference: POR 054 and POR 0541	secondary water drained to ground	0	0	1	Low level soil contamination	1	1	3	1	6	no recorded events	work practice = 0	local instrumentation in areas where contact with ground is not possible	secondary water	stream dominated	stream dom 3 nuclides
3	N/A	Outside storage of package	Package leakage	Robust packaging chosen. Periodic package inspections are performed. severe weather procedures direct securing in-bldg or moving within secure outdoor. Packages inspected monthly.	package degradation allows rain to penetrate package and flush activity to ground (see CR 07-14371 and 08-15278)	0	0	2	Low level soil contamination	1	1	2	1	8	no recorded events	work practice = 0	packaging subject to long term degradation	low specific activity solids	< 10% Co-60; balance H-63, Fe-55, & short lived nuclides not listed	activity dom 2 nuclides
			dropped package	Use of support in training, standard personnel, pre-job briefings and rigging inspections	spread of contents on soil upon package failure	0	0	1	Moderate, local soil contamination	1	1	2	1	6	no recorded events	work practice = 0	packaging should minimize or prevent spread	low specific activity solids	< 10% Co-60; balance H-63, Fe-55, & short lived nuclides not listed	activity dom 2 nuclides
			OSSF operations - dropped package	HCE used for material storage are durable and unlikely to rupture if dropped	spread of contents on soil upon package failure	0	0	1	High local soil contamination	3	2	2	1	7	no recorded events	work practice = 0	packaging should minimize or prevent spread	high specific activity solids	Co-60 and Cs-137 is significant fraction of activity but only traces of higher hazard nuclides	activity dom 2 nuclides
			Warehouse "D" storage - packages degrade over time and leak	Building engineered with berms around waste containers. equipment containers inspected	package degradation allows local contamination	0	0	0	Moderate, local contamination to soil	2	1	2	1	6	no recorded events	work practice = 0	packaging and berms should prevent spread	intermediate specific activity solids	Co-60 and Cs-137 is significant fraction of activity but only traces of higher hazard nuclides	activity dom 2 nuclides
4	N/A	old reactor head storage	package leakage from rain	Engineered storage design with enclosure to minimize chance of leak	spread of contamination to surface of storage area	0	0	0	Low level soil contamination	1	1	2	1	6	no recorded events	work practice = 0	packaging should minimize or prevent spread	low solubility	Co-60 is significant fraction of activity, no higher hazard nuclides	activity dom 2 nuclides
5	N/A	old S/O storage	package leakage to local contamination	Building designed with sump to collect contaminated contamination water for monitoring before release	spread of contamination to building sump with overflow	0	0	0	Low level contamination to soil	1	1	2	1	6	no recorded events	work practice = 0	inside structure engineered to prevent spread	low solubility	Co-60 is significant fraction of activity, no higher hazard nuclides	activity dom 2 nuclides



Item No.	System ID	Risk Area	Potential Failure Mode	Mitigating Action (Reduced)	Potential Cause (Uncertain Likelihood)	LIKELIHOOD			Potential Failure Effect (Uncertain Consequence)	CONSEQUENCE				PRIORITY INDEX	LIKELIHOOD			CONSEQUENCE		
						History	Condition	Design		Inventory	Hazard	Mobility	Post-Release Detection		History	Condition	Design	Inventory	Hazard	Consequence
7	NSA	Local deposition of low level particles	Design discharge to roof of MAB	Most batch of directed to storm drainage rather than to the ground (see Regulatory issues Summary 2/20/02)	rain washing of deposited activity to drainage system and groundwater	3	0	1	Low level contamination to storm sewer system	1	1	2	2	22	known ongoing process	work practice = D	evictor wash into storm drain system; particles should have been collected with soil	low solubility particles	< 10% Co-60, balance N-63, Fe-55, & short lived nuclides not listed	activity down 2 nucleides
8	N/A	Vacuum trucks	split of secondary water to soil	Personnel training with operations on soil preservation response and environmental compliance (reference PGR 004 and PGR 004)	operator error, joint leakage, or pipe failure	0	0	1	Low level soil contamination	1	1	3	1	6	no recorded events	work practice = D	minimal volume and spread of activity most likely on asphalt	secondary water	total dominated	trium dominates
Reservoirs																				
9	N/A	Main Cooling Reservoir	Miss Practice, Overflow, improper maintenance of berm	Berm maintained and evaluated routinely by visual inspection and geotechnical measurements per Specifications 9/5/05/1004	Cracking reservoir, (Not likely as the water level is monitored continuously)	0	0	1	Release to adjacent surface waters and local drainage swales (low concentrations of tritium discharged to adjacent wetlands and exiles)	1	1	1	1	4	no recorded events	safety related system closely inspected and well maintained	less majority of activity would flow the Colorado River with little time to absorb into ground; low initial concentration	tritium + EPA drinking water limit dominated	tritium dominated	although not exposure!
			Migration through soil to water table (by design)	Discharge to groundwater is accepted and approved per plant license	Infiltration through soil column (likely as it was part of the plant design)	3	1	3	Reservoir discharged to groundwater by design, and is acceptable	1	1	3	1	23	known design feature; migration as evidenced with monitoring	migration through soil spot checked but with long and consistent HGLM monitoring program	long term exposure allows penetration into shallow aquifer at low initial concentration	tritium + EPA drinking water limit dominated	tritium dominated	tritium
			Unvaluated use resulting in discharge to unvaluated release pathway	Work practice that should be identified and evaluated per various plant procedures	Infiltration through soil column is area beyond current influence of reservoir	0	0	2	Extend top level tritium contamination beyond bounds of current reservoir influence	1	1	3	1	11	no recorded events	procedures in place to prevent (Chemistry Section Top)	exposure term likely to be short limiting the opportunity to penetrate into shallow aquifer	tritium + EPA drinking water limit dominated	tritium dominated	tritium
			Reservoir Embankment Breach	Embankment monitored and evaluated routinely by visual inspection and geotechnical measurements per Specifications 9/5/05/1004	Geotechnical Observations announced periodically (very unlikely as a breach would cause plant shut down)	0	0	1	Release to adjacent surface waters and local drainage swales. Larger effect from emissions effort	1	1	1	1	4	no recorded events	safety related system closely inspected and well maintained	less majority of activity would flow the Colorado River or Little Rocksee South with little time to absorb into ground; low initial concentration	tritium + EPA drinking water limit dominated	tritium dominated	although not exposure!
Sumps																				
10		Collection Sumps	Sumps are within buildings and have little to no potential for leaks to reach groundwater	Negative pressure from groundwater into the building would allow groundwater to infiltrate the sump, and prevent trapped water from being released to the environment	Corrosion, cracks, overfilling above the threshold is low for exposing the environment as sumps are located within buildings and below the water table	0	0	1	No pathway to impact environment	2	2	2	0	4	no recorded events	below water table to all leakage into the sump	below water table to all leakage into the sump	only radioactive material is liquid	typically Co-60 dominated hazard but may be controlled by tritium	typically Co-60
Tanks																				
11		Yard Area Waste Monitor Tanks	Catastrophic Failure	Leads when tanks are monitored	Environmental	0	1	0	Overflow of berm water surface soil	2	1	3	0	4	no recorded events	good condition and on maintenance schedule	berm around tanks to control leaks before contamination reaches soil	processed rad waste	may contain Co-60 although typically dominated by tritium	tritium
			Cracked Welds		Corrosion or seams, fatigue and weathering	0	1	0	Leaks captured by the WMT sump and emptying sump	2	1	3	0	4	no recorded events	good condition and on maintenance schedule	berm around tanks to control leaks before contamination reaches soil	processed rad waste	may contain Co-60 although typically dominated by tritium	tritium
			Corrosion		Damage to tank to cause pitting and possible leaks	0	1	0	Leaks captured by the WMT sump and emptying sump	2	1	3	0	4	no recorded events	good condition and on maintenance schedule	berm around tanks to control leaks before contamination reaches soil	processed rad waste	may contain Co-60 although typically dominated by tritium	tritium
			Joint Leak		Worn materials under cracks and/or corrosion	0	1	0	Leaks captured by the WMT sump and emptying sump, unless pitting and joints are located below tanks, then leaks would impact shallow soils	2	1	3	0	4	no recorded events	good condition and on maintenance schedule	berm around tanks to control leaks before contamination reaches soil	processed rad waste	may contain Co-60 although typically dominated by tritium	tritium
			Pitting		Corrosion of tank materials	0	1	0	Leaks captured by the WMT sump and emptying sump	2	1	3	0	4	no recorded events	good condition and on maintenance schedule	berm around tanks to control leaks before contamination reaches soil	processed rad waste	may contain Co-60 although typically dominated by tritium	tritium
12		TOS Tanks (these are associated with the Condensate Polishing System - each includes the low and high level disrupted solids tanks)	Catastrophic Failure	Berm with leakage returned to CP sump	Environmental	0	1	0	Leaks to berm and then potentially to shallow groundwater	1	1	3	0	4	no recorded events	good condition and on maintenance schedule	berm around tanks to control leaks before contamination reaches soil	secondary water	tritium dominated	tritium

Item No.	System ID	Risk Area	Potential Failure Mode	Mitigating Action (optional)	Potential Causes (Justify Likelihood)	LIKELIHOOD			Potential Failure Effect (Justify Consequence)	CONSEQUENCE				PRIORITY INDEX	LIKELIHOOD			CONSEQUENCE		
						History	Condition	Design		Inventory	Hazard	Ability	Post-Release Detection		History	Condition	Design	Inventory	Hazard	Ability
			Cracked Welds		Corrosion in seams, fatigue and weathering	0	1	0	Leak to berm and then potentially to shallow groundwater	1	1	3	C	8	no recorded events	good condition and on maintenance schedule	berm around tanks to control leaks before contamination reaches soil	secondary water	return decomposed	High
			Corrosion		Damage to tank to cause pitting and possible leaks	0	1	0	Leak to berm and then potentially to shallow groundwater	1	1	3	D	8	no recorded events	good condition and on maintenance schedule	berm around tanks to control leaks before contamination reaches soil	secondary water	return decomposed	High
			Joint Leak		Worn materials and/or cracks and/or corrosion	0	1	0	Leak to berm and then potentially to shallow groundwater	1	1	3	D	8	no recorded events	good condition and on maintenance schedule	berm around tanks to control leaks before contamination reaches soil	secondary water	return decomposed	High
			Pitting		Corrosion of tank materials	0	1	0	Leak to berm and then potentially to shallow groundwater	1	1	3	D	8	no recorded events	good condition and on maintenance schedule	berm around tanks to control leaks before contamination reaches soil	secondary water	return decomposed	High
13		Liquid Waste Storage Tanks	Catastrophic Failure	Tanks located within a building at elevations below the static water table. Releases would be captured by sumps.	Environmental	0	1	0	Leak would be observed and maintained. Based on the negative pressure from the surrounding aquifer (outside the building)	3	2	2	D	8	no recorded events	good condition and on maintenance schedule	located within building preventing ground contamination should leak occur	liquid red waste	probably dominated by Co-60	probably d
			Cracked Welds		Corrosion in seams, fatigue and weathering	0	1	0	Leak would be observed and maintained. Based on the negative pressure from the surrounding aquifer (outside the building)	3	2	2	D	8	no recorded events	good condition and on maintenance schedule	located within building preventing ground contamination should leak occur	liquid red waste	probably dominated by Co-60	probably d
			Corrosion		Damage to tank to cause pitting and possible leaks	0	1	0	Leak would be observed and maintained. Based on the negative pressure from the surrounding aquifer (outside the building)	3	2	2	D	8	no recorded events	good condition and on maintenance schedule	located within building preventing ground contamination should leak occur	liquid red waste	probably dominated by Co-60	probably d
			Joint Leak		Worn materials and/or cracks and/or corrosion	0	1	0	Leak would be observed and maintained. Based on the negative pressure from the surrounding aquifer (outside the building)	3	2	2	D	8	no recorded events	good condition and on maintenance schedule	located within building preventing ground contamination should leak occur	liquid red waste	probably dominated by Co-60	probably d
			Pitting		Corrosion of tank materials	0	1	0	Leak would be observed and maintained. Based on the negative pressure from the surrounding aquifer (outside the building)	3	2	2	D	8	no recorded events	good condition and on maintenance schedule	located within building preventing ground contamination should leak occur	liquid red waste	probably dominated by Co-60	probably d
14		Spent Water Storage Tanks	Catastrophic Failure	Tanks located within a building at elevations below the static water table. Releases would be captured by sumps.	Environmental	0	1	0	Leak would be observed and maintained. Based on the negative pressure from the surrounding aquifer (outside the building)	2	1	3	D	6	no recorded events	good condition and on maintenance schedule	located within building preventing ground contamination should leak occur	slated reactor coolant	probably dominated by tritium	probably d
			Cracked Welds		Corrosion in seams, fatigue and weathering	0	1	0	Leak would be observed and maintained. Based on the negative pressure from the surrounding aquifer (outside the building)	2	1	3	D	6	no recorded events	good condition and on maintenance schedule	located within building preventing ground contamination should leak occur	slated reactor coolant	probably dominated by tritium	probably d
			Corrosion		Damage to tank to cause pitting and possible leaks	0	1	0	Leak would be observed and maintained. Based on the negative pressure from the surrounding aquifer (outside the building)	2	1	3	D	6	no recorded events	good condition and on maintenance schedule	located within building preventing ground contamination should leak occur	slated reactor coolant	probably dominated by tritium	probably d
			Joint Leak		Worn materials and/or cracks and/or corrosion	0	1	0	Leak would be observed and maintained. Based on the negative pressure from the surrounding aquifer (outside the building)	2	1	3	D	6	no recorded events	good condition and on maintenance schedule	located within building preventing ground contamination should leak occur	slated reactor coolant	probably dominated by tritium	probably d
			Pitting		Corrosion of tank materials	0	1	0	Leak would be observed and maintained. Based on the negative pressure from the surrounding aquifer (outside the building)	2	1	3	D	6	no recorded events	good condition and on maintenance schedule	located within building preventing ground contamination should leak occur	slated reactor coolant	probably dominated by tritium	probably d
Spent Fuel Pool																				
15		Spent Fuel Pool	Catastrophic Failure	The bottom of the pool is at elevation 21 feet, 11 inches MSL. The basement floor is at elevation 39 feet MSL, with access to the basement 60 feet above the bottom of the pool floor and the	Environmental	0	1	0	Leak would be observed as the bottom of the pool is accessible	2	2	2	D	8	no recorded events	good condition and on maintenance schedule	located within building preventing ground contamination should leak occur	slated reactor coolant including tritium fuel	possibly dominated by Co-60	possibly d

Item No.	System ID	Risk Area	Potential Failure Mode	Mitigating Action (preferred)	Potential Cause (Justify Likelihood)	LIKELIHOOD			Potential Failure Effect (Justify Consequence)	CONSEQUENCE				PRIORITY INDEX	LIKELIHOOD			CONSEQUENCE		
						History	Condition	Design		Inventory	Hazard	Mobility	Post-Release Duration		History	Condition	Design	Inventory	Hazard	Mobility
			Cracks in pool		Fatigue / aging	0	1	0	Leak would be observed as the bottom of the pool is accessible	2	2	2	0	6	no recorded events	good condition and on maintenance schedule	located within building with some brine where leakage would be observed before ground contamination should leak occur	shaded reactor coolant including crud from fuel	possibly dominated by Co-60	possibly d
			Cracked walls		Corrosion at seams, fatigue and weathering	0	1	0	Leak would be observed as the bottom of the pool is accessible	2	2	2	0	6	no recorded events	good condition and on maintenance schedule	located within building preventing ground contamination should leak occur	shaded reactor coolant including crud from fuel	possibly dominated by Co-60	possibly d
			Corrosion		Damage to tank to cause pitting and possible leaks	0	1	0	Leak would be observed as the bottom of the pool is accessible	2	2	2	0	6	no recorded events	good condition and on maintenance schedule	located within building preventing ground contamination should leak occur	shaded reactor coolant including crud from fuel	possibly dominated by Co-60	possibly d
			Joint Leak		Worn materials and/or cracks and/or corrosion	0	1	0	Leak would be observed as the bottom of the pool is accessible	2	2	2	0	6	no recorded events	good condition and on maintenance schedule	located within building preventing ground contamination should leak occur	shaded reactor coolant including crud from fuel	possibly dominated by Co-60	possibly d
			Pitting		Corrosion of tank materials	0	1	0	Leak would be observed as the bottom of the pool is accessible	2	2	2	0	6	no recorded events	good condition and on maintenance schedule	located within building preventing ground contamination should leak occur	shaded reactor coolant including crud from fuel	possibly dominated by Co-60	possibly d
System Piping																				
15	CP	Total Disposed Solids Discharge Piping Sub-Surface Pipe	Catastrophic Failure		Pipe rupture	0	2	3	Leak to shallow soil	1	1	3	2	22	no recorded events	requiring maintenance issues	not lined and previous event left detectable contamination	secondary water	tritium dominated	tritium
			Cracks in piping	Quick Water Leak Plan of Action 07-13322-6	Failures due to high water shock	1	2	3	Leak to shallow soil	1	1	3	2	23	history of events but mitigating actions now implemented	requiring maintenance issues	not lined and previous event left detectable contamination	secondary water	tritium dominated	tritium
			Corrosion		Damage to piping	1	2	3	Leak to shallow soil	1	1	3	1	23	historical event but mitigating actions now implemented	requiring maintenance issues	not lined and previous event left detectable contamination	secondary water	tritium dominated	tritium
			Joint Leak		Cracks or worn materials in joints	0	2	3	Leak to shallow soil	1	1	3	2	22	no recorded events	requiring maintenance issues	not lined and previous event left detectable contamination	secondary water	tritium dominated	tritium
			Pitting		Leaks in piping	0	2	3	Leak to shallow soil	1	1	3	2	22	no recorded events	requiring maintenance issues	not lined and previous event left detectable contamination	secondary water	tritium dominated	tritium
17	WS	Liquid Waste Discharge Piping	Catastrophic Failure	Majority of the piping is located within buildings or above ground, with the exception of one buried section that runs underground from the yard area close to a penetration in the concrete wall.	Environmental or physical damage.	0	1	1	Leak from above ground piping and buried sections could impact soil and groundwater	2	1	3	0	11	no recorded events	monitored by operators	very limited opportunity for leaks to reach the environment outside a building	leached rad waste at relatively low concentrations	tritium dominated	tritium
			Cracks in piping		Corrosion at seams or pipe failure	0	1	1	Leak from above ground piping and buried sections could impact soil and groundwater	2	1	3	0	11	no recorded events	monitored by operators	very limited opportunity for leaks to reach the environment outside a building	leached rad waste at relatively low concentrations	tritium dominated	tritium
			Corrosion		Damage to cause pitting and possible leaks	0	1	1	Leak from above ground piping and buried sections could impact soil and groundwater	2	1	3	0	11	no recorded events	monitored by operators	very limited opportunity for leaks to reach the environment outside a building	leached rad waste at relatively low concentrations	tritium dominated	tritium
			Joint Leak		Worn materials and/or cracks and/or corrosion	0	1	1	Leak from above ground piping and buried sections could impact soil and groundwater	2	1	3	0	11	no recorded events	monitored by operators	very limited opportunity for leaks to reach the environment outside a building	leached rad waste at relatively low concentrations	tritium dominated	tritium
			Pitting		Corrosion of pipe materials	0	1	1	Leak from above ground piping and buried sections could impact soil and groundwater	2	1	3	0	11	no recorded events	monitored by operators	very limited opportunity for leaks to reach the environment outside a building	leached rad waste at relatively low concentrations	tritium dominated	tritium

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Item No.	System ID	Risk Area	Potential Failure Mode	Mitigating Action (optional)	Potential Causes (Primary Likelihood)	LIKELIHOOD			Potential Failure Effect (Primary Consequence)	CONSEQUENCE				PRIORITY INDEX	LIKELIHOOD			CONSEQUENCE		
						History	Condition	Design		Inventory	Hazard	Mobility	Port Surface Condition		History	Condition	Design	Inventory	Hazard	Consequence
18	OC	Auxiliary Cooling Open Loop Piping	Catastrophic Failure	Normal catastrophic failure would likely be a complete rupture (or leak, mostly) and would be visually observed, and the plant would be shut down and repaired.	Environmental	0	3	5	Erosion to shallow soils and release of low levels of impacted water to shallow soils	1	1	3	1	32	no recorded events	conditions not well known but inspection planned	low level soil contamination possible	concentrations similar to secondary system	stream dominated	NR
			Cracked Welds		NA															
			Corrosion		NA															
			Joint Leak		NA															
			Piping		NA															
19	OC	Circulating Water Piping	Catastrophic Failure	Normal catastrophic failure would likely be a complete rupture (or leak, mostly) and would be visually observed, and the plant would be shut down and repaired.	Environmental	0	0	2	Erosion to shallow soils and release of low levels of impacted water to shallow soils	1	1	3	1	11	no recorded events	low pressure system inspected on routine basis	contamination likely but no greater than design basis for reservoir	stream < EPA drinking water limit dominated	stream dominated	NR
			Cracked Welds		NA															
			Corrosion		NA															
			Joint Leak	Reference MP 011340 scheduled for 2014 project for 2017	NA															
			Piping		NA															
20		Reservoir Elbow down Piping	Catastrophic Failure	Reservoir would follow the line and impact the Colorado River where the elbow down is discharged into the river.	Environmental/Mechanical	0	1	2	Low level contamination (approx 13,000 pCi/L) to shallow soils and river, where line discharges	1	1	3	1	17	no recorded events	inspected	soil contamination possible but an analyzed pathway	stream < EPA drinking water limit dominated	stream dominated	NR
			Cracked Welds		Corrosion at seams, fatigue and weathering	0	1	2	Low level contamination (approx 13,000 pCi/L) to shallow soils and river, where line discharges	1	1	3	1	17	no recorded events	inspected	soil contamination possible but an analyzed pathway	stream < EPA drinking water limit dominated	stream dominated	NR
			Corrosion		Damage to pipe to cause piping and possible leaks	0	1	2	Low level contamination (approx 13,000 pCi/L) to shallow soils and river, where line discharges	1	1	3	1	17	no recorded events	inspected	soil contamination possible but an analyzed pathway	stream < EPA drinking water limit dominated	stream dominated	NR
			Joint Leak		Worn materials and/or cracks and/or corrosion	0	1	2	Low level contamination (approx 13,000 pCi/L) to shallow soils and river, where line discharges	1	1	3	1	17	no recorded events	inspected	soil contamination possible but an analyzed pathway	stream < EPA drinking water limit dominated	stream dominated	NR
			Piping		Corrosion of pipe materials	0	1	2	Low level contamination (approx 13,000 pCi/L) to shallow soils and river, where line discharges	1	1	3	1	17	no recorded events	inspected	soil contamination possible but an analyzed pathway	stream < EPA drinking water limit dominated	stream dominated	NR
21	ON	Dry Waste Piping	Catastrophic Failure		Environmental/Mechanical	0	3	2	Leak to surface and/or underground leaks to soil and groundwater	1	1	3	1	28	no recorded events	unknown condition	detectable soil contamination at environmental levels possible	secondary concentrations	stream	

Item No.	System ID	Risk Area	Potential Failure Mode	Mitigating Action (optional)	Potential Cause (Justify Likelihood)	LIKELIHOOD			Potential Failure Effect (Justify Consequence)	CONSEQUENCE				PRIORITY INDEX	LIKELIHOOD			CONSEQUENCE		
						History	Condition	Design		Inventory	Hazard	Morbidity	Recovery Potential		History	Condition	Design	Inventory	Hazard	Morbidity
			Cracked Walls		Corrosion at seams, fatigue and weathering	0	3	2	Leak to surface and/or underground leaks to soil and groundwater	1	1	3	1	28	no recorded events	unknown condition	detectable soil contamination at environmental levels possible	secondary concentrations	toxic	
			Corrosion		Damage to pipe to cause pitting and possible leaks	0	3	2	Leak to surface and/or underground leaks to soil and groundwater	1	1	3	1	28	no recorded events	unknown condition	detectable soil contamination at environmental levels possible	secondary concentrations	toxic	
			Joint Leak		Worn materials and/or cracks and/or corrosion	0	3	2	Leak to surface and/or underground leaks to soil and groundwater	1	1	3	1	28	no recorded events	unknown condition	detectable soil contamination at environmental levels possible	secondary concentrations	toxic	
			Flow Breaks		Worn cracked materials	2	3	2	Leak to surface and/or underground leaks to soil and groundwater	1	1	5	1	35	recorded events	unknown condition	detectable soil contamination at environmental levels possible	secondary concentrations	toxic	
22	AS	Auxiliary Steam System with low level drain (H-3)	Design discharge to ground through drain traps	Reference Corrosion Report 09-3404	Low levels of lithium in secondary system	3	1	3	Designed to leak to ground inside Protected Area	1	1	2	1	25	condensate designed to discharge to soil	good condition and inspected	soil deposition of condensation	secondary system	toxic	
			Catastrophic Failure		Condensate discharges to ground surface: see item number 1	1	1	1	Leak to soil	1	1	3	1	17	some steam leakage known	good condition and inspected	most activity released to atmosphere but soil contamination possible	secondary system	toxic	
			Cracked Walls		Corrosion at seams, fatigue and weathering	1	1	1	Leak to surface, similar to the designed discharge of condensate to the ground (see item 1)	1	1	3	1	17	some steam leakage known	good condition and inspected	most activity released to atmosphere but soil contamination possible	secondary system	toxic	
			Corrosion		Damage to tank to cause pitting and possible leaks	1	1	1	Leak to surface, similar to the designed discharge of condensate to the ground (see item 1)	1	1	3	1	17	some steam leakage known	good condition and inspected	most activity released to atmosphere but soil contamination possible	secondary system	toxic	
			Joint Leak		Worn materials and/or cracks and/or corrosion	1	1	1	Leak to surface, similar to the designed discharge of condensate to the ground (see item 1)	1	1	3	1	17	some steam leakage known	good condition and inspected	most activity released to atmosphere but soil contamination possible	secondary system	toxic	
			Pitting		Corrosion of pipe materials	1	1	1	Leak to surface, similar to the designed discharge of condensate to the ground (see item 1)	1	1	3	1	17	some steam leakage known	good condition and inspected	most activity released to atmosphere but soil contamination possible	secondary system	toxic	
23		Condensate Storage and Transfer Piping	Catastrophic Failure		Corrosion at seams, fatigue and weathering	0	1	2	Leak to subsurface soils	1	1	3	2	18	no recorded events	good condition and inspected	leakage to soil but modest concentrations possibly below detection	secondary system	toxic	
			Cracked Walls		Corrosion at seams, fatigue and weathering	0	1	2	Leak to subsurface soils	1	1	3	2	18	no recorded events	good condition and inspected	leakage to soil but modest concentrations possibly below detection	secondary system	toxic	
			Corrosion		Damage to pipe to cause pitting and possible leaks	0	1	2	Leak to subsurface soils	1	1	3	2	18	no recorded events	good condition and inspected	leakage to soil but modest concentrations possibly below detection	secondary system	toxic	
			Joint Leak		Worn materials and/or cracks and/or corrosion	0	1	2	Leak to subsurface soils	1	1	3	2	18	no recorded events	good condition and inspected	leakage to soil but modest concentrations possibly below detection	secondary system	toxic	
			Pitting		Corrosion of pipe materials	0	1	2	Leak to subsurface soils	1	1	3	2	18	no recorded events	good condition and inspected	leakage to soil but modest concentrations possibly below detection	secondary system	toxic	
24	NC	HC Basin	Leakage		Age related cracking of concrete	0	1	2	Leak to subsurface soils	1	1	3	2	18	no recorded events	good condition and inspected	leakage to soil but modest concentrations possibly below detection	disposal secondary water	disposed by lithium	toxic

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Item No.	System ID	Risk Area	Potential Failure Mode	Mitigating Action (optional)	Potential Causes (Identify Likelihood)	LIKELIHOOD			Potential Failure Effect (Identify Consequence)	CONSEQUENCE				PRIORITY INDEX	LIKELIHOOD			CONSEQUENCE		
						History	Condition	Design		Inventory	Hazard	Mobility	Post-Release Potential		History	Condition	Design	Inventory	Hazard	Consequence
		Piping to Reservoir	pipe leak	above ground piping or water column	Worn materials, joints, cracks and/or corrosion	1	1	2	Leak to soil	1	1	5	1	22	recorded events	good condition and inspected	leakage to soil but modest concentrations possibly below detection	collected secondary water	eliminated by return	dam
		Organics Basin	leakage		age related cracking of concrete	0	1	2	Leak to subsurface soils	1	1	3	2	19	no recorded events	good condition and inspected	leakage to soil but modest concentrations possibly below detection	collected secondary water	eliminated by return	dam
		Inorganic Basin	leakage		age related cracking of concrete	0	1	2	Leak to subsurface soils	1	1	3	2	19	no recorded events	good condition and inspected	leakage to soil but modest concentrations possibly below detection	collected secondary water	eliminated by return	dam

Notes:  
Likely: 1 - From decomposed waste +1; Co-MB effluent waste +2

## Spent Fuel Pool Matrix

SFPs.xls





## Sump Matrix

Sumps.xls

[illegible]

## APPENDIX D



**APPENDIX D**  
**SYSTEM DETAILS**

## **SYSTEMS QUESTIONNAIRE GROUNDWATER PROTECTION INITIATIVE**

### **GROUNDWATER PROTECTION INITIATIVE - CIRCULATING WATER (CW) and AUXILIARY COOLING WATER OPEN LOOP (OC) BURIED PIPE – CR 07-9083-5 and 7**

#### **CIRCULATING WATER**

The Circulating Water System provides cooling water to the Main Condensers for removal of heat to the Main Cooling Water Reservoir (MCR). 3 or 4 pumps are in service (per Unit) with each rated at approximately 225,000 gpm. The piping is made up of 84" (located in the Turbine Building), 96" and 138" (located above and below ground level) pre-stressed concrete cylinder pipe.

The normal failure of this type pipe is a rupture (fish mouth). Most likely a failure will be visually observed. However if the failure occurs on the supply side to the condensers the Control Room will also get an indication of a plant anomaly due to a change in condenser vacuum or a change in pump discharge pressure.

#### **OPEN LOOP**

The Open Loop System provides cooling water from the MCR to the ACW OC/Closed Loop Heat Exchangers, Non-Essential HVAC Chillers, Steam Generator Feedwater Pump/Turbine Lube Oil Coolers, Main Turbine Lube Oil Coolers and Generator Hydrogen Coolers. Normal Unit configuration has 2 pumps in service, each rated at approximately 11,900 gpm. The buried piping is made up of 30", 24", 18", 16", 14" and 10" diameter pre-stressed concrete cylinder and pre-tensioned concrete cylinder (bar wrapped) pipe.

Liquid Radwaste is discharged to the MCR through the Non-Essential HVAC Chillers OC Return Line.

All Open Loop is returned to the MCR through the CW piping.

The normal failure of this type pipe is a rupture (fish mouth). Most likely a failure will be visually observed. However if a failure occurs on the Control Room will get an alarm indicating a loss of discharge pressure.

#### **MATERIAL CONDITION**

A Life Cycle Management Study was conducted for the CW and OC Buried Pipe in 2002/2003. The following provides a discussion of the findings and the current status.

- The Circulating Water and Auxiliary Cooling Water Open Loop Pipe have 9 failure mechanisms that can be categorized into seven. The seven are corrosion, soil composition (sulfate, chloride and acidic), atmospheric exposure, stray current corrosion, galvanic corrosion cell, differential aeration cell and hydrogen induced cracking (cathodic overprotection).
- Stray Current and Galvanic Corrosion Cell were determined not to be a potential problem.
- We had no data on the soil composition, atmospheric exposure, and differential aeration cell corrosion (applies only to Circulating Water).
- There was data that showed that we had over impressed the cathodic protection current for about one-year in 1995.

The following activities have been conducted to determine the condition of the pipe. Also the status has been provided.

#### **ATMOSPHERIC EXPOSURE (Resolved)**

This failure mechanism exists for both CW and OC pipe that is exposed to the atmosphere and is located from the intake structure until the pipe enters the ground on the outside of the Main Cooling Reservoir embankment. It also exists for CW piping again where it penetrates the ground on the outside of the embankment on the return side until it reaches the reservoir water.

- The Carbonation analyzes of the OD concrete revealed very little degradation and is considered satisfactory. The recommended action is to develop an inspection PM and implement every 12 years. 04-10730-5, COMPLETE 2/20/05. PM 05436

#### **DIFFERENTIAL AERATION CELL (Resolved) – Circulating Water ONLY**

The Differential Aeration Cell exists at the splash zone where the pipe and the reservoir water interface.

- The carbonation levels ranged from a pH of 11.5 to 12.0 which is considered negligibly corrosive. The water soluble chloride concentration indicated a low potential for degradation of the concrete or corrosion of the pre-stressed wire. 04-10730-16, COMPLETE 5/17/07. PM 05436

#### **SOIL DEGRADATION (Resolved)**

The required action to protect the pipe from soil degradation is to maintain the cathodic protection system within the required parameters. Currently the cathodic protection system is performing as required to protect the Buried Pipe.

#### **CORROSION ISSUE (Resolved)**

Because of the size of the OC Pipe a visual inspection of the ID was not conducted and the above ground ID joints have the same material as the Circulating Water pipe. Based the inspection of the above ground OD CW Pipe joints the OC joints are considered acceptable.

The industry standard for joint material is Portland cement (the free lime (pH) in Portland cement passivates the carbon steel components and prevents corrosion). We have joints that have joint material other than Portland cement.

During 2RE12, 1-Unit 2 138" OD and 1- Unit 2 96" ID joint were inspected. The 138" joint was filled with an oil based product called Ram-Neck and showed no signs of deterioration.

The 96" joint material was determined to be Tex-O-Flex. This material holds water and was originally impregnated with Portland cement. The joint material, which had rust bleed from it, was removed and the steel parts were found to be in satisfactory condition.

As a result of these inspections our consultant provide inspection criteria and the initial inspection are underway.

#### **HYDROGEN INDUCED CRACKING (Analysis is underway)**

The Eddy Current Inspections of the Circulating Water Pipe were completed during 1RE12 and 2RE11. The data collected from this inspection will also be used for evaluating the Open Loop Pipe. The inspection method requires traversing the pipe and the Open Loop Pipe is too small a diameter and due to our piping configuration technology does not exist to perform this type of inspection in OC.

The firm of Simpson, Gumpertz and Hager (SGH) of Boston, MA has reviewed the Eddy Current data and has recommended further examination of the pipe. System Engineering is in the process of developing a Plan of Action and obtaining funding to perform this next step. Once the visual inspection of buried pipe is completed a repair /replacement plan will be developed and implemented.

#### **MAINTENANCE AND INSPECTION ACTIVITIES (07-9083-5)**

The following lists current activities related to inspection and maintenance activities.

- Inspection PM 05436 with a frequency of 624 weeks and a scope of OBTAIN THE SERVICES OF A CONSULTANT/LABORATORY TO (1) OBTAIN SAMPLES AND ANALYSIS OF EXTERIOR CONCRETE COVERING OF ATMOSPHERICALLY EXPOSED CIRCULATING WATER PIPE AND (2) OBTAIN SAMPLES AND ANALYSIS OF EXTERIOR CONCRETE COVERING WITHIN THE SPLASH ZONE OF THE 4-138" DISCHARGE PIPE. (RECOMMEND STRUCTURAL INTEGRITY, ORIGINAL LCM CONSULTANT AND TOOK INITIAL SAMPLE AND ANALYSIS, PM IS A RECOMMENDATION FROM SI). ALSO A WORK PACKAGE MAYBE REQUIRED TO PROVIDE ACCESS TO LOCATION AND REPAIR THE DISTURBED AREA (THIS WILL DEPEND ON DEPTH OF CONCRETE REMOVED).

- Inspection PM's 05648 and 05649 for the ID of the Unit 1 and 2 CW Pipe respectively with a frequency of C3 (every third cycle or 4.5 years) has a scope of DRAIN PIPING AND PROVIDE ACCESS TO PERFORM MATERIAL CONDITION INSPECTION. REPAIR ANY NOTED DEFICIENCIES THAT CANNOT MAKE A REFUELING CYCLE, OTHERWISE DOCUMENT FINDINGS AND CORRECT IN NEXT OUTAGE. **This is an ID inspection only.**
  - In addition to this scheduled inspection of the 96" above ground pipe and the buried and above ground 138" an inspection of the ID of the 96" pipe is conducted every cycle (every 18 months) also.
- The OD of the above ground 30" OC and 96" and 138" CW pipe is periodically inspected.

#### **WORK PRACTICES (07-9083-7)**

The following work practices are observed during various evolutions.

- Liquid Radwaste is discharged through a portion of the Open Loop System to the Circulating Water System. Both the CW and OC Operating Procedures require that the systems remaining in service for a prescribed time after completion of the discharge of Liquid Radwaste to prevent any potential contamination in the CW and OC systems.
- Precautions are taken during the drain down of the CW and OC Systems.
  - All joints on the temporary pipe are wrapped.
  - Berms are placed around the storm drains in the vicinity of the drain-down pumps and temporary pipe.
  - The temporary pipe between the supplemental cooling towers and the selected chillers is sloped to toward the Turbine Building.
- Warning signs are posted in certain sections of the OC System requiring HP personnel when a pipe connection is breached.

**SYSTEMS QUESTIONNAIRE  
GROUNDWATER PROTECTION INITIATIVE**

**System:** RCB Tendon Gallery Sump Pumps (DR)

**Name:** Matthew Hiatt

**Date:** 07/07/08

**System Description:** *(Provide a brief description of the purpose of the system)*

The RCB Tendon Gallery Sump Pumps (also known as the Fire Protection Drainage System Sump Pumps) are designed to remove water from the RCB Tendon Gallery Sumps and discharge it to the Yard Storm Drainage System. They are considered to be part of the Non-Radioactive Drains system (DR). The water in the sumps has four possible sources: fire protection water from the EAB cable spreading rooms and chases in the event of a fire and fire protection actuation, from the floor drains located on the -36'9" level of the tendon gallery, any seepage or condensation into the tendon gallery from outside sources (rain, humidity, etc.) and the drainage of groundwater seepage from FHB Room 11A (described in DCP 01-4145-1 and 2). None of the first three sources are generally radioactive and none would be expected to be radioactive in non-accident conditions (that is, there could be some release of radionuclides to the EAB during an accident that might be washed to the sump in the event of a fire protection actuation but this is not relevant for the purposes of groundwater protection). The fourth source is not radioactive under normal conditions but if there were through-wall leakage from the 16" Safety Injection line in the room, it would be possible for contaminated water to drain to the sumps. This is highly unlikely and would be detected through mechanisms such as system pressure tests, local leak rate tests, operator rounds, etc. (Ref. SPEC-DESIGN 9Q060MS1035)

In summary, this is not a credible avenue for groundwater contamination by radionuclides.

**Construction Materials:**

The pumps have a stainless-steel impeller, aluminum housing and zinc-plated carbon steel strainer.

**Location:** *(Above or below ground, located within structures, etc...)*

The RCB Tendon Gallery Sump Pumps are located below grade on the -39'9" level between the RCB and EAB. The discharge piping is routed up through the tendon gallery access area in the EAB and out to the Yard Storm Drainage System.

**Potential for leak:** *(Identify if small leaks would be detected and repaired, or if leaks would likely be a catastrophic failure)*

Any leakage from the pumps would be directed to the sump. Leakage from this system does not represent a credible source for groundwater contamination.

**Historic Repairs/Maintenance Activities:**

Not researched given the lack of credibility of these pumps as a source of groundwater contamination.



**Work Practices** *(Include frequency of inspections and proposed modifications/upgrades):*

Not researched given the lack of credibility of these pumps as a source of groundwater contamination.

**SYSTEMS QUESTIONNAIRE  
GROUNDWATER PROTECTION INITIATIVE**

**System: Liquid Waste (WL)**

**Name: Matthew Hiatt**

**Date: 07/07/08**

**System Description:** *(Provide a brief description of the purpose of the system)*

"The function of the liquid waste processing system (LWPS) is to collect, segregate, process, recycle and discharge various liquid wastes during plant operating power, refueling and maintenance operations". (Ref. DESIGN-SDM 5R309ND1014, Rev. 4, page 1)

The liquid waste system is designed to process contaminated fluids for eventual discharge into the environment. The system collects radioactive water from various sources within the plant including the equipment drains, floor drains, laundry and regenerated wastes. The liquids are processed through a collection of demineralizers, filters, ALPS and holding tanks (to allow for decay of the various nuclides present in the water) to reduce the concentration of radioactive nuclides in the water below the limits for release into the environment.

**Construction Materials:**

The vast majority of the piping in the WL system is made according to piping specification WG. This specifies that the pipe is quality class 7 and be made of Schedule 40S stainless steel (A312 316 or 316L). The one section of buried piping in the WL system has a 6" guard pipe made to specification XC around 4" process pipe made to specification WG. The guard pipe is quality class 7 seamless carbon steel (A106 Grade B). There are also limited portions of the system made to the WD, WR, WN, RC and RB specifications. With a few exceptions (i.e. nitrogen supplies to the RCDT, LASRST, etc.), most of the piping made to these specifications is no longer used because the equipment it supplies has been abandoned in place or is not used (i.e. waste evaporator package, auxiliary steam supply, etc.). (Ref. SPEC-DESIGN 5L019PS0004, Rev. 21)

The Yard Area Waste Monitor Tanks are constructed of stainless steel (A240 316L) with welded seams and welded nozzle connections. (Ref. VTI-DRAW 4442--00029UU)

**Location:** *(Above or below ground, located within structures, etc...)*

"The majority of the LWPS are located in the Mechanical Auxiliary Building (MAB) with some equipment in the Reactor Containment, the Fuel Handling Building and the Yard Area". (Ref. DESIGN-SDM 5R309ND1014, Rev. 4, page 2)

The majority of the WL system piping is located within the MAB with smaller sections in the FHB, RCB and Yard Area. The portions of the WL system that are in the Yard Area are associated with Waste Monitor Tanks (WMT) D, E and F on the south side of the MAB. There is one section of buried pipe (4"WL1596-WG7 inside 6"WL1596-XC7) that runs from the Yard Area down to a penetration in the MAB at 22' 6". Otherwise, all of the Yard Area WL piping is above-ground.

**Potential for leak:** *(Identify if small leaks would be detected and repaired, or if leaks would likely be a catastrophic failure)*

Given the low operating pressures/flow-rates in the WL system, the materials used for the process piping and the process fluid (very dilute boric acid), the locations with the highest potential for leakage are mechanical joints such as flanges and valve packing. Because most of the WL process piping is located indoors, the only area where leaks would present a credible groundwater contamination issue is on the piping around the WMTs in the Yard Area and the WMTs themselves. Given the materials of construction used for these components and the methods of construction (almost every joint is welded and the one section of buried pipe has a guard pipe surrounding it), leakage is unlikely.

In the event a leak did occur in the Yard Area, it would be detected in a timely fashion as this piping is monitored daily by plant operators during rounds. Regular walk-downs of the Yard Area piping by the System Engineer for Freeze Protection and for system monitoring would also ensure that leakage is observed and corrected in a timely fashion. Furthermore, plant operators log the WMT levels daily as part of their rounds and would observe a decline in level if significant leakage were to occur downstream of the WMTs. There is also a 26 week PM to inspect and clean the berms around the tanks. Performance of this PM helps to ensure that leakage is identified in a timely manner.

The consequences of leakage from the outdoor WMTs are also not as significant as leakage from other areas of the WL system since this is the last step before the water is discharged to the reservoir. The concentration of radionuclides in the water in the outdoor WMTs is near or below the limits for radioactive effluent and thus the amount of contamination that can be spread from a leak is limited. Leakage from the WMT area should flow into the sump area and be pumped back into the WMT by the WMT Sump Emptying Pump which will further minimize groundwater contamination.

**Historic Repairs/Maintenance Activities:**

There have been a number of CRs and work orders written to track leakage in the WL system but there are currently no leaks being monitored in the radwaste yard area. All of the identified leaks on the WL system are located inside the MAB or RCB. The maintenance history on the outdoor WMTs does not record any leakage from the tanks.

The maintenance history on the outdoor WL components showed a total of 6 work orders over 20 years of operation to correct external leaks. Most of these leaks were on the seals for the various WMT pumps or the WMT Sump Emptying Pump. Given the relative infrequency of these work orders when compared to other pumps in the plant, no additional PMs (there are existing Inspect and Lube PMs on a 208 week frequency for all of these pumps) will be generated and the frequency will not be changed.

**Work Practices** *(Include frequency of inspections and proposed modifications/upgrades):*

The WMTs and their associated piping are monitored daily during operator rounds. On a less frequent basis, they are also monitored by the WL System Engineer as part of normal system

monitoring and Freeze Protection walk-downs. There is also a 26 week PM (06000652 for Unit 1 and 06000658 for Unit 2) to "Inspect and clean area inside berms surrounding the waste monitoring tanks and pumps". Performance of this PM provides both an opportunity to identify leakage and an improvement in the ability of the operator or engineer to spot leakage during their regular walk-downs (i.e. no loose debris to hide boric acid deposits). If a leak is identified in this area, it would be monitored under the Fluid Leak Management Program (OPGP03-ZA-0133) or the Boric Acid Corrosion Control Program (OPGP03-ZE-0133).

## Systems Questionnaire Groundwater Protection Initiative

<b>System:</b> Condensate Polishing (CP)
<b>Impacted Portion:</b> Total Dissolved Tank (TDS) discharge in both Units to Neutralization (NC) Basin
<b>Name:</b> Charles Corporon
<b>Date:</b> July 10, 2008
<b>System Description:</b> Discharges waste water from resin regeneration to the Neutralization Basin. The Total Dissolved Solids tanks and discharge pumps are contained inside a concrete berm. The discharge piping exits the berm and goes underground and surfaces at the Neutralization Basin. All discharge water is monitored for radiation.
<b>Construction Materials:</b> Filament wound, glass fiber reinforced, thermosetting epoxy resin (FRP) pipe with threaded, mechanical adhesive or combination type joints, ASTM D-2310 and D-2996 (piping spec WZ, 5L019PS0004)
<b>Location:</b> Begins on the East side of the TGB of each Unit, traveling underground South and then East, entering the North side of the NC Basin
<b>Potential for leak:</b> Leaks have occurred in this piping in the past and the evidence of a leak shows on the ground surface. This piping is monitored as a routine part of Operational rounds. Plant procedures direct Operations personnel to check for process piping leakage in the course of their normal operator rounds.
<b>Historic Repairs / Maintenance Activities:</b> Since 1994, Unit 1 piping has had 18 underground leaks and 1 above ground leak. Unit 2 piping has had 7 underground leaks. Underground leaks were repaired by excavating the piping and making repairs in accordance with plant procedures.
<b>Work Practices:</b> Leaks are repaired as they occur.

**Systems Questionnaire  
Groundwater Protection Initiative**

<b>System:</b> Oily Waste (OW)
<b>Impacted Portion:</b> Turbine Generator Building Sumps in both Units to Main Reservoir
<b>Name:</b> Charles Corporon
<b>Date:</b> July 10, 2008
<b>System Description:</b> Receives oily waste water from sumps in both Units, processes the water through the Oily Waste Processing area and discharges clean water to the Main Reservoir. All discharge water is monitored for radiation.
<b>Construction Materials:</b> Ductile iron pipe to ANSI A-21-51, cement lined to ANSI A21.4, Joint to ANSI A-21.11(2, 3 and 5) (pipe spec WF, 5L019PS0004)
<b>Location:</b> Underground between Units 1 and 2, collected in the Utility Area Sump, transferred to the Oily Waste Treatment area and then is sent underground to the main Reservoir.
<b>Potential for leak:</b> This piping is monitored as a routine part of Operational rounds. Plant procedures direct Operations personnel to check for process piping leakage in the course of their normal operator rounds.
<b>Historic Repairs / Maintenance Activities:</b> There have been no underground pipe leaks. There have been 5 above ground leaks from pipe or hose leaks which were repaired using plant approved methods.
<b>Work Practices:</b> Leaks are repaired as they occur.

**Systems Questionnaire  
Groundwater Protection Initiative**

<b>System:</b> Auxiliary Steam (AS) <b>Impacted Portion:</b> Auxiliary Steam Header between Units 1 and 2 <b>Name:</b> Charles Corporon <b>Date:</b> July 10, 2008
<b>System Description:</b> The Aux Steam Header is used to transfer steam from one Unit to the other Unit, from the Auxiliary Boiler to either of the Unit and from each Unit to the Liquid Waste station in each Unit.
<b>Construction Materials:</b> Carbon Steel, seamless, ASTM A-106 Grade B (6, 12 & 13)
<b>Location:</b> From the South of each TGB and traverses South to the header running South of the road on the South side of each Fuel Handling Building, running above ground and through concrete tunnels under roads.
<b>Potential for leak:</b> This piping is monitored as a routine part of Operational rounds. Plant procedures direct Operations personnel to check for process piping leakage in the course of their normal operator rounds.
<b>Historic Repairs / Maintenance Activities:</b> No leaks have been found in this piping.
<b>Work Practices:</b> Leaks would be repaired as they occur.

**Systems Questionnaire  
Groundwater Protection Initiative**

<b>System:</b> Condensate Storage and Transfer (CT)
<b>Impacted Portion:</b> Secondary Makeup Tank to Turbine Generator Building in each Unit
<b>Name:</b> Charles Corporon
<b>Date:</b> July 10, 2008
<b>System Description:</b> Stores and transfers makeup water to the condenser in each Unit.
<b>Construction Materials:</b> Carbon Steel, seamless, ASTM A-106 Grade B (19 & 20) (piping spec. XC, 5L019PS0004)
<b>Location:</b> Underground between the Secondary Makeup Tank and TGB in each Unit
<b>Potential for leak:</b> This piping is monitored as a routine part of Operational rounds. Plant procedures direct Operations personnel to check for process piping leakage in the course of their normal operator rounds.
<b>Historic Repairs / Maintenance Activities:</b> There have been no underground leaks in this piping.
<b>Work Practices:</b> Leaks would be repaired as they occur.



**Systems Questionnaire  
Groundwater Protection Initiative**

<b>System:</b> Nonradioactive Chemical Waste Treatment (NC) Neutralization Basin <b>Impacted Portion:</b> Neutralization Basin to Main Reservoir <b>Name:</b> Charles Corporon <b>Date:</b> July 10, 2008
<b>System Description:</b> Receives nonradioactive chemical waste from various sources and transfers to Main Reservoir after treatment.
<b>Construction Materials:</b> Ductile iron pipe to ANSI A-21.51, Joints to ANSI A-21.11 (2 & 3)(pipe spec. WC)
<b>Location:</b> From South of the NC basin above and below ground through a carbon steel tunnel under the reservoir road and discharges into Main Reservoir.
<b>Potential for leak:</b> This piping is monitored as a routine part of Operational rounds. Plant procedures direct Operations personnel to check for process piping leakage in the course of their normal operator rounds. Low pressure open ended piping.
<b>Historic Repairs / Maintenance Activities:</b> There have been leaks both above and below ground.
<b>Work Practices:</b> Leaks are repaired as they occur.

**Systems Questionnaire  
Groundwater Protection Initiative**

<b>System:</b> Nonradioactive Chemical Waste Treatment (NC) Organics Basin <b>Impacted Portion:</b> Organics Basin to Neutralization Basin <b>Name:</b> Charles Corporon <b>Date:</b> July 10, 2008
<b>System Description:</b> Collects organic nonradioactive chemical waste from various sources and transfers to the NC Basin for treatment.
<b>Construction Materials:</b> Carbon steel, ASTM A-53 Type E or better, Flanged both ends with 150# ANSI B16.5 flanges of ASTM A-395 cast ductile iron, polypropylene lined with molded, raised face. (pipe spec. WX)
<b>Location:</b> South of Units between the Organics Basin and the NC Basin.
<b>Potential for leak:</b> This piping is monitored as a routine part of Operational rounds. Plant procedures direct Operations personnel to check for process piping leakage in the course of their normal operator rounds.
<b>Historic Repairs / Maintenance Activities:</b> There have been no leaks in this piping.
<b>Work Practices:</b> Leaks will be repaired as they occur.

## APPENDIX E

**APPENDIX E**  
**CONDITION REPORT DOCUMENTATION**

## CONDITION RECORD

Page 1 Of 6

Condition No : 06-1056

Date Printed: 04/29/2008

Z 31.02

## Description:

TRITIUM WAS IDENTIFIED IN WATER SAMPLES FROM PIEZOMETER WELL #221 (BETWEEN UNITS 1 AND 2) AND TENDON GALLERY WATER SAMPLES FROM EACH UNIT. THE HIGHEST RESULT WAS ASSOCIATED WITH THE UNIT 2, 64 DEGREE TENDON BUTTRESS AND SIMILAR TO THE CONCENTRATION OF SOME 2005 MAIN COOLING RESERVOIR SAMPLES. PIEZOMETER WELL #221 ALSO EXHIBITED SIMILAR LEVELS. SAMPLES FROM WELLS AT THE PERIPHERY OF THE PROTECTED AREA AND BETWEEN THE UNITS AND THE RESERVOIR WERE MUCH LOWER. NO GAMMA EMITTING RADIONUCLIDES WERE DETECTED. ALL SAMPLES ARE BELOW THE EPA DRINKING WATER LIMIT FOR TRITIUM.

Discovery Date : 01/24/08 15:52:00

Originator : WILLIAM T BULLARD

Created/Entered By: WILLIAM T BULLARD

Unit : 9

Related No :

Activity No :

System:

TPNS:

Location: Bldg:

Room :

Elevation :

Document No:

Supervisor Oper: NO

SS Oper:

Human Performance: NO

Supervisor Rprt : NO

SS Rprt :

Significance Code: C Level: D Type: O Description: CAQ-D, DEPT-OTHER

Supervisor : WILLIAM T BULLARD

Owner : DAVID P SWETT

DAVID P SWETT

08/14/2008

Organization : HEALTH PHYSICS

Signature

Date

Cause :

Event Code: 2A3 CONTAMINATION INTRUSION  
2A4 EFFLUENTS/RAD MONITOR ISSUE

Cause Code :

Resp Org Code:

Cross Ref CR : 06-3508 ANALYSIS OF SAMPLES IN UNIT  
06-3826 OVERALL TRACKING OF PROJECT

Source Document:

Comments:

Status: CLOSED

Status Date: 08/14/2008

Closure Comments: SEE ACTION COMMENTS

## CONDITION RECORD

Page 2 Of 6

Action No : 06-1056-1

Action Description : CONFIRM RESULTS - ANALYZE DUPLICATE SAMPLES FROM U1 AND 2 TENDON GALLERY AND WELL 221

Action Type : INVST / SUPPT / NA

Unit : 9

WAN :

Activity No :

System Code:

TPNS:

Document No:

Action Owner : JIMMY DARRELL SHERWOOD

Organization : HEALTH PHYSICS

Initiation Date : 01/24/2006

Due Date :

02/16/2006

Completion Date : 02/13/2006

50.59 Review Date:

Owner Comments : COLLECTION OF SAMPLES WAS COMPLETED ON 01/31/2006 AND THE RESULTS WERE REPORTED ON 02/13/2006. DATA TO BE INCLUDED IN ACTION #5

General Comments:

Attachments:

Action No : 06-1056-2

Action Description : EVALUATE PLAN OF ACTION FOR ADDITIONAL SAMPLING TO BOUND THE AFFECTED AREA(S)

Action Type : INVST / SUPPT / NA

Unit : 9

WAN :

Activity No :

System Code:

TPNS:

Document No:

Action Owner : GORDON E WILLIAMS

Organization : HEALTH PHYSICS

Initiation Date : 01/24/2006

Due Date :

02/15/2006

Completion Date : 02/14/2006

50.59 Review Date:

Owner Comments : SAMPLING EXPANDED TO INCLUDE ALL WELLS WITHIN THE PROTECTED AREA (DEEP AND SHALLOW) THAT CAN BE SAMPLED. ALSO SAMPLE BOTH BUTTRESS AREAS AND THE TENDON GALLERY SUMPS OF BOTH UNITS FOR GROUND WATER INTRUSION. ALSO SAMPLE THE MOISTURE IN THE AIR OF BOTH UNITS FUEL HANDLING BUILDINGS USING COLD TRAPS.

General Comments:

Attachments:

## CONDITION RECORD

Page 3 Of 6

Action No : 06-1056-3

Action Description : ANALYZE CHEMICAL CONSTITUENTS/ OTHER CHARACTERISTICS OF WATER SAMPLES ? E.G.,  
CONDUCTIVITY, ANIONS, ETC

Action Type : INST / SUPPT / NA

Unit : 9

WAN :

Activity No :

System Code:

TPNS:

Document No:

Action Owner : GORDON E WILLIAMS

Organization : HEALTH PHYSICS

Initiation Date : 01/24/2006

Due Date :

02/02/2006

Completion Date : 02/02/2006

60.69 Review Date:

Owner Comments : SEE ATTACHED ANALYSIS.

General Comments:

Attachments: ANALYSIS RESULTS

Action No : 06-1056-4

Action Description : DEVELOP FAULT TREE TO DETERMINE POTENTIAL SOURCES OF TRITIUM TO EXPLAIN THE  
OBSERVATION

Action Type : INST / SUPPT / NA

Unit : 9

WAN :

Activity No :

System Code:

TPNS:

Document No:

Action Owner : WILLIAM HUMBLE JR

Organization : RAPID RESPONSE TEAM

Initiation Date : 01/24/2006

Due Date :

02/02/2006

Completion Date : 01/30/2006

60.69 Review Date:

Owner Comments : ATTACHMENT CONTAINS INITIAL FAULT TREE OF JAN 26, 2006.

General Comments:

Attachments: INITIAL FAULT TREE

## CONDITION RECORD

Page 4 Of 6

Action No : 06-1056-5

Action Description : PERFORM APPARENT CAUSE FOR TRITIUM RESULTS IN GROUND WATER

Action Type : INVST / EVAL / APPARENT

Unit : 9

WAN :

Activity No :

System Code:

TPNS:

Document No:

Action Owner : GORDON E WILLIAMS

Organization : HEALTH PHYSICS

Initiation Date : 01/24/2006

Due Date :

03/30/2006

Completion Date : 03/22/2006

50.59 Review Date:

Owner Comments : SEE ATTACHED.

General Comments:

Attachments: EVALUATION

Action No : 06-1056-6

Action Description : EVALUATE IMPACT ON OOCM/REMP AND NEED FOR AUGMENTED SAMPLING

Action Type : EVAL / ASSESSMNT / FLT IMPACT

Unit : 9

WAN :

Activity No :

System Code:

TPNS:

Document No:

Action Owner : GORDON E WILLIAMS

Organization : HEALTH PHYSICS

Initiation Date : 01/24/2006

Due Date :

08/31/2006

Completion Date : 05/02/2006

50.59 Review Date:

Owner Comments : SAMPLING IDENTIFIED NO PATHWAY TO A MEMBER OF THE PUBLIC NOT PREVIOUSLY IDENTIFIED IN THE OOCM. NO EVIDENCE WAS FOUND THAT INDICATES THAT TRITIUM IDENTIFIED WITHIN THE PROTECTED AREA MIGRATES OFFSITE IN CONCENTRATIONS NOT ALREADY EXCEEDED IN SURFACE WATER RUNOFF. GROUND WATER FROM THE SHALLOW AQUIFER WHERE TRITIUM WAS IDENTIFIED IS NOT CONSUMED BY MEMBERS OF THE PUBLIC. THE PRIMARY EXPOSURE PATHWAY FOR TRITIUM IN WATER CONTINUES TO BE RELIEF WELL FLOW THAT DRAINS OFFSITE AND MAY BE CONSUMED BY CATTLE THAT ARE SUBSEQUENTLY CONSUMED BY MEMBERS OF THE PUBLIC. SHALLOW WELLS NEAR THE SITE BOUNDARY THAT COULD BE USED FOR LIVESTOCK WATER MAY ONE DAY BE INFLUENCED BY RESERVOIR WATER INTRUSION. HOWEVER, THE OOCM ALREADY ASSUMES LIVESTOCK CONSUME WATER INFLUENCED BY TRITIUM IN THE RESERVOIR SO NO NEW PATHWAY EXISTS.

FIVE WELLS WITHIN THE PROTECTED AREA SHOULD BE SAMPLED ON A QUARTERLY OR ANNUAL BASIS TO CONFIRM NO INCREASE IN CONCENTRATION OR MIGRATION OF TRITIUM OUTSIDE THE PROTECTED AREA. HOWEVER, THE OOCM DOES NOT REQUIRE REVISION AS A CONSEQUENCE OF THIS VOLUNTARY GROUND WATER SAMPLING.

General Comments:

Attachments:



## CONDITION RECORD

Page 5 Of 6

Action No : 06-1056-7

Action Description : EVALUATE STP DECOMMISSIONING PLAN TREATMENT OF TRITIUM IN GROUND WATER IN LIGHT OF THE APPARENT CAUSE AND EXTENT OF CONDITION INCLUDING FINANCIAL ASSURANCE AND RECORD KEEPING REQUIREMENTS OF 10CFR50.75

Action Type : EVAL / ACTION / OTHER

Unit :

9

WAN :

Activity No :

System Code:

TPNS:

Document No:

Action Owner : GORDON E WILLIAMS

Organization : HEALTH PHYSICS

Initiation Date : 01/24/2006

Due Date :

08/30/2006

Completion Date : 05/01/2006

50.59 Review Date:

Owner Comments : THE CONCENTRATION OF TRITIUM IDENTIFIED IN GROUND WATER IS WITHIN THE EPA DRINKING WATER LIMITS. ALTHOUGH TRITIUM IS WIDE SPREAD IN THE SHALLOW GROUND AQUIFER, THE EXTENT OF THE AREA IMPACTED AND THE CONCENTRATIONS IDENTIFIED ARE BOUNDED BY THE DESCRIPTIONS IN THE ODCM AND UPSAR. NO SPECIFIC PLANS ARE REQUIRED TO DECONTAMINATE AT THE TIME OF DECOMMISSIONING. THE DECOMMISSIONING CRITERIA CANNOT BE FULLY ANTICIPATED AT THIS TIME, BUT RADIOACTIVE DECAY IN THE SHALLOW AQUIFER WILL LIKELY BE THE MOST PRACTICAL DECONTAMINATION OPTION AND SHOULD MINIMIZE THE POTENTIAL FOR EXPOSURE TO MEMBERS OF THE PUBLIC.

General Comments:

Attachments:

Action No : 06-1056-8

Action Description : EVALUATE THIS DATA AGAINST HISTORICAL RESULTS FROM THE TENDON GALLERY

Action Type : INVST / SUPPT / NA

Unit :

9

WAN :

Activity No :

System Code:

TPNS:

Document No:

Action Owner : GORDON E WILLIAMS

Organization : HEALTH PHYSICS

Initiation Date : 01/24/2006

Due Date :

02/02/2006

Completion Date : 01/30/2006

50.59 Review Date:

Owner Comments : CHEMISTRY WAS ABLE TO FIND A RESULT FROM 8 JANUARY 1989 FOR THE UNIT 1 FIB BUTTRESS AREA. AT THAT TIME THE TRITIUM CONCENTRATION WAS 4220 PC/KG. THE TRITIUM CONCENTRATION IN THE RESERVOIR AVERAGED ABOUT 9600 PC/KG IN 1988. THE LAST TIME THE RESERVOIR WAS AS LOW AS 4000 PC/KG WAS IN 1984.

General Comments:

Attachments:

## CONDITION RECORD

Page 6 Of 6

Action No : 06-1056-9

Action Description : DEVELOP LABELS FOR WATER WELLS INSIDE THE PROTECTED AREA. 25 WELLS NEED IDENTIFICATION AROUND THE PVC PIPE LABELED.  
203C,218C,218E,220C,221C,221E,222C,222E,222H,223C,223E,225C,225E,230C,238E,241C,241E,243C,243E,244C,244E,245C,245E,273K

Action Type : LBLRQ / REQUEST / ACTION

Unit : 0

WAN :

Activity No :

System Code:

TPNS:

Document No:

Action Owner : CHERYL HAGER

Organization : OPERATIONS CAP &amp; ASSESSMENTS

Initiation Date : 05/10/2006

Due Date : 07/31/2006

Completion Date : 06/07/2006

50.59 Review Date:

Owner Comments : 24 B2 BLK BORDER TT TO L. STOICESCU.  
KRY  
THE PLANT LABELING DEPT. HAS BEEN ASKED TO HELP.

General Comments:

Attachments:

Action No : 06-1056-10

Action Description : CREATE PROJECT FOR MONITORING, ANALYSIS, AND COMMUNICATION OF GROUND WATER TRITIUM  
Action Type : CORAC / NA / NA

Unit : 0

WAN :

Activity No :

System Code:

TPNS:

Document No:

Action Owner : DAVID P SWETT

Organization : HEALTH PHYSICS

Initiation Date : 06/08/2006

Due Date : 06/12/2006

Completion Date : 06/07/2006

50.59 Review Date:

Owner Comments : PROJECT CREATED WITH R. GANGLIFF AS PROJECT MANAGER. CR 06-3826 CREATED TO TRACK ACTIONS FOR THE PROJECT.

General Comments:

Attachments:

**ATTACHMENT TO**

**CR ACTION**

**06-1056-4**

**Document Description/Title:**

**INITIAL FAULT TREE**

**Fault Tree for CR 06-1056**  
**Tritium Was Identified in Water Samples From Piezometer Well #221**  
**(Between Units 1 and 2) and Tendon Gallery Water Samples From Each**  
**Unit**  
**January 26, 2006**

**Sources considered to be highly likely:**

- 1.0 CP discharge piping
- 2.0 CW piping
  - 2.1 Unit 1 piping
    - 2.1.1 Unit 1 supply piping
    - 2.1.2 Unit 1 return piping
  - 2.2 Unit 2 piping
    - 2.2.1 Unit 2 supply piping
    - 2.2.2 Unit 2 return piping
- 3.0 OC piping
  - 3.1 Unit 1 supply piping
  - 3.2 Unit 2 supply piping
- 4.0 Sand layers under site (Reservoir)

**Sources considered to be medium likely:**

- 5.0 Oily Waste Piping
- 6.0 OW Surge Tank
- 7.0 NC Basin
- 8.0 Organics Basin
- 9.0 Draining events of secondary system (CD)

**Sources considered to be low likelihood:**

- 10.0 SPF
- 11.0 RCS
- 12.0 Secondary Systems
  - 12.1 Steam between Units
  - 12.2 CD between Units
- 13.0 Rain runoff
- 14.0 RWST
- 15.0 Inorganics Basin
- 16.0 ECW piping
- 17.0 NaHCl pits
- 18.0 Liquid Radiological Waste piping
- 19.0 Truck bay drains

**Fault Tree for CR 06-1056**  
**Tritium Was Identified in Water Samples From Piezometer Well #221**  
**(Between Units 1 and 2) and Tendon Gallery Water Samples From Each**  
**Unit**

January 26, 2006

Questions to be asked of high, medium, and low likelihood sources of tritium:

1. Is the source activity concentration (current or historical) high enough to explain the observation? All sources
2. What is the proximity of this source to the observation locations? All sources
3. Regardless of proximity is there a feasible pathway? All sources
4. Are methods available to detect and quantify leakage? All sources
5. Are samples from deeper wells consistent with samples already collected? Reservoir and High likelihood sources
6. What samples are needed to characterize on site tritium concentrations? (where, frequency, etc.)

Actions:

1. Gather data for systems regularly sampled. Owner: Chemistry Due Date: 2/23/06
2. Sample other low and medium likelihood systems for results. Owner: Chemistry Due Date: 3/23/06
3. Sample CP discharge (Unit 1 and Unit 2) Owner: Chemistry Due Date: 2/23/06
4. Expand piezometer sampling. Owner: Health Physics Due Date: 5/15/06

**Plus/Deltas for Fault Tree Meeting**

Plus	Delta
<ul style="list-style-type: none"><li>• Good discussion</li></ul>	<ul style="list-style-type: none"><li>• Conflict with NRC pre-exit meeting<ul style="list-style-type: none"><li>• Is a consultant needed?</li></ul></li></ul>

**ATTACHMENT TO**

**CR ACTION**

**06-1056-3**

Document Description/Title:

**ANALYSIS RESULTS**

### Chemical Characteristics of Water Samples

Sample Point	Date/ Time	Conductivity (uS)	Chloride (ppm)	Sulfate (ppm)	Nitrate (ppm)	Silica (ppm)	Tritium (pCi/kg)
Circ Water	1/24/2006 13:57	3580	911	175	55	16.4	~13,000
Well 221C	12/1/2006 11:15	25100	38	1615	3965	21.5	13,500
Well 244C	12/1/2006 14:25	29700	1086	222	4394	23.5	<LLD
U-1 EAB 10' sump	1/9/2006 13:30	24200	7.5	9.3	3470	14.5	2030
U-2 64deg. Buttress	1/9/2006 13:00	21800	10.9	6.8	3182	7.3	13,800

**ATTACHMENT TO**

**CR ACTION**

**06-1056-5**

Document Description/Title:

**EVALUATION**



# Condition Report 06-1056

## Groundwater Tritium within the Protected Area

### Event Description:

Nuclear power facilities release tritium to the atmosphere and in liquid effluents. The nuclear power industry has identified issues with unmonitored tritium and tritium in local ground water. STP is evaluating tritium at STP and is tracking associated actions on related Condition Report 06-3826.

STP is known to release about 2000 Curies of tritium each year, mostly to the main cooling reservoir. The main cooling reservoir is the source of the circulating coolant used to condense secondary steam as part of the electric generation process. Because tritium is released to the reservoir, the tritium concentration in the circulating coolant normally ranges between about 9,000 to 15,000 pCi/kg.

The reservoir is above grade so hydrostatic pressure forces some reservoir water into the shallow groundwater aquifer. Hence tritium is routinely measured in groundwater from shallow relief wells that encircle the main cooling reservoir. In 1999 samples were collected from the tendon gallery sumps of the Units to determine the concentration in groundwater leaking into these areas of the plant. The concentrations measured (about 4000 pCi/kg) were consistent with the reservoir concentration at that time. Recently a set measurements of the groundwater associated with shallow wells within the protected area also identified trace concentrations of tritium. The concentrations measured (up to about 1000 pCi/kg) were much lower than the reservoir water (13,000 pCi/kg) with the highest concentrations closest to the reservoir. However, Well #221C located between the two Units had a tritium concentration similar to the reservoir.

The slightly elevated concentration measured between the two Units may be due to a source other than infiltration of the main cooling reservoir water into the ground water within the protected area. To answer this question, a comprehensive set of samples was obtained from all the wells within the protected area from which samples could be collected. In addition samples were collected from all spaces within the two Units into which groundwater was thought to penetrate.

### Significance:

If tritium were entering the groundwater from a source not identified by the ODCM, STP could have an unmonitored effluent release point. In that event, the ODCM would require modification and a method to quantify the release would be necessary. This analysis did not identify a new release point.

### Apparent Cause:

The elevated concentration of tritium for Well #221C (shallow) is most likely due to leakage from piping buried in the vicinity of the well. The Total Dissolved Solids (TDS) pipe from Unit 2 passes about 20-feet west of the well and is known to have leaked in this area in May of 2003. The circulating coolant and open loop coolant lines pass east of Well #221C about 35-feet. All are relatively shallow which would explain the lower tritium concentration in the adjacent but deeper Well #221E.

### Recommended Actions:

1. Continue monitoring Wells #221C and #221E quarterly to identify any change in the concentration of tritium.

2. Perform chloride and sulfate checks of the Well #221C water for comparison with the TDS and circulating coolant concentrations.
3. Annually sample Wells #220C, #222C, and #273K (north, south, and east respectively) to identify any spread of the tritium in the shallow aquifer.

If the tritium concentration in Well #221C increases above 20,000 pCi/kg or the tritium concentration in any of the surrounding wells indicates spreading of the tritium in the shallow aquifer, additional actions should be considered.

#### **Additional Information:**

Groundwater in the shallow aquifer was sampled from wells within the protected area as shown in the following figure. Groundwater that seeped into the Units was also sampled although the building environment likely affected the measured tritium concentrations.

Wells were purged with about 5 gallons of water before collecting samples. The wells had maximum pipe diameters of about 1.25 to 1.75 inches; hence each gallon of water cleared about 31 feet of pipe. Most of the wells were less than about 40 feet deep and sampling at these wells was within about a foot of the bottom. When a well was deeper than the length of sample hose, the sampling was performed at the maximum hose length. Note that all depths are the depth of the well measured from local grade level. Local grade is about 29 feet above sea level in most areas.

Four wells were sampled in duplicate. At locations with more than one well, both deep and shallow wells were sampled as available. Wells designated by the letter "C" were typically the shallowest. Wells with an "E" or other designator were deeper, some more than the sample hose length (up to 62 feet). The samples were collected from December 2005 through February 2006.

The samples collected within the Units involved scooping a gallon of water from standing water in each area sampled. The sampling method assumed that tritium was well mixed in the water since in all cases the water had been standing for extended periods of time, sometimes exceeding a year.

The following figure contains the well locations relative to the excavation performed for the foundations of each unit. Wells surrounded by green boxes were found to have trace amounts of tritium from less than detectable (<300 pCi/kg) up to about 500 pCi/kg. The wells surrounded by orange boxes contain tritium concentrations up to about 1500 pCi/kg and appear more strongly influenced by the reservoir. Note that the reservoir runs parallel to the bottom of the figure and is outside the area plotted.

Locations with tritium concentrations equal to or greater than the reservoir are identified by red. Each Unit is identified by red since tritium concentrations are higher than the reservoir water in some areas into which ground water penetrates.



# TRITIUM IN GROUND WATER INSIDE THE PROTECTED AREA

LSN	STATION CODE	VECTOR (Approximate)	LOCATION DESCRIPTION (depths from local grade)	Tritium Activity Level (picocuries/kilogram)
39913	801	Protected Area	Ground Water Well # 201 E 53'	1.15E+03
39914	803	Protected Area	Ground Water Well # 203 C 18'	<LLD
39915	803	Protected Area	Ground Water Well # 203 C 18'	<LLD
39916	805	Protected Area	Ground Water Well # 218 C 18'	<LLD
39917	806	Protected Area	Ground Water Well # 218 E >62'	3.91E+02
39918	806	Protected Area	Ground Water Well # 218 E >62'	4.25E+02
40328	835	Protected Area	Ground Water Well # 220 C 21'	<LLD
40329	836	Protected Area	Ground Water Well # 220 E >50'	4.94E+02
39919	807	Protected Area	Ground Water Well # 221 C 23'	1.35E+04
40176	807	Protected Area	Ground Water Well # 221 C 23'	1.38E+04
40177	808	Protected Area	Ground Water Well # 221 E 40'	5.71E+02
39920	809	Protected Area	Ground Water Well # 222 E 24'	<LLD
40319	810	Protected Area	Ground Water Well # 222 C 20'	4.20E+02
40330	837	Protected Area	Ground Water Well # 222 H 50'	<LLD
39921	811	Protected Area	Ground Water Well # 223 C 41'	2.74E+02
40320	812	Protected Area	Ground Water Well # 223 E >50'	9.94E+02
39922	813	Protected Area	Ground Water Well # 225 C 43'	<LLD
40321	813	Protected Area	Ground Water Well # 225 C 43'	<LLD
40322	814	Protected Area	Ground Water Well # 225 E 44'	<LLD
39923	815	Protected Area	Ground Water Well # 230 C 41'	3.21E+02
40323	815	Protected Area	Ground Water Well # 230 E >50'	9.71E+02
39924	818	Protected Area	Ground Water Well # 238 E 16'	<LLD
39925	821	Protected Area	Ground Water Well # 241 C 39'	3.86E+02
40324	822	Protected Area	Ground Water Well # 241 E 45'	4.42E+02
40325	823	Protected Area	Ground Water Well #243 C 36'	<LLD
39926	824	Protected Area	Ground Water Well # 243 E 62'	<LLD
39927	825	Protected Area	Ground Water Well # 244 C 41'	<LLD
40326	826	Protected Area	Ground Water Well #244 E 42'	<LLD
39928	827	Protected Area	Ground Water Well # 245 C 16'	<LLD
40327	828	Protected Area	Ground Water Well # 245 E 48'	3.87E+02
40331	838	Protected Area	Ground Water Well #273 K 50'	<LLD
40122	829	Unit #1	Unit 1 41' MAB Rm 363, Butress	2.03E+03
40250	829	Unit #1	Unit 1 41' MAB Rm 363, Butress	4.32E+03
40123	830	Unit #2	Unit 2 41' MAB Rm #363, Butress	1.38E+04
40178	830	Unit #2	Unit 2 41' MAB Rm #363, Butress	1.30E+04
40251	830	Unit #2	Unit 2 41' MAB Rm 363, Butress	1.33E+04
40252	831	Unit #1	Unit 1 EAB Rm 001D, Tendon	1.87E+03
40253	832	Unit #2	Unit 2 EAB Rm 001D, Tendon	2.87E+03
40254	833	Unit #1	Unit 1 -29' FHB Rm 007	2.80E+04
40255	834	Unit #2	Unit 2 -29' FHB Rm 007	7.52E+04
40401	839	Unit #1	Unit 1 68' FHB Butress Rm 011A	4.46E+03
40402	840	Unit #2	Unit 2 68' FHB Butress Rm 011A	4.27E+04

The table of the preceding page summarizes the results of tritium analyses for samples collected within the protected area. The tritium concentration in the reservoir typically runs about 10,000 pCi/kg but has recently (2005) increased slightly to about 13,000 pCi/kg. The only samples that approached or exceeded the reservoir concentration are indicated in red. Of the well samples, only the shallow aquifer sample from Well #221C indicated an elevated tritium concentration and it was similar to that of the reservoir.

Generally the deeper well at a location where tritium was measured had a higher concentration than the shallower well. Of the 14 locations sampled and found to contain tritium at some depth, only Wells #221C and #222C had a higher concentration in the shallower well than the deeper. These two wells are both located between the two units.

Plant liquid effluents are discharged into the reservoir; the tritium activity is reported; and the concentration in the reservoir is monitored monthly. The circulating coolant and open loop coolant water is from the main cooling reservoir which is known to contain tritium. The circulating coolant and open loop coolant piping run parallel to one another and within about 20 feet of the surface. Both carry reservoir water near Well #221 (about 35 feet away) as shown in the figure on the following page. Although the water pressure is low it is possible that one of these pipes leaks into the backfill material between the two units. This could explain the elevated result for Well #221C and the fact that it is very similar to the reservoir's tritium concentration.

The Unit 2 Total Dissolved Solids (TDS) line also runs within about 20-feet of Well #221C and is also shallow. This line leaked and was repaired in May 2003 (Condition Report 03-7595, WO #430966). The TDS line carries Condensate Polisher Regeneration Waste water from the secondary to the neutralization basin prior to discharge into the reservoir. TDS waste water is known to contain small amounts of tritium. This tritium is included in the liquid effluent to the reservoir and subsequently a fraction is known to enter the shallow water. Although the tritium concentration (up to 26,000 pCi/kg) in the water carried in this line is may be higher than measured in Well #221C, dilution in the ground water could explain the 13,000 pCi/kg measured.

All of the groundwater infiltration samples from within the Units are a significant fraction (>10%) of the reservoir water concentration. However, tritium within the plant may have contributed to these elevated values. The tritium results for samples 40254 and 40255 are elevated above the reservoir concentrations and cannot be fully attributed to reservoir water leakage into the groundwater near the Units. These two samples were collected from rooms (FHB Rm 007) inside the radiologically controlled areas of Units 1 and 2 respectively. These spaces may be influenced by tritium contained in plant systems; however, in-leakage of groundwater is also known to occur. Although the tritium concentrations in these areas are elevated above the values found elsewhere, it is unlikely that tritium in the groundwater caused these elevated levels.

The air in the fuel handling buildings contains moisture largely originating from the spent fuel pool. Water condensed from the fuel handling building air contains tritium at a concentration of about  $2.0\text{E}+06$  pCi/kg (samples #40362 and #40368). Monthly, the building ventilation is isolated for routine testing and plant personnel report that at those times (about 6-hours each month) the concrete "sweats" when moisture in the air condenses. A little mixing of this water with the groundwater infiltrating FHB Rm 007 could account for the elevated tritium concentration of these samples. Note that water removed from this area (an infrequent activity) it is discharged into the radioactive waste processing system and is monitored prior to release to the reservoir. Condition Report 06-3508 addresses the issue of tritium identified in groundwater that has collected within the Units.

The chemical characteristics of selected samples were also measured in hope of identifying the probable source of the water. A sample of circulating coolant was collected by Chemistry so that its chemical characteristics could be compared to those of other samples as shown in the following table.

### Chemical Characteristics of Water Samples

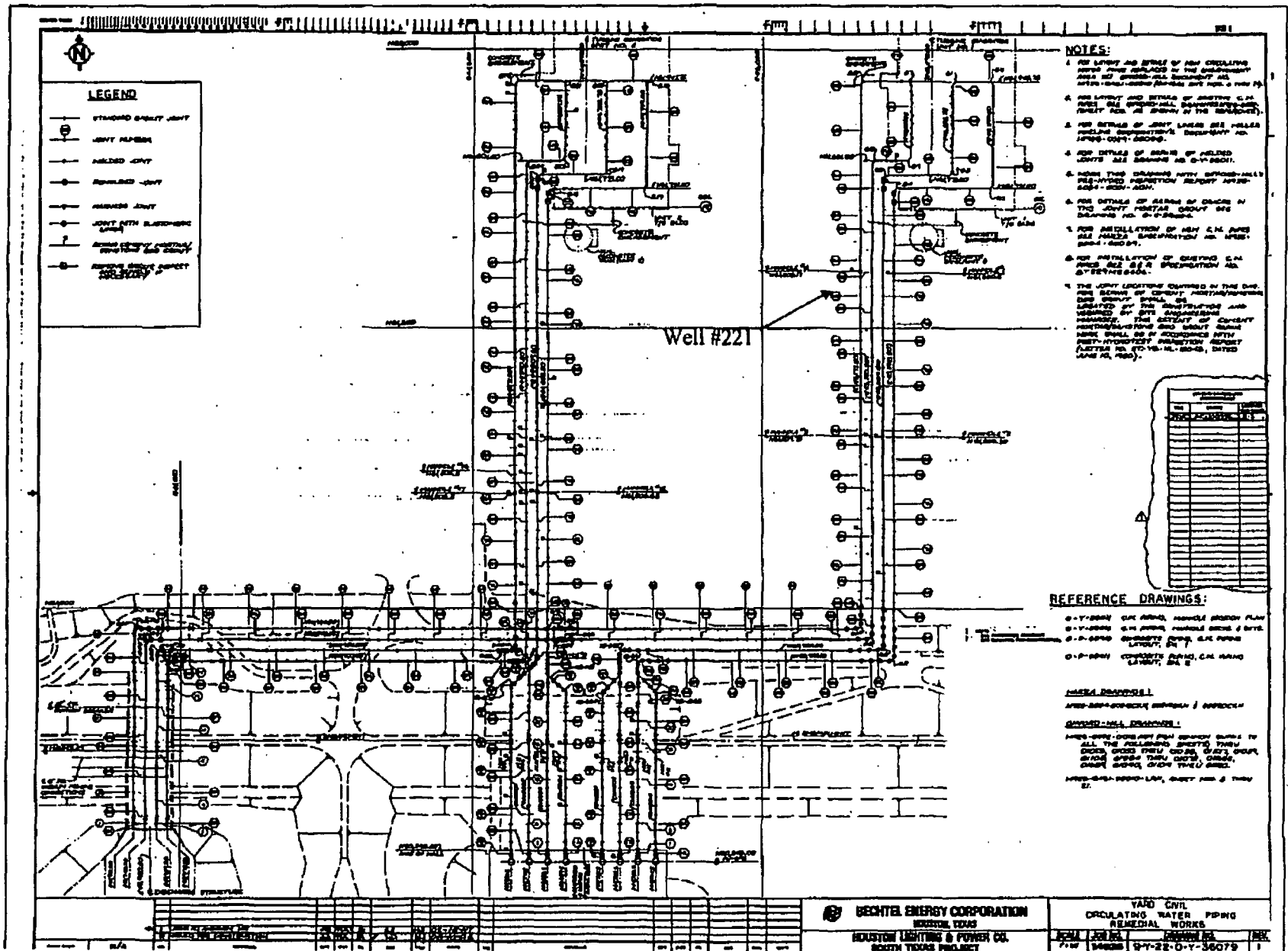
Sample Point	Date/ Time	Conductivity (uS)	Chloride (ppm)	Sulfate (ppm)	Nitrate (ppm)	Silica (ppm)	Boron (ppm)	Tritium (pCi/kg)
Circ Water	1/24/2006 13:57	3580	911	175	55	16.4	—	~13,000
Well 221C	12/1/2006 11:15	25100	38	1615	3965	21.5	—	13,500
Well 244C	12/1/2006 14:25	29700	1086	222	4394	23.5	—	<LLD
U-1 EAB 10' sump	1/9/2006 13:30	24200	7.5	9.3	3470	14.5	—	2030
U-2 64deg. Buttress	1/9/2006 13:00	21800	10.9	6.8	3182	7.3	—	13,800
Unit 1 29' FHB Rm 007B	1/31/2006 13:00	30000	—	—	—	—	0.43	28,000
Unit 2 29' FHB Rm 007B	2/1/2006 16:15	25000	—	—	—	—	0.19	75,200

If the groundwater was being displaced by circulating coolant or reservoir water to a large extent, the conductivity should more closely approximate the circulating coolant. The following table shows that none of the water samples suspected to be influenced by circulating coolant or reservoir water had conductivity similar to the circulating coolant. The conductivity values for the tritium containing test samples span a relatively small range of conductivity (21,800 to 30,000) and are 6 to 8 times higher than the circulating coolant value of 3580. Since they are much closer to the unaffected groundwater conductivity of Well 244C, these measurements do not support large scale circulating coolant or reservoir water displacement of the groundwater as the source of the tritium in Well #221C. The anion analysis did not suggest that the circulating coolant was the source of tritium either since the anion concentrations were not similar. Although these data do not appear to support leakage of circulating coolant as the source of the tritium in Well #221C they do not preclude that possibility.

Note that although the chloride and sulfate concentrations at Well #221C do not match the circulating coolant, they do parallel the TSD line water values where we typically find low chlorides and elevated sulfates.

Samples of suspected groundwater from the fuel handling buildings, -29' FHB Rm 007, of each Unit were also analyzed. These two samples had much higher tritium concentrations than the circulating coolant, but they were collected within the radiologically controlled area of each fuel handling building and were likely influenced by airborne or other sources of tritium in the buildings. Note that neither of these two samples contained significant boron concentrations. The spent fuel pool boron concentration in Unit 2 is about 3000 ppm and its tritium concentration is about  $2.8E+07$  pCi/kg. If the tritium were due to spent fuel pool water or similar leakage, the boron concentration in FHB Rm 007 of Unit 2 should have been about 8 ppm. Hence, the tritium in this area is likely due to sources within the building but not from spent fuel pool water leakage. The conductivity of the water suggests that it is likely groundwater infiltration rather than the de-mineralized water used in plant systems.

Circulating Coolant Piping diagram with area of elevated groundwater tritium concentration (Well #221C) indicated with an arrow.



# Fault Tree for CR 06-1056

## Tritium Was Identified in Water Samples From Piezometer Well #221 (Between Units 1 and 2) and Tendon Gallery Water Samples From Each Unit

Revised February 9, 2006

### Most Likely Sources:

- |     |   |  |
|-----|---|--|
| 1.0 | CP discharge piping (Total Dissolved Solids discharge line) | } Most likely source since known leakage event near the affected well (about 30 feet) and high enough tritium concentration. TDS water chemistry similar to Well #221C.  |
| 2.0 | CW piping   |  |
|     | 2.1 Unit 1 piping   |  |
|     | 2.1.1 Unit 1 supply piping                                  |  |
|     | 2.1.2 Unit 1 return piping                                  | } Not as likely since a large volume of water would need to displace the local ground water affecting the groundwater chemistry or creating visible water on the surface.  |
|     | 2.2 Unit 2 piping   |  |
|     | 2.2.1 Unit 2 supply piping                                  |  |
|     | 2.2.2 Unit 2 return piping                                  | } Eliminated since Unit 2 between pipes and Well #221C   |
| 3.0 | OC piping   |  |
|     | 3.1 Unit 1 supply piping                                    | } Not as likely since a large volume of water would need to displace the local ground water affecting the groundwater chemistry or creating visible water on the surface.  |
|     | 3.2 Unit 2 supply piping                                    | } Eliminated since Unit 2 between pipes and Well #221C.  |
| 4.0 | Sand layers under site (Reservoir)                          | } Eliminated since the tritium concentrations in wells between the reservoir and Well #221C were all much less than Well #221C. Also, Well #221E showed that the tritium concentration in the aquifer below Well #221C was much lower than Well #221C. |

### Possible Sources:

- |     |  |  |
|-----|--|--|
| 5.0 | Oily Waste Piping                        |  |
| 6.0 | OW Surge Tank                            |  |
| 7.0 | NC Basin                                 |  |
| 8.0 | Organics Basin                           |  |
| 9.0 | Draining events of secondary system (CD) | } Eliminated since other wells would likely be affected and none were. |

### Unlikely Sources:

- |      |                                  |   |
|------|----------------------------------|---|
| 10.0 | SPF                              |   |
| 11.0 | RCS                              |   |
| 12.0 | Secondary Systems                |   |
|      | 12.1 Steam between Units         |   |
|      | 12.2 CD between Units            | } Eliminated since these sources not near Well #221C and other wells would be affected but none were. |
| 13.0 | Rain runoff                      | } Eliminated since the concentration should be similar in other wells.                                |
| 14.0 | RWST                             |   |
| 15.0 | Inorganics Basin                 |   |
| 16.0 | ECW piping                       |   |
| 17.0 | NaHCl pits                       | } Eliminated since tritium concentration is too low.  |
| 18.0 | Liquid Radiological Waste piping |   |
| 19.0 | Truck bay drains                 | } Eliminated since these sources not near Well #221C and other wells would be affected but none were. |



**APPENDIX F**  
**MONITORING WELL DOCUMENTATION**



engineering and constructing a better tomorrow

January 20, 2009

Ms. Sandra Dannhardt  
STPEGS Nuclear Company  
PO Box 289  
Wadsworth, TX 77483

**Subject:      Monitoring Well Documentation  
                 Groundwater Protection Initiative  
                 South Texas Project Electric Generating Station**

Dear Ms. Dannhardt

This letter report provides the drilling and well construction details as well as the final 'as built' drawings to supplement the Conceptual Site Model completed in support of the NEI 07-07 Groundwater Protection Initiative.

In accordance with the recommendations in the Conceptual Site Model Report (MACTEC, 2008), five groundwater monitoring wells were installed at the South Texas Project Electric Generating Station (STPEGS) located near Wadsworth, Texas. The wells were installed to supplement the existing groundwater monitoring network and to specifically provide data along the east and downgradient side of Unit-2 as well as west of the Main Cooling Reservoir. Monitoring well locations are shown on Figure 1.

Wells were installed and developed in accordance with the specifications provided in Attachment A. Boring logs and well installation details are provided in Attachment B. In accordance with state regulations, well permits were submitted by Lewis Environmental Drilling, a Texas-licensed driller, to the Texas Department of Licensing and Regulation on December 11, 2008. Copies of these forms are provided in Attachment C.

It should also be noted that the wells were proposed to be installed to intersect the watertable. However during the drilling the saturated soils were encountered at approximately 16 to 20 feet below ground surface. The shallow wells (MW-801L, 802L, 803L and 805L) were then installed to span the interval where saturated soils were first encountered. As is common in the area, the water table is located in a semi confined aquifer and therefore the depth to water following installation stabilized at approximately 8 to 12 feet bgs, several feet above where the saturated soils were first encountered. No modifications need to be made to the Conceptual Site Model, nor is this a deviation from the work plan. This should just be documented should questions be asked during an assessment or follow up to the NEI 07-07 initiative.

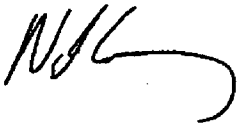
Ms. Sandra Dannhardt  
January 20, 2009  
Page 2

At this time, the new wells are ready to be included in the annual groundwater monitoring program. Should elevated concentrations of tritium be detected, additional wells may be installed, however at this time, no additional groundwater monitoring points are warranted.

To ensure that the well conditions are maintained over time, an assessment form should be filled out during the annual groundwater sampling event. A copy of this form is provided in Attachment D. If the collars or protective casing weather over time, or becomes damaged, a licensed driller may be called for repairs. Similarly, compression caps and locks may be replaced by plant personnel as needed.

If you require any additional information or support, please feel free to call Nadia Glucksberg at (207) 828-3535 or Mike Sufnarski at (704) 357-5633.

Sincerely,  
MACTEC Engineering and Consulting, Inc

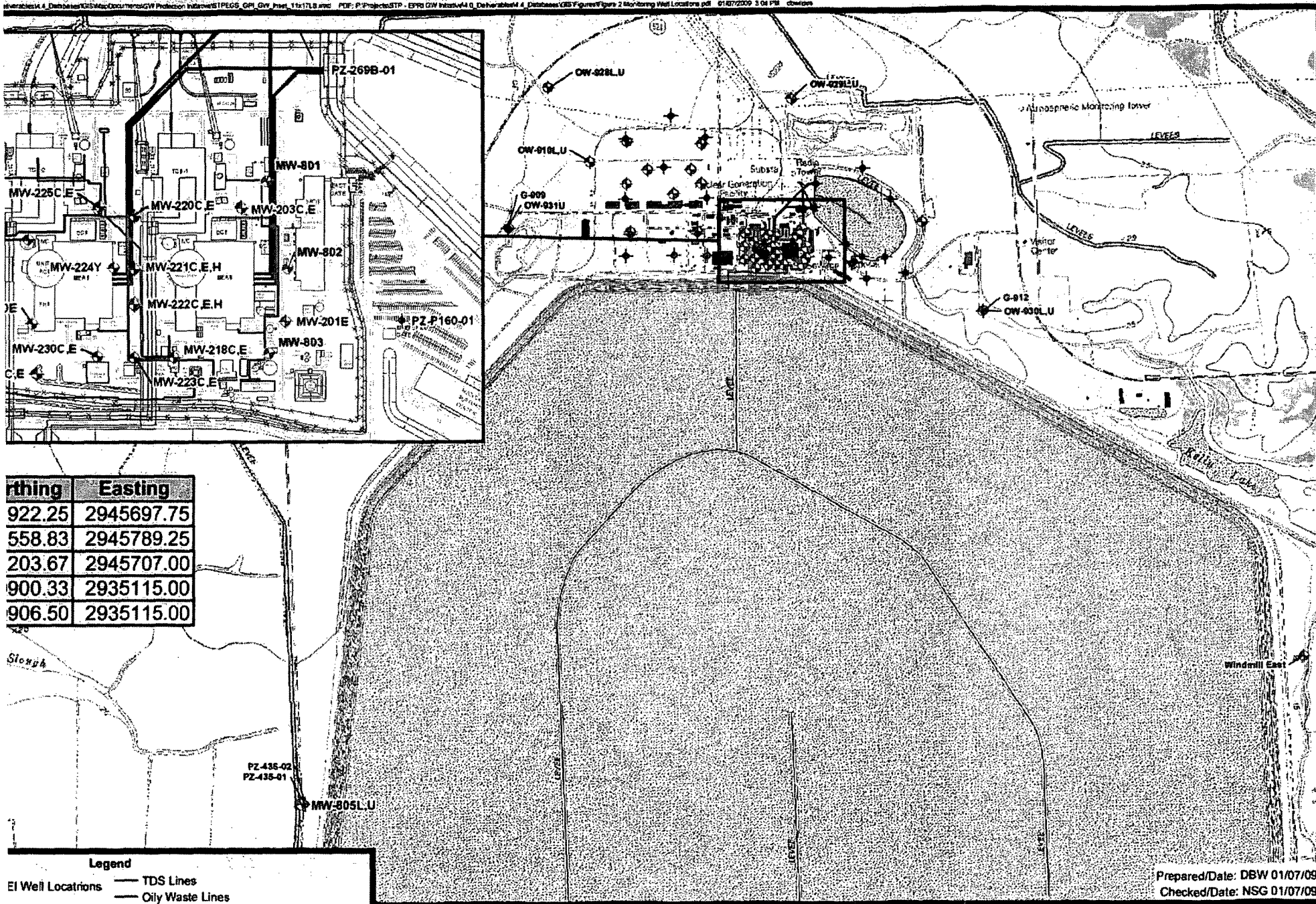


Nadia Glucksberg, CG  
Principal Hydrogeologist



Michael D. Sufnarski  
Project Manager

*For Mr. Sufnarski with permission*



Prepared/Date: DBW 01/07/09  
Checked/Date: NSG 01/07/09

STEGS  
Wadsworth, Texas

**MACTEC**

Monitoring Well Locations  
Project 6234-08-4613

Figure 1

**ATTACHMENT A**

**ATTACHMENT A  
DRILLING SPECIFICATIONS  
STPEGS UNITS 1 & 2**

**DRILLING**

Drilling activities shall be completed by a Texas-Licensed driller. Water shall be provided by STP. All discharge water shall be controlled to prevent excessive erosion, pollution, contamination, or other damage. The preferred drilling method shall be by hollow stem augers, but rotary drilling, or a casing advancement drilling methods are also acceptable. For rotary drilling, potable water is the preferred drilling fluid or a biodegradable drilling fluid additive, as required.

Soil samples shall be collected generally at 5 foot intervals however additional samples may be requested by the CONTRACTOR based on soil stratification and professional judgment. Soil samples shall be collected using a 2-inch OD split-barrel sampler. The holes shall be re-cleaned to the bottom if the split-barrel sampler does not rest on the bottom prior to sampling. The sampler shall be driven a minimum of 18 inches or to refusal, which is defined as a penetration of 6 inches or less per 50 blows. The samples obtained shall be logged and the soils returned to the cuttings pile to be managed as investigation derived waste (IDW). Standard Penetration Test hammer system shall use either NW or AW size rods. Other systems may be used, with approval from the CONTRACTOR.

**Abandoned and Grouting of Boreholes**

If the termination criterion is not met, and the borehole cannot be completed with well installation, the borehole shall be filled with cement/bentonite grout to the ground surface. The grout shall be prepared in the following approximate proportions: 8 gallons of water and 2.5 pounds of powdered bentonite per 94-pound sack of Portland cement. The grout shall be placed using the tremie method to the bottom of the borehole and slowly raising it while pumping the grout into the hole. The tremie end shall be continuously submerged in the grout until the grout reaches the ground surface. Should loss or shrinkage of the grout occur after the hole is filled, the hole shall be refilled until it remains full.

Boreholes abandoned before reaching the specific final depth because of mechanical failure of the drilling equipment, negligence or operator error on the part of the SUBCONTRACTOR, or other such preventable causes, may be rejected by the CONTRACTOR. Any hole rejected by the CONTRACTOR shall be supplemented by another hole drilled adjacent to the first.

**WELL INSTALLATION**

Groundwater monitoring wells shall be installed in general accordance with ASTM D 5092, and in compliance with any local or state regulations. The CONTRACTOR shall obtain all local and state permits required to drill and install wells. The final design (depth of well screen placement) for each well will be based on the field conditions encountered during drilling and will be determined by the CONTRACTOR or on-Site representative. Four shallow (upper) wells are anticipated to be installed to depths of 40 feet or less. The one deeper (lower) well proposed for this field event is anticipated to be installed at a depth no greater than 70 feet bgs.

Borings drilled for monitoring wells shall be drilled a minimal of 8 inches in diameter to a depth of approximately 2 to 3 feet below the bottom of the target well depth. Any water source or additive must be approved by the CONTRACTOR prior to use.

**ATTACHMENT A  
DRILLING SPECIFICATIONS  
STPEGS UNITS 1 & 2**

**Well Materials**

The riser casing used for monitoring well construction shall be comprised of 2-inch inside diameter (ID) Schedule 40 polyvinyl chloride (PVC). The casing shall be clean, straight and free of obstructions. If requested by the CONTRATOR, well materials will be pressure washed with potable water prior to well installation.

Well screens shall be comprised of 2-inch Schedule 40 PVC with 0.020 inch manufactured or machine cut slots. Screens shall be 10 feet in length. The bottom of the screen shall be fitted with a blank casing (or silt trap) approximately 1 foot in length. The bottom of this casing shall be capped.

Filter pack material shall be clean, well-graded sand. The selected filter pack shall be 10/20 sand as recommended in ASTM D 5092 or equivalent, as approved by the CONTRACTOR. The filter pack shall extend a minimum of 2 feet above the top of the screen or as directed by the CONTRACTOR. A bentonite seal will then be installed immediately above the top of the sand pack. The bentonite chips, pellets, or a slurry may be used to install the seal. The seal must be a minimum of 3 feet thick. The remaining annular space will be backfilled with cement/bentonite grout to approximately 1 foot below ground surface (bgs).

**Well Construction**

The well will be lowered into the hole with oversight from the CONTRACTOR. The sand pack will be installed into the annular space between the casing and the PVC, prior to pulling back the casing. The sand pack will be installed in such a way that at no time will the PVC well screen be exposed to the surrounding native soils. As noted above, the sand pack shall be installed to a minimum of 2 feet above the top of the screen.

After the sand pack is installed a bentonite seal (using pellets, chips or a slurry) shall be installed with a minimum thickness of 3 feet. If a slurry is used, then the seal shall be installed via tremie hose. Pellets or chips may be installed from the ground surface.

Following placement of the seal, the remainder of the annular space between the riser casing and the borehole will be backfilled with a cement/bentonite grout. The grout shall be placed via tremie hose and pumped into the annular space to 1 foot bgs. If the grout settles, additional grout will be used to top off and fill the annular space.

After the grout has settled, a protective, lockable steel casing shall be installed over the top of the riser. Protective casings shall consist of stick ups or flush mounted road boxes. The CONTRACTOR in conjunction with STP will determine what type of well completion will be selected. The protective casings will not extend more than 6 inches above the top of the PVC riser. If flush mounted protective casings are used, then a compression cap shall also be installed on the PVC riser to further protect the well.

To complete installation of the protective casing, a concrete seal at least 2 feet square and 1 foot thick shall be installed around the protective casing. The surface of the seal shall extend partially above the ground surface and slope away from the well. The concrete surface seal shall consist of Portland cement (ASTM C 150), fine and coarse aggregate, and water, proportioned and mixed as to produce a plastic workable mix. The aggregate material used for the concrete mixture shall conform to ASTM C 33.

**ATTACHMENT A  
DRILLING SPECIFICATIONS  
STPEGS UNITS 1 & 2**

If stickup completions are to be installed, two seep holes shall be drilled in the steel well cover just above the top of the concrete surface to allow for water to drain. The stickups shall then be painted with a rust preventative having a bright reflective color. For flush mounted completions two seep holes shall be drilled below the concrete seal to allow for drainage of standing water, should it collect over time. Alternatively a layer of sand may be installed at the base of the roadbox to allow for drainage.

**Well Development**

Each well shall be developed by bailing, surging, airlifting or pumping to remove sediment from the well and filter pack. Development will continue along the length of the well screen until the well produces clear water, or development has occurred for 2 hours. For clay and silty formations, 5 well volumes may be removed over time in an attempt to clean out the sediment (it should be noted that for this circumstance, the water will likely remain turbid after development). The CONTRACTOR shall approve the method and duration of development. Each well shall be developed following a minimum of 24 hours after installation.

Monitoring wells may be sampled for radionuclides after a seven day equilibration period following the development.

**DECONTAMINATION**

All materials including the drill rig may be washed using a steam cleaner or pressure washer, using potable or other approved water source. The rig and drilling equipment (augers/casing) will be decontaminated upon mobilization, and then again in between boring locations. Decontamination fluids will be allowed to be discharged to the ground, but the SUBCONTRACTOR shall take care not to cause erosion, ponding, or to release the fluids to the storm water system.

**GROUNDWATER TRITIUM SCREENING**

Groundwater associated with the proposed wells may contain tritium at concentrations above background, however, based on generator knowledge tritium concentration will be well below the Maximum Contaminant Levels (MCLs) issued by the Environmental Protection Agency (EPA). The CONTRACTOR will work at the direction of STP's Health Physics personnel who will determine if screening samples are required. STP will provide "Right to Know" training prior to drilling. However, based on the existing data, no additional precautions will be taken during drilling.

**SURVEYING SERVICES**

Qualified land surveyors shall perform the survey in compliance with requirements of the State of Texas. Ground surface elevations shall be based on the 1929 National Geodetic Vertical Datum (NGVD) of the 1988 North American Vertical Datum (NAVD). The horizontal survey to locate completed wells shall meet third order accuracy (1:5,000) and the vertical accuracy shall be to the nearest 0.1 ft.



**ATTACHMENT A  
DRILLING SPECIFICATIONS  
STPEGS UNITS 1 & 2**

For each installed well, surveyors will provide the following:

- Horizontal coordinates for the center point of each well.
- Elevation of the top of the concrete pad
- Elevation of the reference point, marked on the PVC riser casing. This mark will be made by the SUBCONTRACTOR using a permanent marker.

**REPORT**

All required forms and data shall be submitted to the CONTRACTOR and STP to review within 30 days of completing the field program. Within 14 days after receiving comments and/or approval of the draft forms, the forms shall be finalized and filed with the State of Texas, in accordance with applicable regulations.

The data report to support the EPRI Initiative and NEI 07-07 will be completed by the CONTRACTOR and submitted to STP within 30 days of receiving analytical data results.

**ATTACHMENT B**

**ATTACHMENT B-1**

Project Name : Job Number <b>SOIL LOG - Boring No. MW-801</b> STP : 6234-08-4613			
Type and Diameter of Boring Hollow stem / 4.25"	Boring Location	See figure	Total Depth 31 feet
Drilling Contractor and Rig LED / B 57		Ground Water Depth N/A	Depth to Bedrock N/A
Sampling Method Split Spoon	Sample Driving Hammer/Drop	No. of Samples 8	Date Started 11/4/08
	Borehole Inclination vertical	Logged by Glucksberg, Nadia	Date Completed 11/5/08

Reviewed by / Date N. Glucksberg

Depth (feet)	Sample	Sample Type & No.	Uncorrected Blow/ft Inches	Recovery (Inches)	Water Content	Grain Size	Alterberg Limits	Lithology	Soil Type (USCS)	Lithology	Remarks	Elevation (feet)
0												
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15	X	SS 1	5 18	24 24					SM	Red tan very fine poorly graded SAND (SM) with clay and silt very firm		
16	X	SS 2	6 6	24 24					SM	Red very fine sandy SILT (ML) with clay (moist) very stiff		
17	X	SS 3	6 3	24 24					ML	Red very fine sandy SILT (ML) with clay (some gray and clay mottling moist) stiff		
18	X	SS 4	3 5	24 24					ML	Red tan very fine sandy SILT (ML) with clay (moist) firm		
19	X	SS 5	8 10	24 24					ML	Red tan very fine sandy SILT (ML) with some clay 23 - 24 feet less stiff (water residing zones) very stiff		
20	X	SS 6	5 6	24 24					ML	Red very fine sandy SILT (ML) with some clay 24 - 25 feet very soft fine sandy silt Below 25 - 26 feet very stiff silty CLAY (CL) (saturated)		
21												
22												
23												
24												
25												
26												
27												
28												
29												
30												
31												
32												
33												
34												
35												
36												
37												
38												
39												
40												

Project Name : Job Number <b>SOIL LOG - Boring No. MW-803</b> STP : 6234-08-4813			
Type and Diameter of Boring Hollow stem / 4.25"	Boring Location	See figure	Total Depth 30 feet
Drilling Contractor and Rig LED / B 57		Ground Water Depth N/A	Depth to Bedrock N/A
Sampling Method Split Spoon	Sample Driving Hammer/Drop	No. of Samples 8	Date Started 11/4/08
	Borehole Inclination vertical	Logged by Glucksberg, Nadia	Date Completed 11/4/08

Reviewed by / Date N. Glucksberg

Depth (feet)	Sample	Sample Type & No	Uncorrected Blow/6 inches	Recovery (inches)	Water Content	Grain Size	Atterberg Limits	Lithology	Soil Type (USCS)	Lithology	Remarks	Elevation (feet)
0												
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11	X	SS 1	3 6	24 24					ML	Red clayey very fine sandy SILT (ML) with slight gray and black mottle (moist) stiff to very stiff		
12	X	SS 2	3 4 7	24 24								
13	X	SS 3	4 7 11	24 24								
14	X	SS 4	5 9 13	24 24								
15	X	SS 5	4 10 10	24 24								
16	X	SS 6	5 9 7	24 24								
17	X	SS 7	4 8 18	24 24					ML	Red very fine sandy SILT (ML) with clay saturated sand lense at 23-24 feet very stiff		
18	X	SS 8	3 4 4	24 24					ML	Red fine sandy SILT (ML) with clay (saturated) firm		
19												
20												
21												
22												
23												
24												
25												
26												
27												
28												
29												
30												
31												
32												
33												
34												
35												
36												
37												
38												
39												
40												

Project Name : Job Number <b>SOIL LOG - Boring No. MW-805L</b> STP : 6234-08-4613			
Type and Diameter of Boring Hollow stem / 4.25"	Boring Location See figure	Total Depth 52 feet	
Drilling Contractor and Rig LED / B 57		Ground Water Depth N/A	Depth to Bedrock N/A
Sampling Method Split Spoon	Sample Driving Hammer/Drop	No. of Samples 4	Date Started 11/4/08
	Borehole Inclination vertical	Logged by Glucksberg, Nadia	Date Completed 11/5/08

Reviewed by / Date N. Glucksberg

Depth (feet)	Sample	Sample Type & No.	Uncorrected Blow/6 Inches	Recovery (Inches)	Water Content	Grain Size	Altairberg Limits	Lithology	Soil Type (USCS)	Lithology	Remarks	Elevation (feet)
0									ML	Gray sandy SILT (ML) (based upon drill cuttings)		
1									ML	Brown silty SAND (SM) (based upon drill cuttings)		
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12									ML	Brown reddish brown SILT (ML) (clay like very dense stiff based upon drill cuttings)		
13												
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												
25									SM	Brown reddish brown silty SAND (SM) (much less dense mostly sand wet based upon drill cuttings)		
26												
27												
28												
29												
30												
31												
32												
33												
34												
35												
36												
37												
38												
39												
40												

Project Name : Job Number

**SOIL LOG - Boring No. MW-805L**

STP : 6234-08-4613

Depth (feet)	Sample	Sample Type & No.	Uncorrected Blow/ft Inches	Recovery (inches)	Water Content	Grain Size	Atterberg Limits	Lithology	Soil Type (USCS)	Lithology	Remarks	Elevation (feet)
40	X	SS 1	8 40 44	20 24					SP	Brown fine SAND (SP) very little silt (wet) very dense		
41												
42	X	SS 2	4 4 27	19 24								
43												
44												
45	X	SS 3	5 5 17	24 24					SP-SM	Brown fine SAND (SP-SM) with silt clay layer at bottom inch of spoon at 46.7 feet very dense		
46												
47												
48												
49												
50	X	SS 4	5 5 17	24 24					SP-SM	Brown fine SAND (SP-SM) with hard silt layer at 50 to 50.2 feet very firm		
51												
52												
53												
54												
55												
56												
57												
58												
59												
60												
61												
62												
63												
64												
65												
66												
67												
68												
69												
70												
71												
72												
73												
74												
75												
76												
77												
78												
79												
80												



Undisturbed sample  
SH = Shelby; P = Pitcher; O = other



Driven (2.5 to 3.0 inch) with liners  
MC = Modified California; O = other



Standard Penetration Test (SPT) sampler

Project Name : Job Number

**SOIL LOG - Boring No. MW-807**

STP : 6234-08-4613

Type and Diameter of Boring Hollow stem / 4.25"	Boring Location	See figure	Total Depth 30 feet
Drilling Contractor and Rig LED / B 57		Ground Water Depth N/A	Depth to Bedrock N/A
Sampling Method Split Spoon	Sample Driving Hammer/Drop	No. of Samples 6	Date Started 11/7/08
	Borehole Inclination vertical	Logged by Glucksberg, Nadia	Date Completed 11/7/08

Reviewed by / Date N. Glucksberg

Depth (feet)	Sample	Sample Type & No.	Uncorrected Blows/6 Inches	Recovery (inches)	Water Content	Grain Size	Atterberg Limits	Lithology	Soil Type (USCS)	Lithology	Remarks	Elevation (feet)
0												
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16	X	SS 1	9 05	19 24					ML	Red fine sandy SILT (ML) with clay some gray mottling. (moist) very stiff		
17	X	SS 2	8 11	24 24					ML	Red to tan clayey very fine sandy SILT (ML) (moist) very stiff		
18	X	SS 3	5 33	24 24					ML	Red to tan very fine sandy SILT (ML) sand lense at 19 - 19.5 feet (wet) remaining sample is very dry firm		
19	X	SS 4	4 5	24 24					ML	Red tan very fine sandy SILT (ML) with clay (wet at 22 feet below ground surface with slightly lower sand content) stiff		
20	X	SS 5	8 22	24 24					ML	Red to tan silty very fine poorly graded SAND (SM) with clay with clean sand lenses (saturated) loose		
21	X	SS 6	5 33	24 24					ML	Red to tan silty fine poorly graded SAND (SM) with clay (saturated) loose		
22												
23												
24												
25												
26												
27												
28												
29												
30												
31												
32												
33												
34												
35												
36												
37												
38												
39												
40												



**ATTACHMENT B-2**

Project Name: STP UNITS 1 & 2  
Project Number: 6234-08-4813



WELL CONSTRUCTION DIAGRAM: MW-801

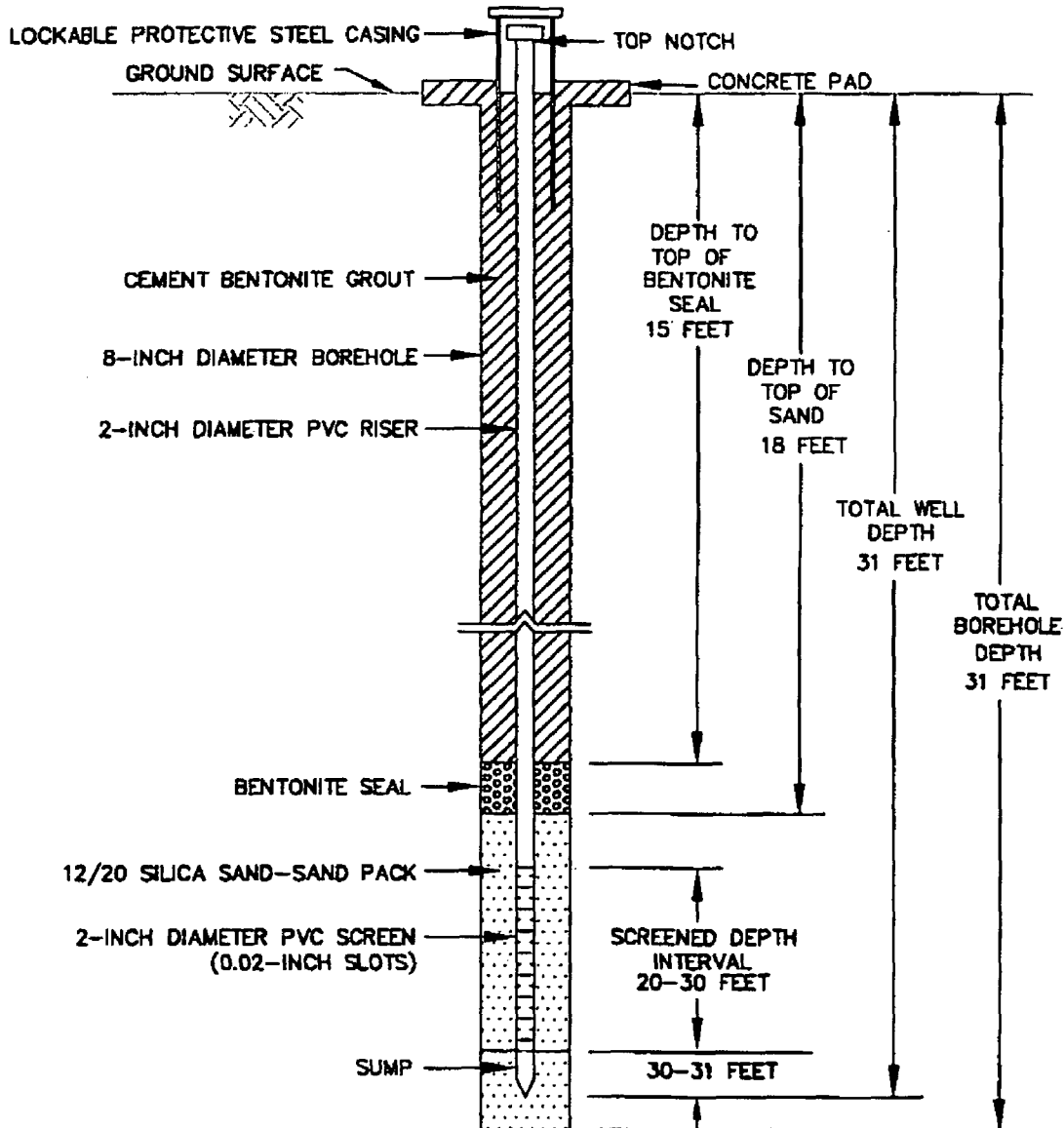
Type of Boring: HOLLOW STEM AUGER  
Drill Rig Model: MOBILE B57

Field Technician:  
Nadia Glucksberg

DATE COMPLETED: 11/05/08

Prepared by *[Signature]* 01-06-09

Checked by *[Signature]* 1/6/09



Project Name: STP UNITS 1 & 2  
Project Number: 6234-08-4613



WELL CONSTRUCTION DIAGRAM: MW-802

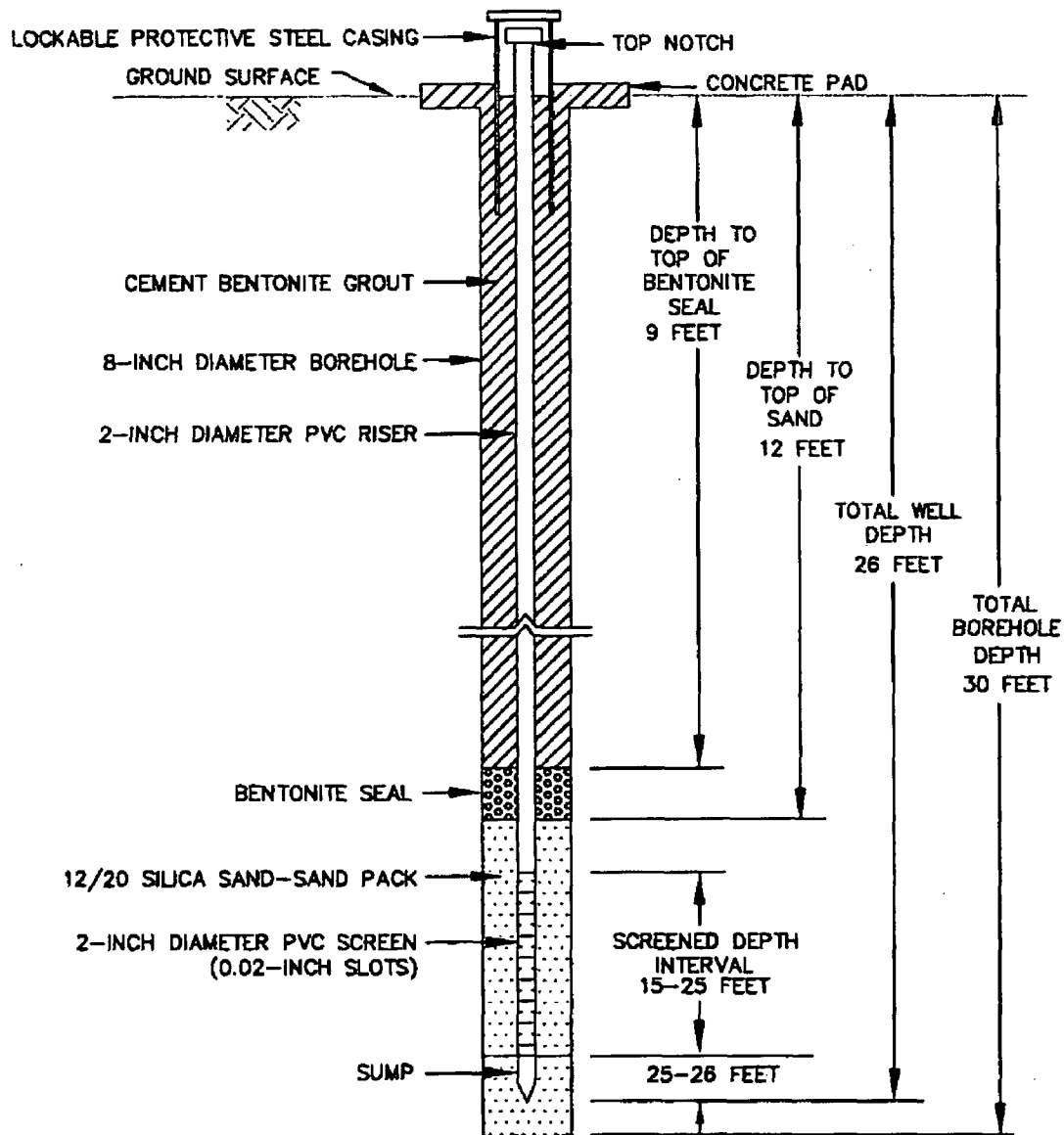
Type of Boring: HOLLOW STEM AUGER  
Drill Rig Model: MOBILE B57

Field Technician:  
Nadia Glucksberg

DATE COMPLETED: 11/05/08

Prepared by: *[Signature]* 01-06-09

Checked by: *[Signature]* 11/6/08



Project Name: STP UNITS 1 & 2  
Project Number: 6234-08-4813



WELL CONSTRUCTION DIAGRAM: MW-803

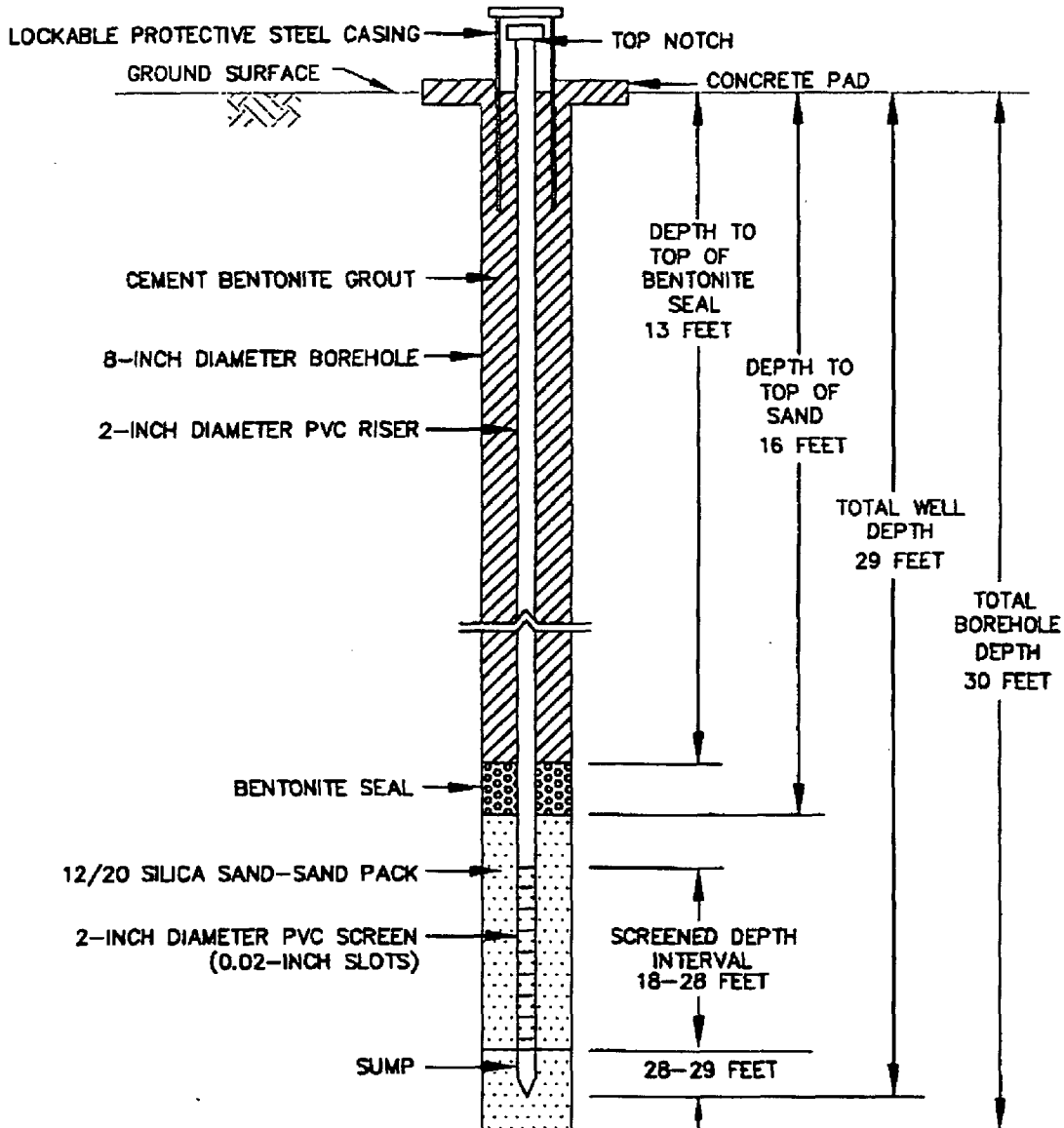
Type of Boring: HOLLOW STEM AUGER  
Drill Rig Model: MOBILE B57

Field Technician:  
Nadia Glucksberg

DATE COMPLETED: 11/04/08

Prepared by *[Signature]* 01-06-09

Checked by *[Signature]* 1/4/09



Project Name: STP UNITS 1 & 2  
Project Number: 8234-08-4813



WELL CONSTRUCTION DIAGRAM: MW-805U

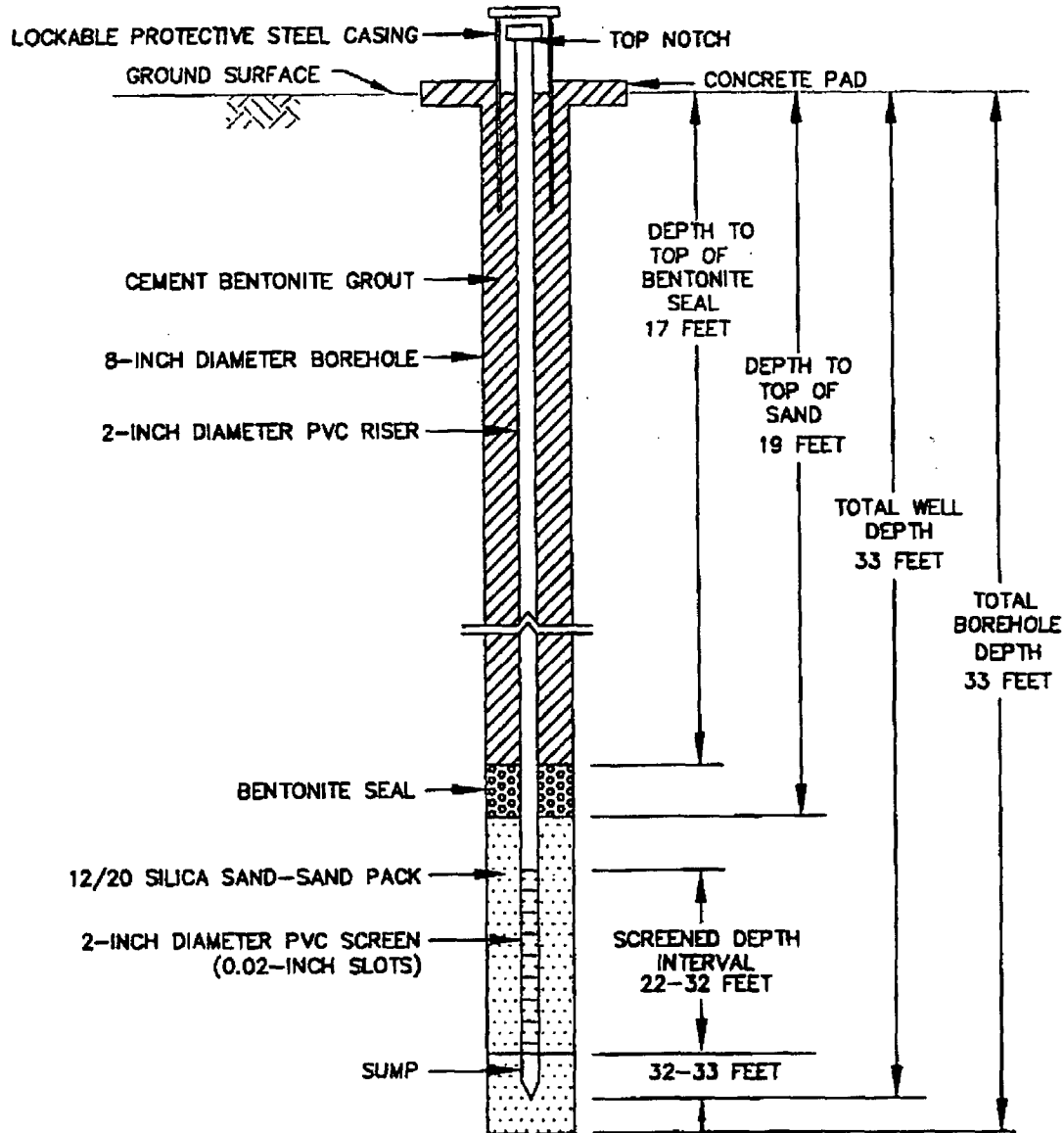
Type of Boring: HOLLOW STEM AUGER  
Drill Rig Model: MOBILE B57

Field Technician:  
Miles VanNoordennen

DATE COMPLETED: 11/07/08

Prepared by *[Signature]* 01-06-09

Checked by *[Signature]* 1/11/09



Project Name: STP UNITS 1 & 2  
Project Number: 6234-08-4613



WELL CONSTRUCTION DIAGRAM: MW-805L

Type of Boring: HOLLOW STEM AUGER  
Drill Rig Model: MOBILE B57

Field Technician:  
Miles VanNoordennen

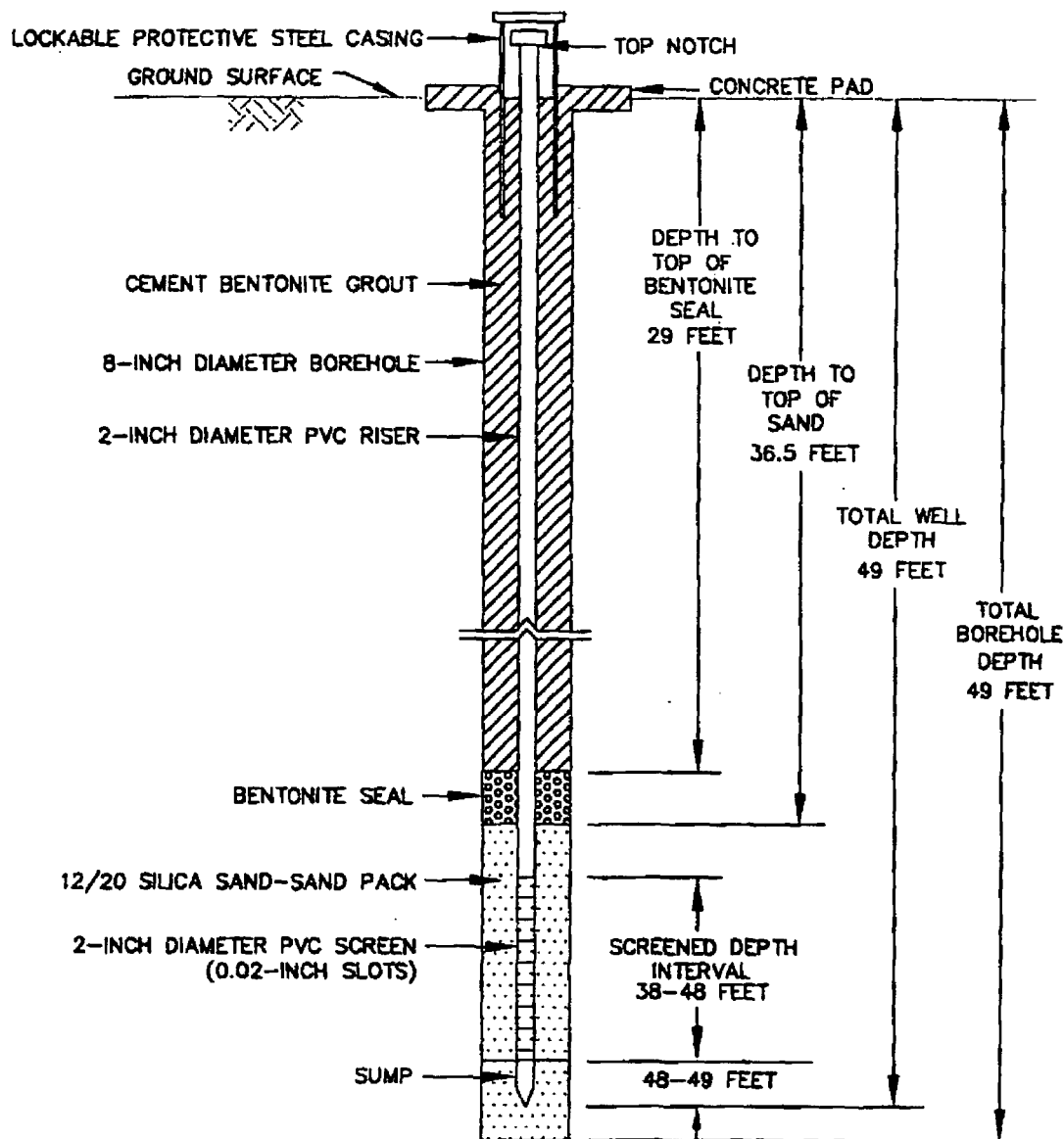
DATE COMPLETED: 11/07/08

Prepared by

Checked by

01-06-09

1/6/08



**ATTACHMENT C**

Attention Owner:  
Confidentiality Privilege Notice  
on reverse side of owner's copy.

Texas Department of Licensing and Regulation  
Water Well Driller/Pump Installer Section  
P.O. Box 12157 Austin, Texas 78711 (512)463-7880 FAX (512)463-8816  
Toll free (800)803-9202

This form must be completed  
and filed with the department  
and owner within 60 days  
upon completion of the well.

Email address: [water.well@license.state.tx.us](mailto:water.well@license.state.tx.us) Web address: [www.license.state.tx.us](http://www.license.state.tx.us)

### WELL REPORT

Name: <b>SOUTH TEXAS NATURAL POWER PLANT</b>		Address: <b>8 MILES WEST OF WADSWORTH ON FM 521</b>		City: <b>BAY CITY</b>	State: <b>TX</b>	Zip: <b>77414</b>	
Well # or # of wells drilled: <b>805 L</b>		County: <b>MATAGORDA</b>	Physical Address: <b>8 MILES WEST OF WADSWORTH ON FM 521</b>		City: <b>BAY CITY</b>		
3) Type of Work <input checked="" type="checkbox"/> New Well <input type="checkbox"/> Reconditioning <input type="checkbox"/> Replacement <input type="checkbox"/> Deepening		Lat: <b>29° 3' 22.99" N</b> Long: <b>96° 47' 42.16" W</b> Grid #		4) Proposed Use (check) <input checked="" type="checkbox"/> Monitor <input type="checkbox"/> Environmental Soil Boring <input type="checkbox"/> Domestic <input type="checkbox"/> Extraction <input type="checkbox"/> Industrial <input type="checkbox"/> Irrigation <input type="checkbox"/> Injection <input type="checkbox"/> Closed-Loop Geothermal <input type="checkbox"/> De-watering <input type="checkbox"/> Testwell <input type="checkbox"/> Rig Supply <input type="checkbox"/> Stock <input type="checkbox"/> Public Supply - If Public Supply, were plans approved? <input type="checkbox"/> Yes <input type="checkbox"/> No			
6) Drilling Date Started <b>11 / 7 / 08</b> Completed <b>11 / 7 / 08</b>		Diameter of Hole Dia. (in) From (ft) To (ft) <b>8</b> <b>0</b> <b>52</b>		7) Drilling Method (check) <input type="checkbox"/> Driven <input type="checkbox"/> Air Rotary <input type="checkbox"/> Mud Rotary <input type="checkbox"/> Bored <input type="checkbox"/> Air Hammer <input type="checkbox"/> Cable Tool <input type="checkbox"/> Jetted <input checked="" type="checkbox"/> Hollow Stem Auger <input type="checkbox"/> Reverse Circulation <input type="checkbox"/> Other			
From (ft) To (ft) Description and color of formation material		8) Borehole Completion <input type="checkbox"/> Open Hole <input type="checkbox"/> Straight Wall <input type="checkbox"/> Under-reamed <input checked="" type="checkbox"/> Gravel Packed <input type="checkbox"/> Other <b>12-20</b> Gravel packed interval from: <b>36.5</b> ft. to: <b>52</b> ft. Size:					
<b>SEE ATTACHED</b>		Casing, Blank Pipe, and Well Screen Data					
		Dia. (in.)	New Or Used	Steel, Plastic, etc. Perf. Slotted, etc. Screen Mfg., if commercial	Setting (ft) From To		Depth (ft) to casing
		<b>2</b>	<b>NEW</b>	<b>PLASTIC CASING</b>	<b>14</b>	<b>38</b>	
		<b>2</b>	<b>NEW</b>	<b>PLASTIC SCREEN</b>	<b>38</b>	<b>48</b>	<b>1020</b>
		<b>2</b>	<b>NEW</b>	<b>PLASTIC RIG</b>	<b>48</b>	<b>99</b>	
13) Plugged <input type="checkbox"/> Well plugged within 48 hours Casing left in well: <b>Current/Bentonite placed in well:</b> From (ft) To (ft) From (ft) To (ft) # Sacks & Material used		9) Annular Seal Data: i.e. From <b>29</b> ft. to <b>1020</b> ft. #sacks & material <b>3</b> <b>20</b> ft. <b>6</b> ft. <b>4</b> ft. From <b>0</b> ft. to <b>29</b> ft. #sacks & material From <b>0</b> ft. to <b>0</b> ft. #sacks & material Method Used <b>TRIPLE</b> Performed By <b>LEPE</b> Distance to septic field or other concentrated contamination <b>0</b> ft. Distance to Property Line <b>0</b> ft. Method Verified:					
14) Type Pump <input type="checkbox"/> Turbine <input type="checkbox"/> Jet <input type="checkbox"/> Submersible <input type="checkbox"/> Cylinder <input type="checkbox"/> Other <b>NIA</b> Depth to pump bowl, cylinder, jet etc. <b>ft.</b>		10) Surface Completion (If steel cased, leave blank) <input type="checkbox"/> Surface Slab Installed <input type="checkbox"/> Surface Sleeve Installed <input type="checkbox"/> Pitless Adapter Used <input type="checkbox"/> Alternative Procedure Used					
15) Water Test Type test <input type="checkbox"/> Pump <input type="checkbox"/> Bailor <input type="checkbox"/> Jetted <input type="checkbox"/> Estimated Yield: <b>gpm with</b> <b>ft. drawdown after</b> <b>hrs.</b> <b>NIA</b>		11) Water Level Static level <b>ft.</b> Date: <b>1 / 1</b> Artesian Flow <b>gpm</b> <b>NIA</b>					
16) Water Quality Type of water <b>Depth of Sample:</b> <b>Was a chemical analysis made?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No Did you knowingly penetrate a strata which contains undesirable constituents? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If yes, Continue: Check One: <input type="checkbox"/> Naturally poor-quality groundwater - type <input type="checkbox"/> Hydrocarbons (i.e. gas, oil, etc.) <input type="checkbox"/> Hazardous material/waste contamination encountered <input type="checkbox"/> Other (describe) <input type="checkbox"/> I certify that while drilling, deepening, or otherwise altering the above described well, undesirable water or constituents was encountered and the landowner was informed that such well must be completed or plugged in such a manner as to avoid injury or pollution. By signing this well report, I certify that I drilled or supervised the drilling of this well and that each and all of the statements herein are true and correct.		12) Packers Type <b>Depth</b> <b>Type</b> <b>Depth</b> <b>29-36.5</b> <b>29-36.5</b>					
Company & Individual's Name: (type or print) <b>LENEX ENVIRONMENTAL DRILLING, INC.</b> Lic. No.: <b>3198M</b> <b>ZANE RUEFFEL</b>		City: <b>HOUSTON</b> State: <b>TX</b> Zip: <b>77055</b>					
Address: <b>7611 KEMPWOOD ST. C</b>		City: <b>HOUSTON</b> State: <b>TX</b> Zip: <b>77055</b>					
Signature: <b>Zane Rueffel</b> <b>12 / 11 / 08</b>		Signature:					



Attention Owner:  
Confidentiality/Privacy Notice  
on reverse side of owner's copy.

Texas Department of Licensing and Regulation  
Water Well Drilling/Pump Installer Section  
P.O. Box 12157 Austin, Texas 78711 (512)463-7880 FAX (512)463-8816  
Toll free (800)803-9202

This form must be completed  
and filed with the department  
and owner within 60 days  
upon completion of the well.

Email address: [water.well@license.state.tx.us](mailto:water.well@license.state.tx.us) Web address: [www.license.state.tx.us](http://www.license.state.tx.us)

### WELL REPORT

Name <b>SOUTH TEXAS NUCLEAR POWER PLANT</b>		Address <b>8 MILES WEST OF WADSWORTH ON FM 531</b>		City: <b>BAY CITY</b>	State: <b>TX</b>	Zip: <b>77414</b>
Well # or # of wells drilled <b>MW 802</b>		County: <b>MATAGORDA</b>	Physical Address: <b>8 MILES WEST OF WADSWORTH ON FM 531</b>		City: <b>BAY CITY</b>	
3) Type of Work <input checked="" type="checkbox"/> New Well <input type="checkbox"/> Reconditioning <input type="checkbox"/> Replacement <input type="checkbox"/> Deepening		Lat. <b>29° 3' 22.99" N</b> Long. <b>96° 47' 48.16" W</b>		Grid #		
4) Proposed Use (check) <input checked="" type="checkbox"/> Monitor <input type="checkbox"/> Environmental Soil Boring <input type="checkbox"/> Domestic <input type="checkbox"/> Extraction <input type="checkbox"/> Industrial <input type="checkbox"/> Irrigation <input type="checkbox"/> Injection <input type="checkbox"/> Closed-Loop Geothermal <input type="checkbox"/> De-watering <input type="checkbox"/> Testwell <input type="checkbox"/> Rig Supply <input type="checkbox"/> Stock <input type="checkbox"/> Public Supply - If Public Supply, were plans approved? <input type="checkbox"/> Yes <input type="checkbox"/> No		5)		NT		
6) Drilling Date Started <b>11 / 5 / 08</b> Completed <b>11 / 5 / 08</b>		Diameter of Hole Dia. (in) From (ft) To (ft) <b>8 0 30</b>		7) Drilling Method (check) <input type="checkbox"/> Driven <input type="checkbox"/> Air Rotary <input type="checkbox"/> Mud Rotary <input type="checkbox"/> Bored <input type="checkbox"/> Air Hammer <input type="checkbox"/> Cable Tool <input type="checkbox"/> Jetted <input checked="" type="checkbox"/> Hollow Stem Auger <input type="checkbox"/> Reverse Circulation <input type="checkbox"/> Other		
8) Borehole Completion <input type="checkbox"/> Open Hole <input type="checkbox"/> Straight Well <input type="checkbox"/> Under-reamed <input checked="" type="checkbox"/> Gravel Packed <input type="checkbox"/> Other <b>12-20</b> Gravel packed interval from: <b>12</b> ft to <b>30</b> ft. Size:		Casing, Blank Pipe, and Well Screen Data				
		Dia. (in) New Or Used Steel, Plastic, etc. Perf. Slotted, etc. Screen Mfg. If commercial		Setting (ft) From To		Casing or Screen
		<b>2 NEW PLASTIC CASING</b>		<b>0 15</b>		
		<b>2 NEW PLASTIC SCREEN</b>		<b>15 25</b>		<b>ODD</b>
		<b>2 NEW PLASTIC CONCRETE</b>		<b>25 26</b>		
9) Annular Seal Data: i.e. from 0 ft to 100 ft. #acks & material from <b>0</b> ft to <b>9</b> ft. #acks & material <b>1 Bag 61005</b> from _____ ft to _____ ft. #acks & material _____ from _____ ft to _____ ft. #acks & material _____ Method Used <b>LEDS</b> Performed By <b>LEDS</b> Distance to septic field or other concentrated contamination _____ ft. Distance to Property Line _____ ft. Method Verified:						
13) Plugged <input type="checkbox"/> Well plugged within 48 hours Casing left in well: _____ Cement/Bentonite placed in well: _____ From (ft) To (ft) From (ft) To (ft) # Sacks & Material used						
		<b>NIA</b>				
14) Type Pump <input type="checkbox"/> Turbine <input type="checkbox"/> Jet <input type="checkbox"/> Submersible <input type="checkbox"/> Cylinder <input type="checkbox"/> Other _____ Depth to pump bowls, cylinder, jet etc. _____ ft.						<b>NIA</b>
15) Water Test Type test <input type="checkbox"/> Pump <input type="checkbox"/> Bailor <input type="checkbox"/> Jetted <input type="checkbox"/> Estimated Yield _____ gpm with _____ ft. drawdown after _____ hrs.						<b>NIA</b>
16) Water Quality Type of water _____ Depth of Sample _____ Was a chemical analysis made? <input type="checkbox"/> Yes <input type="checkbox"/> No Did you knowingly penetrate a strata which contains undesirable constituents? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If yes, Continue: Check One: <input type="checkbox"/> Naturally poor-quality groundwater - type _____ <input type="checkbox"/> Hydrocarbons (i.e. gas, oil, etc.) <input type="checkbox"/> Hazardous material/waste contamination encountered <input type="checkbox"/> Other (describe) _____ <input type="checkbox"/> I certify that while drilling, deepening, or otherwise altering the above described well, undesirable water or constituents was encountered and the landowner was informed that such well must be completed or plugged in such a manner as to avoid injury or pollution. By signing this well report, I certify that I drilled or supervised the drilling of this well and that each and all of the statements herein are true and correct. Company & Individual's Name: (type or print) <b>LEWIS ENVIRONMENTAL DRILLING, INC.</b> Lic. No.: <b>3188M</b> <b>ZANE RUFFEN</b> Address: <b>7411 KEMPWOODS STE. C</b> City: <b>HOUSTON</b> State: <b>TX</b> Zip: <b>77055</b> Signature: <b>Zane Ruffen</b> (b) 12 / 11 / 08 Signature: _____ TDLR FORM 001WWD / 1-08 TDLR (Original) Landowner (copy) Driller/Pump Installer (copy)						

Attention Owner:  
Confidentiality Privilege Notice  
on reverse side of owner's copy.

**Texas Department of Licensing and Regulation**  
Water Well Drilled/Pump Installer Section  
P.O. Box 12157 Austin, Texas 78711 (512)463-7880 FAX (512)463-8816  
Toll free (800)803-9202

Email address: [water.well@license.state.tx.us](mailto:water.well@license.state.tx.us) Web address: [www.license.state.tx.us](http://www.license.state.tx.us)

This form must be completed  
and filed with the department  
and owner within 60 days  
upon completion of the well.

**WELL REPORT**

Name: <b>SOUTH TEXAS NUCLEAR POWER PLANT</b>		Address: <b>8 MILES WEST OF WADSWORTH ON FM 531</b>		City: <b>BAY CITY</b>	State: <b>TX</b>	Zip: <b>77414</b>
Well # or # of wells drilled: <b>MW 801</b>		County: <b>MATAGORDA</b>	Physical Address: <b>8 MILES WEST OF WADSWORTH ON FM 531</b>		City: <b>BAY CITY</b>	
3) Type of Work <input checked="" type="checkbox"/> New Well <input type="checkbox"/> Reconditioning <input type="checkbox"/> Replacement <input type="checkbox"/> Deepening		Lat. <b>96° 3' 22.99" W</b> Long. <b>28° 47' 48.16" N</b>		Grid #		
4) Proposed Use (check) <input checked="" type="checkbox"/> Monitor <input type="checkbox"/> Environmental Soil Boring <input type="checkbox"/> Domestic <input type="checkbox"/> Extraction <input type="checkbox"/> Industrial <input type="checkbox"/> Irrigation <input type="checkbox"/> Injection <input type="checkbox"/> Closed-Loop Geothermal <input type="checkbox"/> De-watering <input type="checkbox"/> Testwell <input type="checkbox"/> Rig Supply <input type="checkbox"/> Stock <input type="checkbox"/> Public Supply - If Public Supply, were plans approved? <input type="checkbox"/> Yes <input type="checkbox"/> No		5) Drilling Method (check) <input type="checkbox"/> Driven <input type="checkbox"/> Air Rotary <input type="checkbox"/> Mud Rotary <input type="checkbox"/> Bored <input type="checkbox"/> Air Hammer <input type="checkbox"/> Cable Tool <input type="checkbox"/> Jetted <input checked="" type="checkbox"/> Hollow Stem Auger <input type="checkbox"/> Reverse Circulation <input type="checkbox"/> Other		6) Drilling Date Started <b>11 / 5 / 08</b> Completed <b>11 / 5 / 08</b>		
6) Drilling Date Started <b>11 / 5 / 08</b> Completed <b>11 / 5 / 08</b>		Diameter of Hole Dia. (in.) From (ft) To (ft) Surface <b>8 0 31</b>		7) Drilling Method (check) <input type="checkbox"/> Driven <input type="checkbox"/> Air Rotary <input type="checkbox"/> Mud Rotary <input type="checkbox"/> Bored <input type="checkbox"/> Air Hammer <input type="checkbox"/> Cable Tool <input type="checkbox"/> Jetted <input checked="" type="checkbox"/> Hollow Stem Auger <input type="checkbox"/> Reverse Circulation <input type="checkbox"/> Other		
From (ft) To (ft) Description and color of formation material		8) Borehole Completion <input type="checkbox"/> Open Hole <input type="checkbox"/> Straight Wall <input type="checkbox"/> Under-reamed <input checked="" type="checkbox"/> Gravel Packed <input type="checkbox"/> Other <b>12-30</b> Gravel packed interval from: <b>18</b> ft. to <b>31</b> ft. Size:		Casing, Blank Pipe, and Well Screen Data		
From (ft) To (ft) Description and color of formation material		9) Annular Seal Data: i.e. (from 0 ft. to 15 ft. #sacks & material) <b>2 Bags Gravel</b> from 0 ft. to 15 ft. #sacks & material <b>2 Bags Gravel</b> from 15 ft. to 31 ft. #sacks & material Method Used <b>TECHNICAL</b> Performed By <b>LEAT</b> Distance to septic field or other concentrated contamination ft. Distance to Property Line ft. Method Verified		10) Surface Completion (If steel cased, leave blank) <input checked="" type="checkbox"/> Surface Slab Installed <input type="checkbox"/> Surface Sleeve Installed <input type="checkbox"/> Pitless Adapter Used <input type="checkbox"/> Alternative Procedure Used		
13) Plugged <input type="checkbox"/> Well plugged within 48 hours Casing left in well: Cement/Pentonite placed in well: From (ft) To (ft) From (ft) To (ft) # Sacks & Material used		11) Water Level Static level ft. Date: <b>1 / 1</b> Artesian Flow gpm		12) Packers: Type: <b>Bentonite</b> Depth: <b>15-18</b> Type: <b>CLIPS</b> Depth:		
14) Type Pump <input type="checkbox"/> Turbine <input type="checkbox"/> Jet <input type="checkbox"/> Submersible <input type="checkbox"/> Cylinder <input type="checkbox"/> Other <b>NIA</b> Depth to pump bowls, cylinder, jet etc., ft.		15) Water Test Type test <input type="checkbox"/> Pump <input type="checkbox"/> Bailor <input type="checkbox"/> Jetted <input type="checkbox"/> Estimated Yield: gpm with ft drawdown after hrs <b>NIA</b>		16) Water Quality Type of water: Depth of Static: Was a chemical analysis made? <input type="checkbox"/> Yes <input type="checkbox"/> No Did you knowingly penetrate a strata which contains undesirable constituents? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If yes, Continue: Check One: <input type="checkbox"/> Naturally poor-quality groundwater - type <input type="checkbox"/> Hydrocarbons (i.e. gas, oil, etc.) <input type="checkbox"/> Hazardous material/waste contamination encountered <input type="checkbox"/> Other (describe) <input type="checkbox"/> I certify that while drilling, deepening, or otherwise altering the above described well, undesirable water or constituents was encountered and the landowner was informed that such well must be completed or plugged in such a manner as to avoid injury or pollution. By signing this well report, I certify that I drilled or supervised the drilling of this well and that each and all of the statements herein are true and correct.		
Company & Individual's Name: (type or print) <b>LEWIS ENVIRONMENTAL DRILLING, INC.</b> Lic. No.: <b>3186 M</b>		Address: <b>7611 KENDWOOD STE. C</b> City: <b>HOUSTON</b> State: <b>TX</b> Zip: <b>77055</b>		Signature: <b>[Signature]</b> Date: <b>12 / 11 / 08</b> Signature: <b>[Signature]</b>		
TDLR FORM 001WWD/17-08		TDLR (Original)		Landowner (copy)		Driller/Pump Installer (copy)

Attention Owner:  
Confidentiality Privilege Notice  
on reverse side of owner's copy.

**Texas Department of Licensing and Regulation**  
Water Well Driller/Pump Installer Section  
P.O. Box 12157 Austin, Texas 78711 (512)463-7880 FAX (512)463-8816  
Toll free (800)803-6202

This form must be completed  
and filed with the department  
and owner within 60 days  
upon completion of the well.

Email address: [water.well@license.state.tx.us](mailto:water.well@license.state.tx.us) Web address: [www.license.state.tx.us](http://www.license.state.tx.us)

**WELL REPORT**

Name: <b>SOUTH TEXAS NUCLEAR POWER PLANT</b>		Address: <b>8 MILES WEST OF WADSWORTH ON FM 521</b>		City: <b>BAY CITY</b>	State: <b>TX</b>	Zip: <b>77414</b>
Well # or # of wells drilled: <b>MW 805 U</b>	County: <b>MATAGORDA</b>	Physical Address: <b>8 MILES WEST OF WADSWORTH ON FM 521</b>		City: <b>BAY CITY</b>		
3) Type of Work <input checked="" type="checkbox"/> New Well <input type="checkbox"/> Reconditioning <input type="checkbox"/> Replacement <input type="checkbox"/> Deepening		Lat. <b>29° 3' 22.99" N</b> Long. <b>96° 47' 48.16" W</b> Grid #		5) <b>NT</b>		
4) Proposed Use (check) <input checked="" type="checkbox"/> Monitor <input type="checkbox"/> Environmental Soil Boring <input type="checkbox"/> Domestic <input type="checkbox"/> Extraction <input type="checkbox"/> Industrial <input type="checkbox"/> Irrigation <input type="checkbox"/> Injection <input type="checkbox"/> Closed-Loop Geothermal <input type="checkbox"/> De-watering <input type="checkbox"/> Testwell <input type="checkbox"/> Rig Supply <input type="checkbox"/> Stock <input type="checkbox"/> Public Supply - If Public Supply, were plans approved? <input type="checkbox"/> Yes <input type="checkbox"/> No						
6) Drilling Date Started <b>11 / 7 / 08</b> Completed <b>11 / 7 / 08</b>		Diameter of Hole Dia. (in.) From (ft) To (ft) <b>8 0 33</b>		7) Drilling Method (check) <input type="checkbox"/> Driven <input type="checkbox"/> Air Rotary <input type="checkbox"/> Mud Rotary <input type="checkbox"/> Bored <input type="checkbox"/> Air Hammer <input type="checkbox"/> Cable Tool <input type="checkbox"/> Jetted <input checked="" type="checkbox"/> Hollow Stem Auger <input type="checkbox"/> Reverse Circulation <input type="checkbox"/> Other		
From (ft) To (ft) Description and color of formation material		8) Borehole Completion <input type="checkbox"/> Open Hole <input type="checkbox"/> Straight Wall <input type="checkbox"/> Under-reamed <input type="checkbox"/> Gravel Packed <input type="checkbox"/> Other <b>12-20</b> Gravel packed interval from: <b>19</b> ft to <b>33</b> ft Size:				
SEE ATTACHED		Casing, Blank Pipe, and Well Screen Data:				
		Dia. (in.)	New Or Used	Steel, Plastic, etc. Perf. Slotted, or Screen Mfg., if commercial	Setting (ft) From To	Casing Screen
		<b>2</b>	<b>NEW</b>	<b>PLASTIC CASING</b>	<b>11 22</b>	
		<b>2</b>	<b>NEW</b>	<b>PLASTIC SCREEN</b>	<b>22 32</b>	<b>12-20</b>
		<b>2</b>	<b>NEW</b>	<b>PLASTIC CASING</b>	<b>32 33</b>	
9) Annular Seal Data: i.e. from 0 ft to 17 ft #sacks & material <b>2 Bags GROUT</b> from _____ ft to _____ ft #sacks & material _____ from _____ ft to _____ ft #sacks & material _____ Method Used <b>Grout</b> Performed By _____ Distance to septic field or other concentrated contamination _____ ft. Distance to Property Line _____ ft. Method Verified: _____						
13) Plugged <input type="checkbox"/> Well plugged within 48 hours Casing left in well: _____ Cement/Bentonite placed in well: _____ From (ft) To (ft) From (ft) To (ft) # Sacks & Material used		10) Surface Completion (If steel cased, leave blank) <input checked="" type="checkbox"/> Surface Slab Installed <input type="checkbox"/> Surface Sleeve Installed <input type="checkbox"/> Pitless Adapter Used <input type="checkbox"/> Alternative Procedure Used				
14) Type Pump <input type="checkbox"/> Turbine <input type="checkbox"/> Jet <input type="checkbox"/> Submersible <input type="checkbox"/> Cylinder <input type="checkbox"/> Other _____ N/A Depth to pump bowls, cylinder, jet etc. _____ ft		11) Water Level Static level _____ ft Date: <b>11 / 1</b> Artesian Flow _____ gpm <b>N/A</b>				
15) Water Test Type test <input type="checkbox"/> Pump <input type="checkbox"/> Bailor <input type="checkbox"/> Jetted <input type="checkbox"/> Estimated Yield _____ gpm with _____ ft drawdown after _____ hrs. <b>N/A</b>		12) Packers: Type _____ Depth <b>17-19</b> _____				
16) Water Quality Type of water _____ Depth of Sample _____ Was a chemical analysis made? <input type="checkbox"/> Yes <input type="checkbox"/> No Did you knowingly penetrate a strata which contains undesirable constituents? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If yes, Continue: Check One: <input type="checkbox"/> Naturally poor-quality groundwater - type _____ <input type="checkbox"/> Hydrocarbons (i.e. gas, oil, etc.) <input type="checkbox"/> Hazardous material/waste contamination encountered <input type="checkbox"/> Other (describe) _____ <input type="checkbox"/> I certify that while drilling, deepening, or otherwise altering the above described well, undesirable water or constituents was encountered and the landowner was informed that such well must be completed or plugged in such a manner as to avoid injury or pollution. By signing this well report, I certify that I drilled or supervised the drilling of this well and that each and all of the statements herein are true and correct.						
Company & Individual's Name: (type or print) <b>LEASIS ENVIRONMENTAL DRILLING, INC.</b> Lic No: <b>3198 M</b>		Address: <b>7611 KEMPWOOD STE. C</b> City: <b>HOUSTON</b> State: <b>TX</b> Zip: <b>77055</b>				
Signature: <b>Zone Ruffin</b> <b>12 / 11 / 08</b>		Signature: _____				

This form must be completed and filed with the department and owner within 60 days upon completion of the well.

## WELL REPORT

## WELL REPORT

TDLR FORM 001WWD/7-03

**IDLR (Original)**

Londoner (copy)

**Driller/Punch Installer (copy)**

**ATTACHMENT D**

### Monitoring Well Inspection Summary

Groundwater Sampling Round: \_\_\_\_\_

Note: Individual Well Inspection Reports will be provided for each location sampled, and attached to this summary report.

Well ID	Pre-Sampling Inspection Summary			Post-Sampling Inspection Summary		
	As-Found Condition	Inspector's Initials	Date/Time	As-Left Condition	Inspector's Initials	Date/Time

Reviewed By: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

Approved By: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

**Well Head Inspection Form  
STP Electric Generating Station**

Well ID: \_\_\_\_\_

Weather Conditions: \_\_\_\_\_

Date \_\_\_\_\_

Time \_\_\_\_\_

Item	Description	Condition				Notes
		Good	Fair	Poor	NA	
Condition of Road Box Cement	Cement should not have cracks, chips or appear stressed.					
Condition of Road Box Cover	Cover should have all screws in place and tightened, seal below cover should be intact					
Condition of Road Box Interior	No standing water should be present within the road box, where it could enter the well.					
Condition of Compression Cap	Compression cap should be in place and secure. No rust or stress should be visible that could prevent a protective seal.					
Well integrity	Note any indication of mud, water, or other foreign material in the well.					

<b>Additional Observations</b>	
Depth to groundwater (feet, top of casing)	
Depth to bottom of Well (feet, top of casing)	
Well ID Labeled Appropriately (yes/no)	

Inspected by (name/title): \_\_\_\_\_

Date: \_\_\_\_\_

Reviewed by (name/title): \_\_\_\_\_

Date: \_\_\_\_\_