RIVER BEND STATION ENVIRONMENTAL REPORT

OPERATING LICENSE STAGE

SUPPLEMENT 4

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Supplement to Environmental Report-

Operating License Stage

River Bend Station

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Lead Licensing Engineer
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ENVIRONMENTAL REPORT - OPERATING LICENSE STAGE

The following instructions are for the insertion of Supplement 4 into the RBS ER-OLS. Remove the pages, tables, and/or figures listed in the REMOVE column and replace them with the page, tables, and/or figures listed in the INSERT column. Dashes (---) in either column indicate no action required.

Vertical bars have been placed in the margins of inserted pages and tables to indicate revision locations.

VOLUME 1

Remove	Insert
General Table of Contents Page i/ii	General Table of Contents Page i/ii
Page 1.1-1/2	Page 1.1-1/2
Table 1.2-1 (4 sheets)	Table 1.2-1 (4 sheets)
Page 2-v/vi	Page 2-v/vi
Figure 2.1-3	Figure 2.1-3
Page 2.2-1/2	Page 2.2-1/2
Figure 2.3-11a	Figure 2.3-11a
Figure 2.3-13	Figure 2.3-13
Figure 2.3-17	Figure 2.3-17
Figure 2.3-20	Figure 2.3-20
Figures 2.3-24 through 2.3-26	Figures 2.3-24 through 2.3-26
Figures 2.4-2 through 2.4-4	Figures 2.4-2 through 2.4-4

VOLUME 2

Remove	Insert
General Table of Contents Page i/ii	General Table of Contents Page i/ii
Page 2-v/vi	Page 2-v/vi
Page 2.5-1/2	Page 2.5-1/1a
---	Page 2.5-1b/2
Page 2.5-15/16	Page 2.5-15/16
Figure 2.5-8	Figure 2.5-8
Figure 2.5-18	Figure 2.5-18
Figure 2.6-1	Figure 2.6-1
Page 2.7-9/10	Page 2.7-9/10
Page 2.7-15/16	Page 2.7-15/16*
Page 2.9-1/2	Page 2.9-1/2
---	Page 2.9-2a/2b
Figure 2.9-1	Figure 2.9-1

*Page 2.7-15 continues to be shown as Supplement 2.

VOLUME 3

Remove	Insert
General Table of Contents Page i/ii	General Table of Contents Page i/ii
---	Appendix 2C - Index tab breaker, title page, and Page 2C-i through Figure 2C-2. Insert immediately after Figure 5-2 of Appendix 2B.
Page Q&R 2-i/ii Page Q&R 2.5-1/2 Page Q&R 2.7-3/4 Page Q&R 2.9-1/2	Page Q&R 2-i/ii Page Q&R 2.5-1/2 Page Q&R 2.7-3/4 Page Q&R 2.9-1/2
Page 3.1-1/2 Figure 3.1-1	Page 3.1-1/2 Figure 3.1-1
Page 3.3-1/2	Page 3.3-1/2
Table 3.5-5, Sheet 2	Table 3.5-5, Sheet 2
Figure 4.2-1	Figure 4.2-1
Figure 4.3-1	Figure 4.3-1
Figures 5.3-30 through 5.3-38	Figures 5.3-30 through 5.3-38

VOLUME 4

Remove	Insert
General Table of Contents Page i/ii	General Table of Contents Page i/ii
Pages 5.4-7/8 through 5.4-11/12	Pages 5.4-7/8 through 5.4-11/12
Table 5.4-2, Sheet 1	Table 5.4-2, Sheet 1
Tables 5.4-6 through 5.4-9	Tables 5.4-6 through 5.4-9
Table 5.4-22	Table 5.4-22
Figure 5.8-1	Figure 5.8-1
Appendix 5A	Appendix 5A
Pages 5A-1/2 through 5A-17/-	Pages 5A-1/2 through 5A-17/18
Table 5A-1	Table 5A-1
Table 5A-4, Sheet 1	Table 5A-4, Sheet 1
Page 6-iii/iv	Page 6-iii/iv
Page 6.2-1/2	Page 6.2-1/2
Page 6.2-3/4	Page 6.2-3/4
Page 6.2-4a/4b	Page 6.2-4a/4b
Page 6.2-5/5a	Page 6.2-5/5a
Table 6.2-1 (3 sheets)	Table 6.2-1 (3 sheets)
Table 6.2-2	Table 6.2-2
Figure 6.2-1	Figure 6.2-1
---	Figure 6.2-2
Page 7.1-1/2	Page 7.1-1/2
Remove and discard the entire Chapter 3 (i.e., pages 8-i/ii through Q&R 8.3-1/2). This includes Sections 8.1, 8.2, 8.3, and 8.4, Appendices 8A and 8B, and the Chapter 8 questions and responses section.	Page 8.1-1/- Insert immediately after the Chapter 8 index tab breaker.
Page 10.4-1/2	Page 10.4-1/2

TABLE OF CONTENTS

Chapter	Section	Title	Volume
1		INTRODUCTION	1
	1.1	The Proposed Project	1
	1.2	Status of Reviews and Approvals	1
	1.3	Substantive Informational Changes from Construction Permit Stage	1
2		ENVIRONMENTAL DESCRIPTIONS	1
	2.1	Description of the Station Location	1
	2.2	Land	1
	2.3	Water	1
	2.4	Ecology	1
	2.5	Socioeconomics	2
	2.6	Geology	2
	2.7	Meteorology	2
	2.8	Ambient Air Quality	2
	2.9	Ambient Noise	2
	2.10	Related Federal Project Activities	2
	APPENDICES 2A, 2B, and 2C		3
3		PLANT DESCRIPTION	3
	3.1	External Appearance and Plant Layout	3
	3.2	Reactor Steam - Electric System	3
	3.3	Plant Water Use	3
	3.4	Cooling System	3
	3.5	Radioactive Waste Management Systems	3
	3.6	Nonradioactive Waste Systems	3
	3.7	Power Transmission Systems	3
	3.8	Transportation of Radioactive Materials	3
4		ENVIRONMENTAL IMPACTS OF CONSTRUCTION	3
	4.1	Land Use Impacts	3
	4.2	Hydrological Alterations and Water Use Impacts	3
	4.3	Ecological Impacts	3
	4.4	Socioeconomic Impacts	3
	4.5	Radiation Exposure to Construction Workers	3
	4.6	Measures and Controls to Limit Adverse Impacts During Construction	3

TABLE OF CONTENTS

Chapter	Section	Title	Volume
5		ENVIRONMENTAL IMPACTS OF STATION OPERATION	3
	5.1	Land Use Impacts	3
	5.2	Hydrological Alterations, Plant Water Supply, and Water Use Impacts	3
	5.3	Cooling System Impacts	3
	5.4	Radiological Impacts of Normal Operation	4
	5.5	Nonradioactive Waste System Impacts	4
	5.6	Transmission System Impacts	4
	5.7	Uranium Fuel Cycle Impacts	4
	5.8	Socioeconomic Impacts	4
	5.9	Decommissioning	4
	5.10	Measures and Controls to Limit Adverse Impacts During Operation	4
	APPENDIX 5A		4
6		ENVIRONMENTAL MEASUREMENTS AND MONITORING PROGRAMS	4
	6.1	Thermal	4
	6.2	Radiological	4
	6.3	Hydrological	4
	6.4	Meteorological	4
	6.5	Biological	4
	6.6	Chemical	4
	6.7	Other Monitoring Programs	4
7		ENVIRONMENTAL IMPACTS OF POSTULATED ACCIDENTS INVOLVING RADIOACTIVE MATERIALS	4
	7.1	Plant Accidents	4
	7.2	Transportation Accidents	4
8		THE NEED FOR THE PLANT	4
9		ALTERNATIVES TO THE PROJECT	4

4

CHAPTER 1

INTRODUCTION

This Environmental Report - Operating License Stage (ER-OLS) is submitted in fulfillment of the requirements of 10CFR51 and in support of the application for a license to operate the River Bend Station - Units 1 and 2 nuclear power plant. This ER-OLS is based on the content and format guidelines of Regulatory Guide 4.2, Revision 2, and the Environmental Standard Review Plans (NUREG-0555) issued by the Nuclear Regulatory Commission (NRC) in May 1979. Information from the Construction Permit Stage Environmental Report is restated here for completeness with additional discussion provided, as needed.

Gulf States Utilities Company (GSU) originally submitted an Environmental Report-Construction Permit State (ER-CPS) to the commission in mid-1973 in support of the River Bend Station Construction Permit (CP) Application. Subsequently in September 1973 the Construction Permit Application was docketed and docket numbers 50-458 and 50-459 were assigned to the project. In September 1975 site work was authorized under the issuance of a Limited Work Authorization (LWA). Then in March 1977 Construction Permit Numbers CPPR 145 and CPPR 146 were granted for Units 1 and 2, respectively.

In 1980 the NRC granted GSU a construction permit amendment allowing Cajun Electric Power Cooperative (CEPCO) to become a 30 percent co-owner in River Bend Station - Unit 1. Unit 2 is currently solely owned by GSU. Prior to granting this amendment, the Rural Electrification Administration (REA), according to its regulations, issued a Final Supplemental Environmental Impact Statement (FSEIS)[1] which adopted the Final Environmental Statement (FES) issued by the Atomic Energy Commission (currently the NRC) in September 1974.

In fulfillment of the regulations as stated in 10CFR51, GSU in behalf of itself and for CEPCO has prepared this Environmental Report-Operating License Stage (ER-OLS). GSU is acting as project manager and is responsible for the design, construction, and operation of River Bend Station (RBS).

1.1 THE PROPOSED PROJECT

River Bend Station is located in West Feliciana Parish, Louisiana, 3 km (2 mi) east of the Mississippi River and

approximately 38 km (24 mi) north-northwest of Baton Rouge, Louisiana.

The reactors for River Bend Station are warranted for a core thermal power of 2,894 MWt. Reactor power output at rated plant operating conditions is 2,887 MWt, which corresponds to a net station electrical output of approximately 936 MWe. Each reactor has a design core thermal power of 3,015 MWt (105 percent of reactor warranty steam flow exiting the vessel) for evaluating the design of components, systems, and structures in support of reactor operation.

Dissipation of waste heat will be accomplished through a closed-cycle system, utilizing multi-cell mechanical-draft cooling towers. Makeup water will be withdrawn from the Mississippi River through submerged intake screens and suction pipelines to a dry pit pumphouse structure. Blowdown from the main cooling water system is discharged to the river through a buried pipe located downstream of the intake structure

The transmission system is composed of three routes, 80 percent of which are located adjacent to or parallel with existing rights-of-way. The length of the routes combined totals a distance of 129.2 km (80.2 mi).

The scheduled completion date of construction and fuel loading for Unit 1 is April 1985, with an anticipated commercial operation date of December 1985. Unit 2 is currently not scheduled and only those facilities common to Unit 1 have been constructed; however, the environmental impacts presented in this report are conservatively based on two-unit operation.

TABLE 1.2-1

FEDERAL, STATE, AND LOCAL AUTHORIZATIONS

Agency	Authorization Required	Authority	Date of Request	Status
U.S. GOVERNMENT				
Army Corps of Engineers	Dredging and maintenance of a slip, construction and maintenance of intake and discharge structures, and a barge dock	Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C 403); FWPCA Section 404 (P.L. 92-500, 86 Stat 816)	9/5/74	Permit No. LMNOD-SP (Mississippi) 870 issued 10/15/76. Extension granted 7/7/78. Additional extension granted 1/16/80.
	Construction of transmission lines across Mississippi River	Section 10 of the Rivers and Harbors Act of 1899	7/18/77	Permit No. LMNOD-SP (Mississippi River) 990 Issued 10/25/77.
	Construction of transmission lines across Thompson Creek	Section 10 of the Rivers and Harbors Act of 1899	8/2/79	Permit No. LMNOD-SP (Thompson Creek) 6 Issued 2/13/80. (Route 2)
	Construction of transmission lines across Thompson Creek	Section 10 of the Rivers and Harbors Act of 1899	10/27/81	Permit No. LMNOD-SP (Thompson Creek) 7 Issued 1/15/82. (Route 3)
	Construction of transmission line across Comite River	Section 10 of the Rivers and Harbors Act of 1899	8/25/81	Permit No. LMNOD (Comite River) 6 Issued 4/8/82.
Nuclear Regulatory Commission	Limited Work Authorization	Atomic Energy Act of 1954 as amended, and 10CFR50	6/25/75	Issued 9/5/75.
	Construction Permit	Atomic Energy Act of 1954 as amended, and 10CFR50	9/24/73	Construction Permit No. CPPR 145 and CPPR 146 issued 3/25/77. Extension granted 12/27/82.

TABLE 1.2-1 (Cont)

Agency	Authorization Required	Authority	Date of Request	Status
	Construction Permit Amendment and Unit 1 Joint Ownership	Atomic Energy Act of 1954 as amended, and 10CFR50	10/26/79	Granted 10/3/80.
	Operating License	Atomic Energy Act of 1954 as amended, and 10CFR50	4/81	Application submitted and under review.
	Special Nuclear Materials License	Atomic Energy Act of 1954 as amended, and 10CFR70	Six months prior to delivery of in-core detectors.	Future
	By-Product Nuclear Material License	10CFR30	12/9/82	Application Submitted and under review.
Federal Aviation Administration	River crossing by transmission towers	14CFR77	7/14/77	Approval granted 7/28/77.
Environmental Protection Agency	NPDES permit for construction	FWPCA Section 402 (P.L. 92-500)	5/21/75	Permit No. LA0047112 issued 12/18/75. Request for additional discharge granted 4/29/76.
	NPDES permit for operation	FWPCA Section 402 (P.L. 92-500)	9/5/74	Permit No. LA0042731 issued 8/4/78. Supercedes Permit No. LA0047112.
	Training Center Sanitary Waste Discharge	FWPCA Section 402 (P.L. 92-500)	6/30/82	Draft Permit No. LA0063886 issued 1/7/83.

TABLE 1.2-1 (Cont)

Agency	Authorization Required	Authority	Date of Request	Status
STATE OF TEXAS				
Public Utility Commission	Certificate of Public Convenience and Necessity to construct, own, and operate Units 1 and 2 and transmission lines	Article 1446C of Vernons Annotated Civil Statutes, Public Utility Regulatory Act	10/14/77	Approval granted 3/21/78 under Docket Number 857.
STATE OF LOUISIANA				
Stream Control Commission (LSCC) (Now Water Pollution Control Division of Office of Environmental Affairs)	Waste water discharge permit	La. Revised Statutes of 1950, Title 56, Section 1439(5)	6/25/74	Approval granted 10/25/74. Request for additional discharge granted 11/21/78.
			1/5/83	Request for additional outfalls submitted.
	Training Center Sanitary Waste Discharge	La. Revised Statutes of 1950, Title 56, Section 1439(5)	6/30/82	Permit No. WP0302 effective 11/23/82.
	Certification for EPA Permit (Section 401 Certification)	FWPCA Section 401 (P.L. 92-500)	12/2/74	LSCC refused to act 12/13/74. This constitutes waiver of Section 401 requirements.
Department of Natural Resources	Industrial landfill	La. Sanitary Code, Chapter X, para. 10.52	10/4/79	Approval granted 11/19/79.
	Hazardous waste generator identification number	Act 449, 1979 Legislature, and Hazardous Waste Management Program Rules and Regulations	1/21/80	Granted 1/22/80.

TABLE 1.2-1 (Cont)

Agency	Authorization Required	Authority	Date of Request	Status
Air Control Commission (LACC) (Now the Air Pollution Control Division of the Office of Environmental Affairs)	Burning of construction wastes	LACC regulations amended through 2/20/78	10/4/79	Approval granted 11/19/79.
	Diesel emissions	LACC regulations amended through 2/20/78	Future	Future
Health and Human Resources Administration	Wells registration	-	5/14/76	Approval granted 10/21/76.
Highway Department	Construction of road between Rte. 965 and US Rte. 61 (North Access Road)	La. Stat. Rev. Title 48, Sec. 301 and 344	11/26/74	Permit No. 96025 issued 2/24/75. Permit extended 6/17/75.
Wildlife and Fisheries Commission	Administrative scientific collection permit for surveys or monitoring	La. Stat. Rev. Title 56, Sec. 104H and 318, (1950)	Future	Future
WEST FELICIANA PARISH				
Police Jury	Road modifications	-	-	Approval granted 11/5/74.
	Pipelines and electrical conduit crossing under Police Jury Road	-	2/12/80	Approval granted 2/27/80.

CHAPTER 2

TABLE OF CONTENTS (Cont)

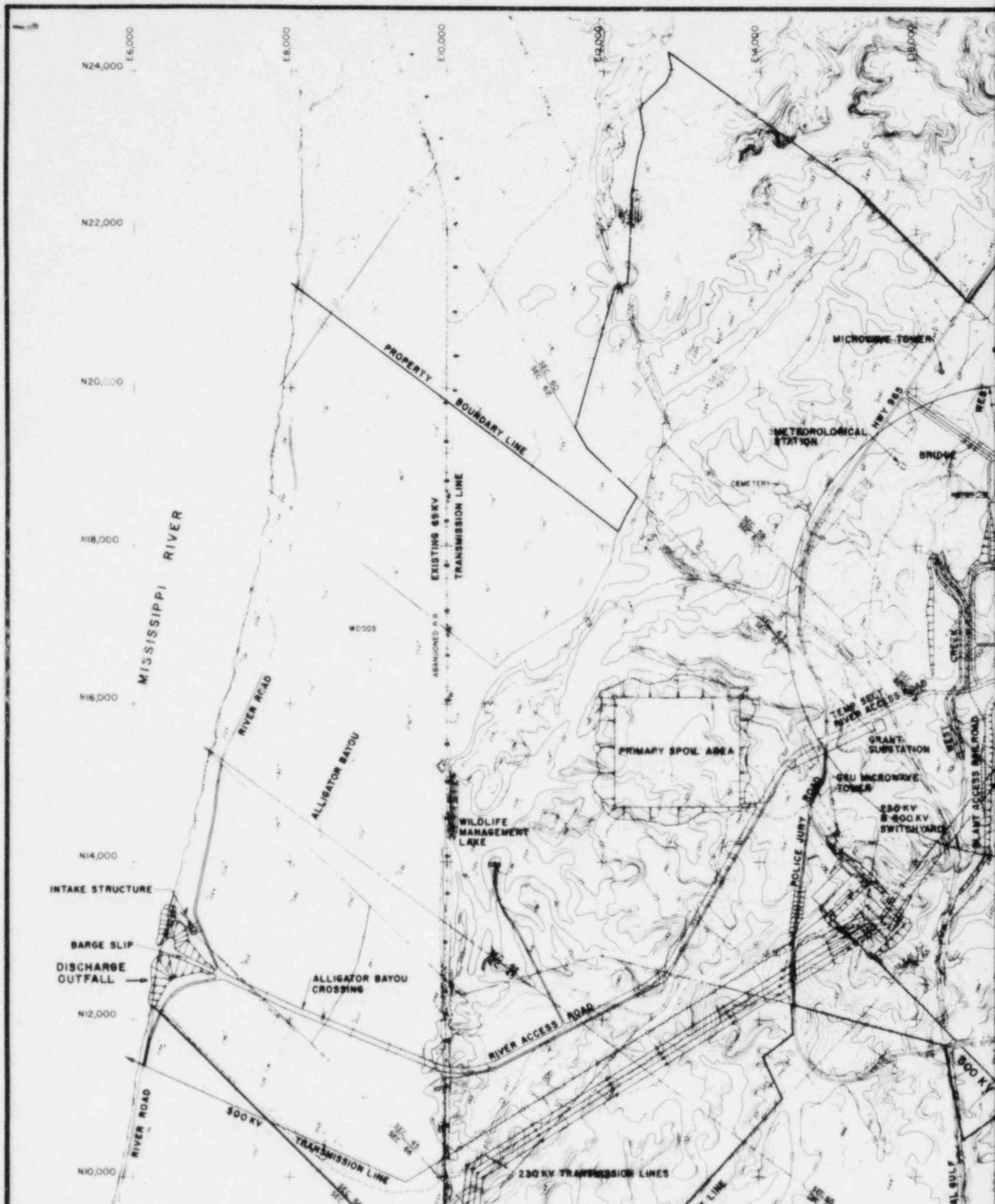
Section	Title	Page
2.8.5	EPA Attainment/Nonattainment and Class I Area Designations	2.8-3
2.8.6	Conclusions	2.8-3
2.9	AMBIENT NOISE	2.9-1
2.10	RELATED FEDERAL PROJECT ACTIVITIES	2.10-1
APPENDIX 2A	HYDROGRAPHIC STUDIES REPORT	
APPENDIX 2B	ALLIGATOR BAYOU FLOOD STUDY PRESENT BAYOU HYDROLOGY	
APPENDIX 2C	POPULATION DISTRIBUTION	4

CHAPTER 2

LIST OF TABLES

Table Number	Title
2.2-1	LAND USES OF PARISHES WITHIN 10 KM OF THE RIVER BEND STATION IN 1972
2.2-1	LAND USES OF PARISHES WITHIN 10 KM OF THE RIVER BEND STATION IN 1972
2.2-2	PIPELINES IN THE VICINITY OF RIVER BEND STATION
2.2-3	INDUSTRIAL AND MANUFACTURING FIRMS AND EXTRACTIVE OPERATIONS WITH 10 KM
2.2-4	MAJOR RECREATION AREAS WITH 10 KM
2.2-5	AGRICULTURAL PRODUCTION OF CROPS AND ANIMALS FOR FOUR PARISHES WITHIN 10 KM FOR 1978
2.2-6	LAND USE DATA ON ROUTE I
2.2-7	LAND USE DATA ON ROUTE II
2.2-8	LAND USE DATA ON ROUTE III
2.2-9	LAND TYPES CROSSED BY TRANSMISSION CORRIDORS
2.2-10	LAND USE CATEGORIES FOR LOUISIANA PARISHES WITHIN 80 KM OF RIVER BEND STATION IN 1972
2.2-11	MAJOR LAND USE CATEGORIES FOR MISSISSIPPI COUNTIES WITHIN 80 KM OF RIVER BEND STATION IN 1979
2.2-12	FOUR PRINCIPAL AGRICULTURAL PRODUCTS IN LOUISIANA: ACREAGE, YIELD, AND PRODUCTION IN 1978 FOR THE THREE FARMING AREAS IN LOUISIANA WITHIN 80 KM OF RIVER BEND STATION
2.2-12a	TOTAL KG CROPS (MAJOR) PER SECTOR, 1978
2.2-12b	TOTAL CATTLE AND CALF PRODUCTION (NO. OF HEAD) PER SECTOR, 1978

2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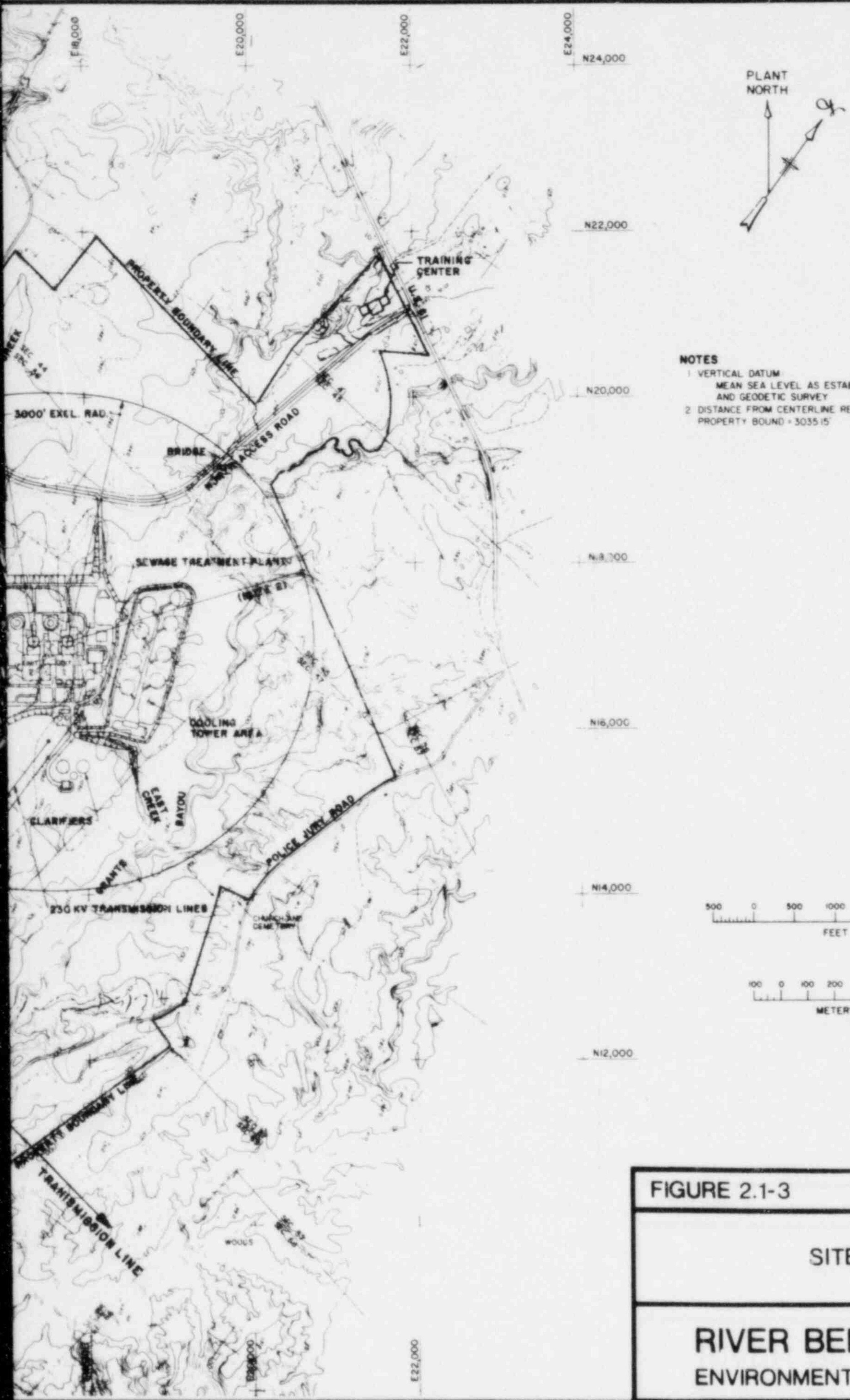
E14,000
E16,000
MISSISSIPPI RIVER
PROPERTY BOUNDARY LINE
EXISTING 69 KV TRANSMISSION LINE
ABANDONED R.R.
WOODS
RIVER ROAD
ALLIGATOR BAYOU
INTAKE STRUCTURE
BARGE SLIP
DISCHARGE OUTFALL
ALLIGATOR BAYOU CROSSING
RIVER ACCESS ROAD
500 KV TRANSMISSION LINE
230 KV TRANSMISSION LINES
WILDLIFE MANAGEMENT LAKE
PRIMARY SPOIL AREA
POLICE JURY ROAD
METEOROLOGICAL STATION
CEMETERY
HWY 965
BRIDGE
GRANT SUBSTATION
GSU MICROWAVE TOWER
230 KV & 500 KV SWITCHYARD
PLANT ACCESS RAILROAD
ILLINOIS CENTRAL GULF
CREEK
500 KV



NOTES

1. VERTICAL DATUM
   MEAN SEA LEVEL AS ESTABLISHED BY U.S. COAST AND GEODETIC SURVEY
2. DISTANCE FROM CENTERLINE REACTOR NO 1 TO PROPERTY BOUND = 3035.15'

500 0 500 1000 1500 2000 2500
FEET
100 0 100 200 300 400 500
METERS

FIGURE 2.1-3

SITE MAP

RIVER BEND STATION
ENVIRONMENTAL REPORT – OLS

2.2 LAND

2.2.1 The Site and Vicinity

2.2.1.1 The Site

The parcel of property on which River Bend Station is located contains a total of 1,352 ha (3,342 acres), of which nearly all but the land located in transportation rights-of-way is owned by GSU. The major land use on the property is the electric generating and transmission facilities required by the two-unit station. A description of station facilities and their land requirements is included in Section 4.3.1. Property boundaries and station layout are presented in Fig. 2.1-3.

There are several other land uses on or adjacent to the property that will continue during station operation. As indicated in Fig. 2.1-3, the property is bounded on the northeast by US Highway 61, the major road between St. Francisville and Baton Rouge. Other roads that cross the property include State Road 965 and Police Jury Road which is its extension; River Road (a minimum maintenance Police Jury Road) and River Access Road connecting River Road to Police Jury Road (with a spur to the Wildlife Management Lake); and North Access Road, constructed between US Highway 61 and State Road 965. Of these only River Access Road and North Access Road belong to Gulf States Utilities. River Road and Police Jury Road belong to West Feliciana Parish; others are state or federally owned.

None of these roads will be closed to public use because of normal station operation. Under emergency conditions, access to the plant by way of State Road 965 and to North Access Road will be limited.

A 3.6-km (2.3-mi) section of the Illinois Central Gulf Railway crosses the property. The right-of-way is in railway company ownership. This section of the Slaughter to Woodville line carries only freight and has daily service on demand. Traffic averages one train daily 5 days a week on the line, which is a local between Zee and St. Francisville[1].

An existing 69-kV transmission line belonging to Gulf States Utilities crosses the property on an abandoned railroad line that runs roughly parallel to the Mississippi River. This transmission line serves the St. Francisville region and the Louisiana State Penitentiary in Angola.

The Starhill Radio Tower is located just north of the intersection of State Road 965 and North Access Road, approximately 1 km (0.6 mi) from the Unit 2 reactor, the nearer of the two units. This microwave tower is part of the long-distance telephone relay line between Lake City, Florida and Houston, Texas. It is an installation for which access 24 hr a day, 7 days a week is required for routine maintenance and emergencies[2]. The microwave tower and its 0.7-ha (1.7-acre) parcel will continue to be owned and operated by American Telephone and Telegraph. Access will not be restricted during operation of River Bend Station.

No major residential areas are located adjacent to the site, but a small residential area is presently located on GSU property along State Road 965. In addition, there is one house on US Highway 61 adjacent to the North Access Road. Upon plant startup, land leases on the River Bend property will be discontinued, as well as housing leases along State Road 965. Residents of the house on US Highway 61 will be permitted to stay.

The western portion of the property is a wildlife management area which will contain a lake of approximately 13.8 ha (34.2 acres). A road will be constructed from the River Access Road to the Wildlife Management Lake. This area will lend itself to use as an outdoor classroom where principles and practices of conservation may be taught to local schoolchildren. A path around the lake's edge will provide access. A land and wildlife management policy is being developed for the River Bend Property.

Approximately 950 acres of the site are considered wetlands by the Louisiana Wildlife and Fisheries Commission and the U.S. Fish and Wildlife Service. Construction within onsite wetlands has been limited to the extent possible, in compliance with Executive Order 11990 (Protection of Wetlands). Approximately 15 acres were removed for construction of River Access Road and the embayment.

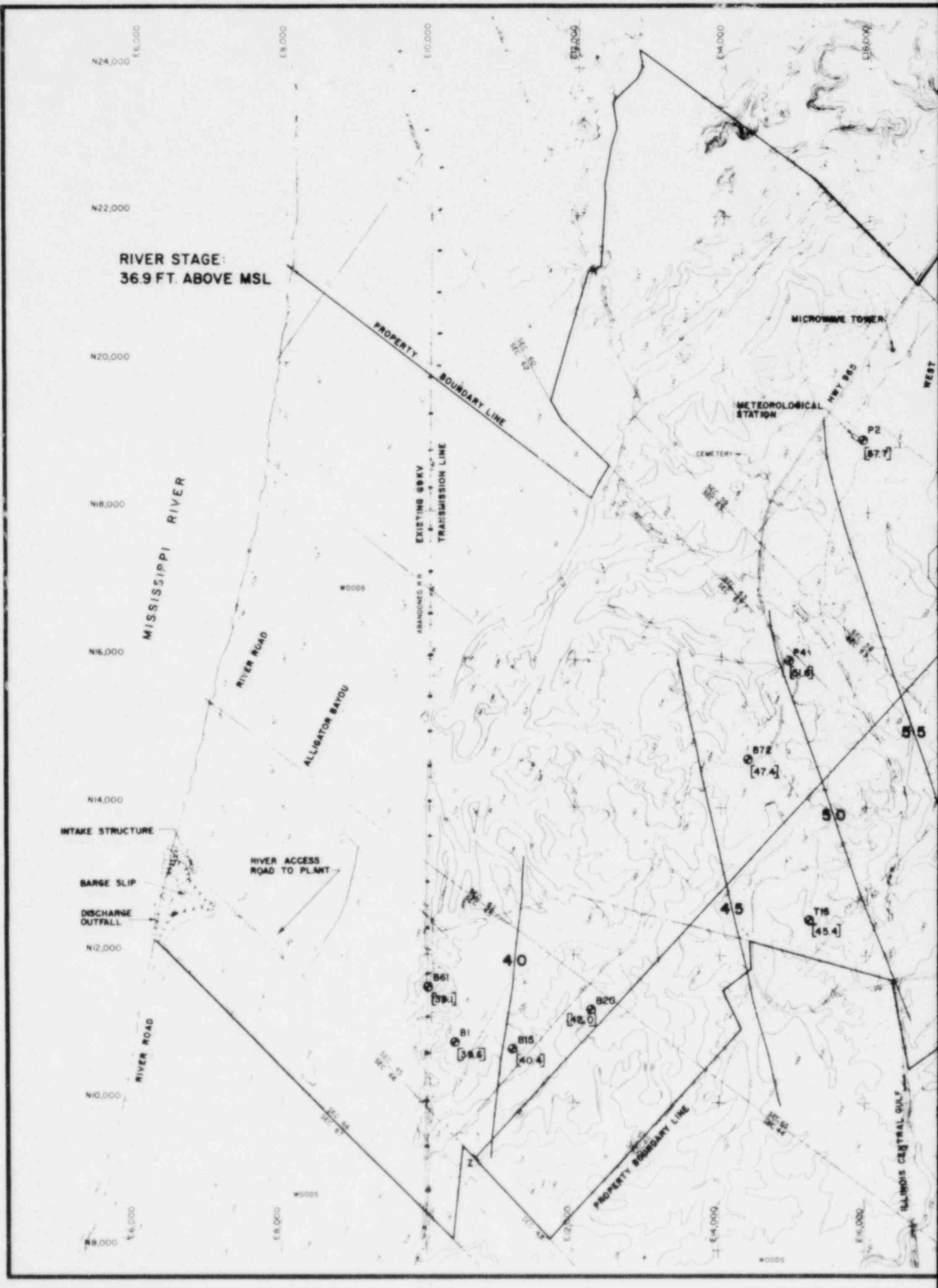
About 830 acres of the site are Mississippi River floodplain. West Creek and a portion of Grants Bayou, and their associated floodplains, are included within the site boundary. In accordance with Executive Order 11988 (Floodplains), construction activities in floodplains have been minimized to the extent possible. Adequate flood protection is provided for plant structures and equipment.

PROPERTY BOUNDARY LINE
TRANSMISSION LINE
RIVER ROAD
MICROWAVE TOWER
METEOROLOGICAL STATION
BRIDGE
CEMETERY
PRIMARY SPOIL AREA
TEMP SECT. RIVER ACCESS ROAD
POLICE JURY ROAD
RIVER ACCESS ROAD
ALLIGATOR BAYOU CROSSING
INTAKE STRUCTURE
RIVER ROAD
PROPERTY BOUNDARY LINE
ILLINOIS CENTRAL RAILROAD

FIGURE 2.3-11A

MISSISSIPPI RIVER FLOOD PLAIN

RIVER BEND STATION
ENVIRONMENTAL REPORT-OLS


RIVER STAGE:
36.9 FT. ABOVE MSL
MISSISSIPPI RIVER
RIVER ROAD
ALLIGATOR BAYOU
WOODS
ABANDONED R.R.
EXISTING 69KV TRANSMISSION LINE
PROPERTY BOUNDARY LINE
INTAKE STRUCTURE
BARGE SLIP
DISCHARGE OUTFALL
RIVER ACCESS ROAD TO PLANT
MICROWAVE TOWER
METEOROLOGICAL STATION
HWY 965
CEMETERY
WEST
ILLINOIS CENTRAL GULF
P2
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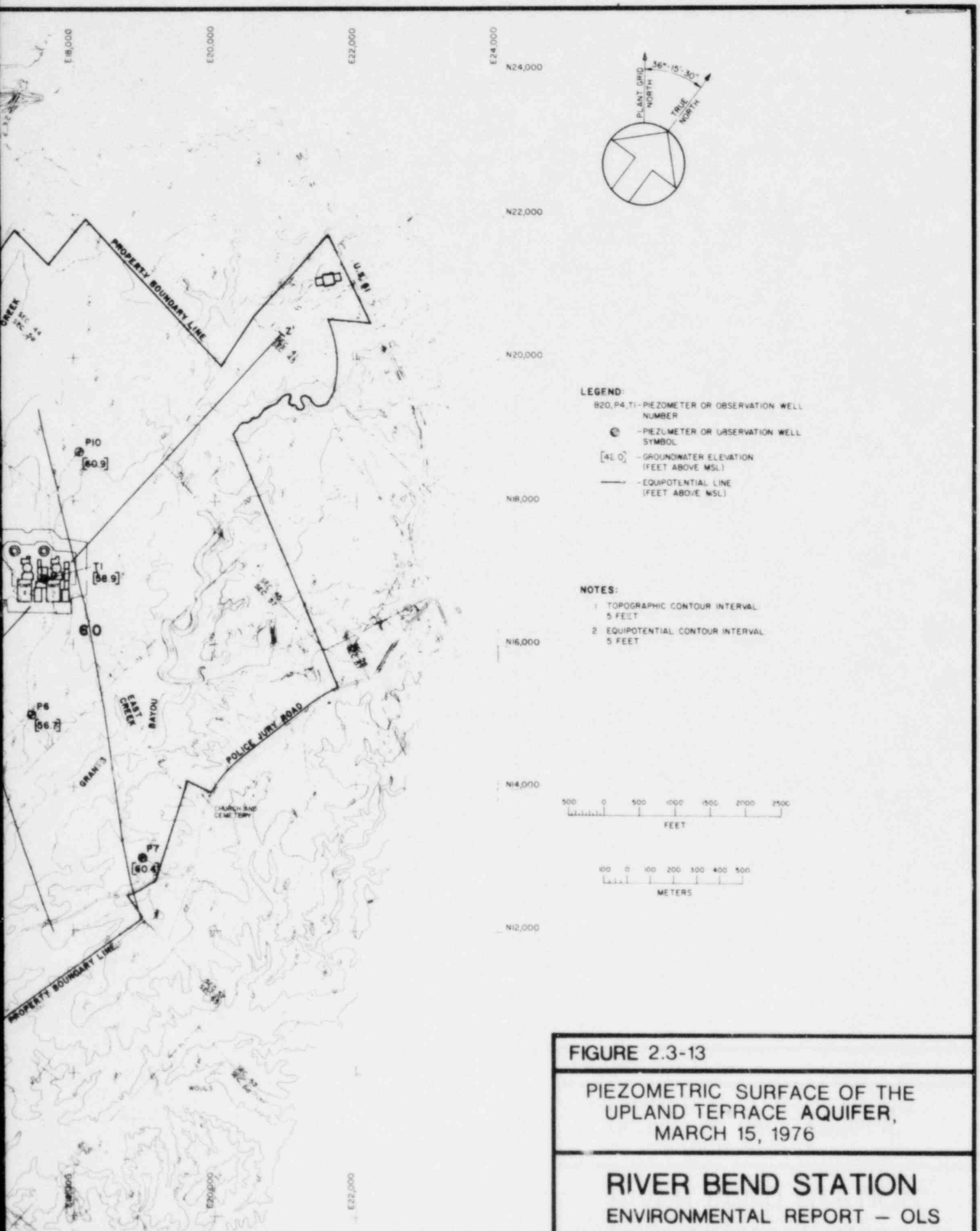
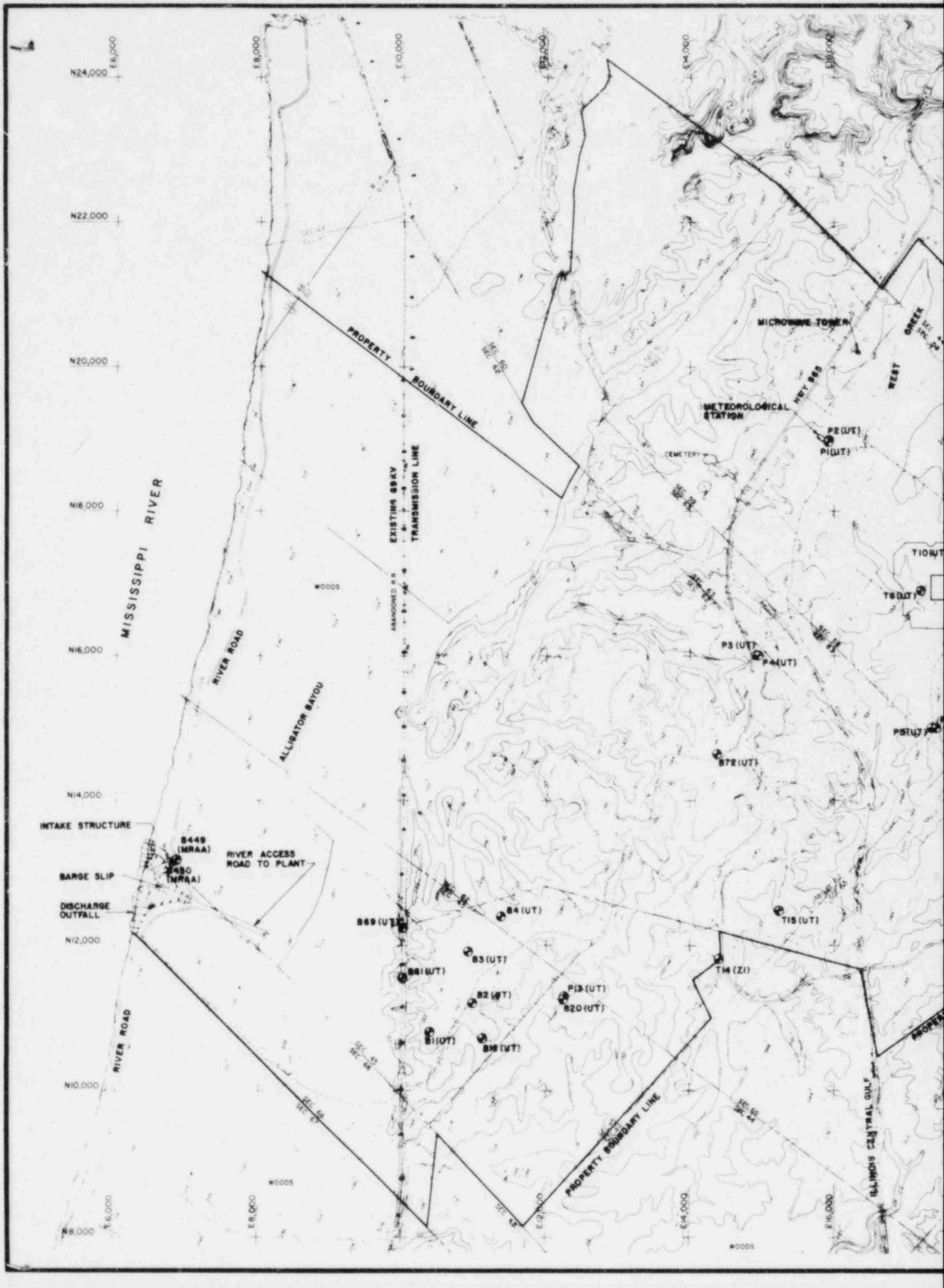


FIGURE 2.3-13

PIEZOMETRIC SURFACE OF THE UPLAND TERRACE AQUIFER, MARCH 15, 1976

RIVER BEND STATION

ENVIRONMENTAL REPORT – OLS



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E16,000
MISSISSIPPI RIVER
RIVER ROAD
ALLIGATOR BAYOU
WOODS
ABANDONED R.R.
EXISTING 69KV TRANSMISSION LINE
PROPERTY BOUNDARY LINE
MICROWAVE TOWER
METEOROLOGICAL STATION
HWY 565
CEMETERY
WEST
CREEK
P2(UT)
P1(UT)
T8(UT)
P3(UT)
P4(UT)
P5(UT)
B72(UT)
INTAKE STRUCTURE
B449 (MRAA)
B450 (MRAA)
BARGE SLIP
DISCHARGE OUTFALL
RIVER ACCESS ROAD TO PLANT
B69(UT)
B4(UT)
B3(UT)
B61(UT)
B2(UT)
B1(UT)
B16(UT)
P13(UT)
B20(UT)
T14(ZI)
T15(UT)
ILLINOIS CENTRAL GULF

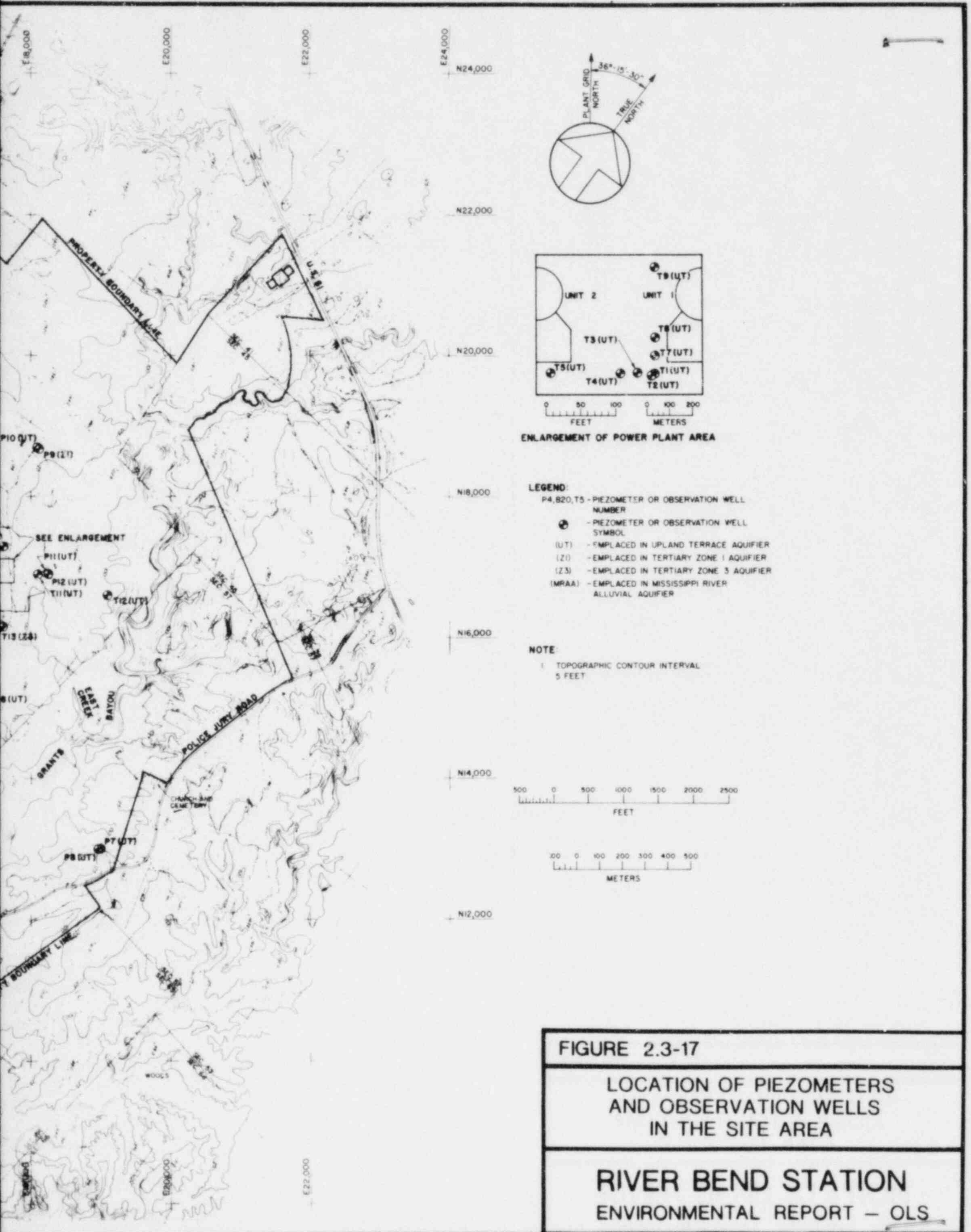
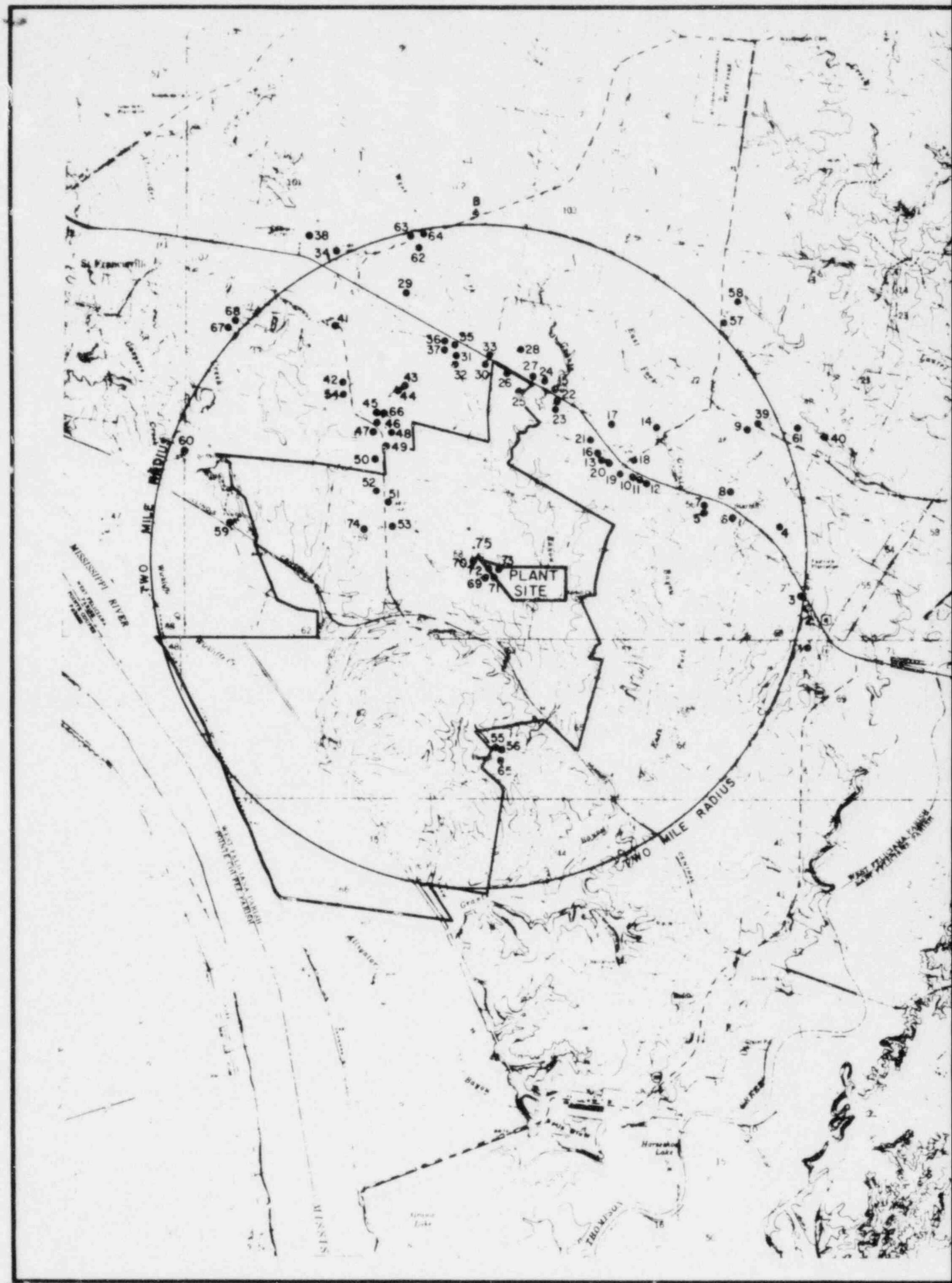


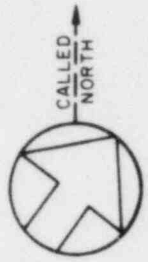
FIGURE 2.3-17

LOCATION OF PIEZOMETERS AND OBSERVATION WELLS IN THE SITE AREA

RIVER BEND STATION
ENVIRONMENTAL REPORT – OLS



TWO MILE RADIUS
TWO MILE RADIUS
PLANT SITE
MISSISSIPPI RIVER
St. Francisville
1 2 3 4 5 6 7 8 9 10 11 12 13 14 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 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



LEGEND

23 - WELL NUMBER CORRESPONDING TO WELL SCHEDULE IN TABLE 2.3-7

● - WELL SYMBOL

NOTE 1. WELL STATUS AND WELL USE LISTED IN TABLE 2.3-7

0 ½ 1 2 3
SCALE - KILOMETERS

0 ½ 1 2
SCALE - MILES

CONTOUR INTERVAL 20FT & 5FT
DATUM IS MEAN SEA LEVEL

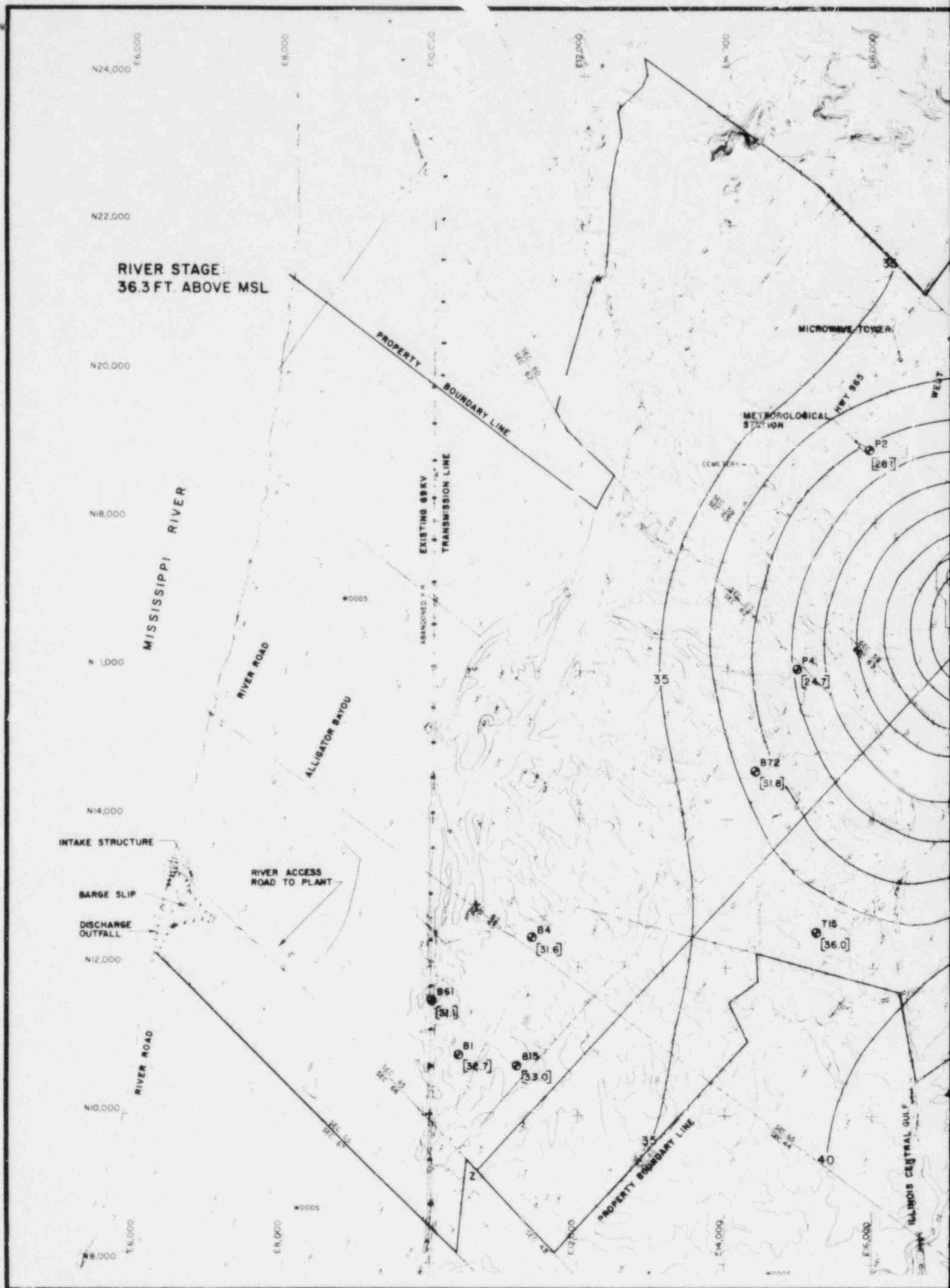
From: PORT HUDSON QUADRANGLE, LA., 7.5' (1963)

ELM PARK QUADRANGLE, LA., 7.5' (1965)

FIGURE 2.3-20

WATER WELLS WITHIN A TWO-MILE RADIUS OF SITE

RIVER BEND STATION
ENVIRONMENTAL REPORT - OLS


RIVER STAGE:
36.3 FT. ABOVE MSL
MISSISSIPPI RIVER
RIVER ROAD
ALLIGATOR BAYOU
PROPERTY BOUNDARY LINE
EXISTING 69KV TRANSMISSION LINE
INTAKE STRUCTURE
BARGE SLIP
DISCHARGE OUTFALL
RIVER ACCESS ROAD TO PLANT
MICROWAVE TOWER
HWY 965
CEMETERY
P4
[24.7]
B72
[31.8]
T15
[36.0]
B4
[31.6]
B1
[32.7]
B15
[33.0]
35
40
ILLINOIS CENTRAL GULF
N24,000
N22,000
N20,000
N18,000
N14,000
N12,000
N10,000
E6,000
E8,000
E16,000

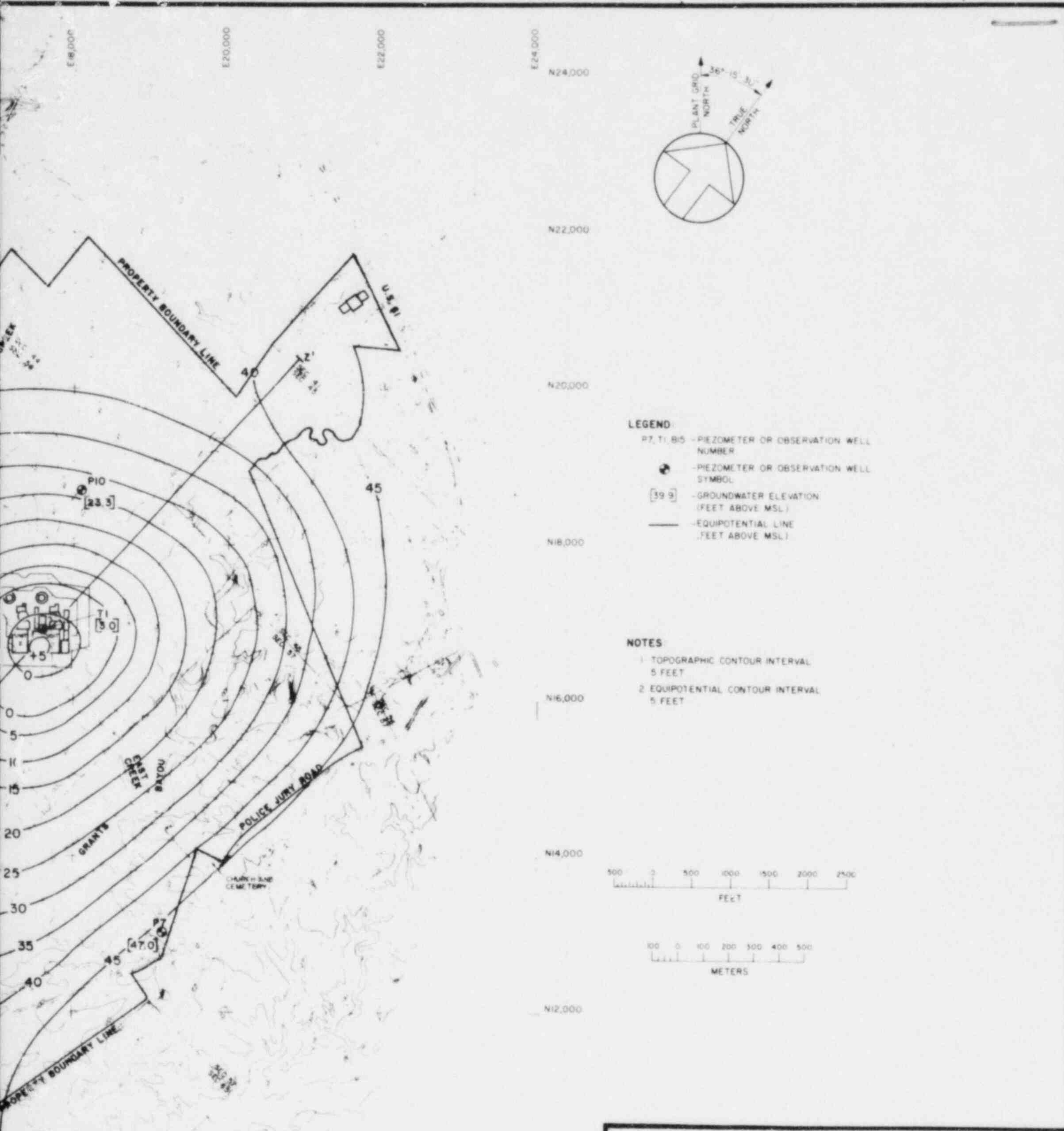
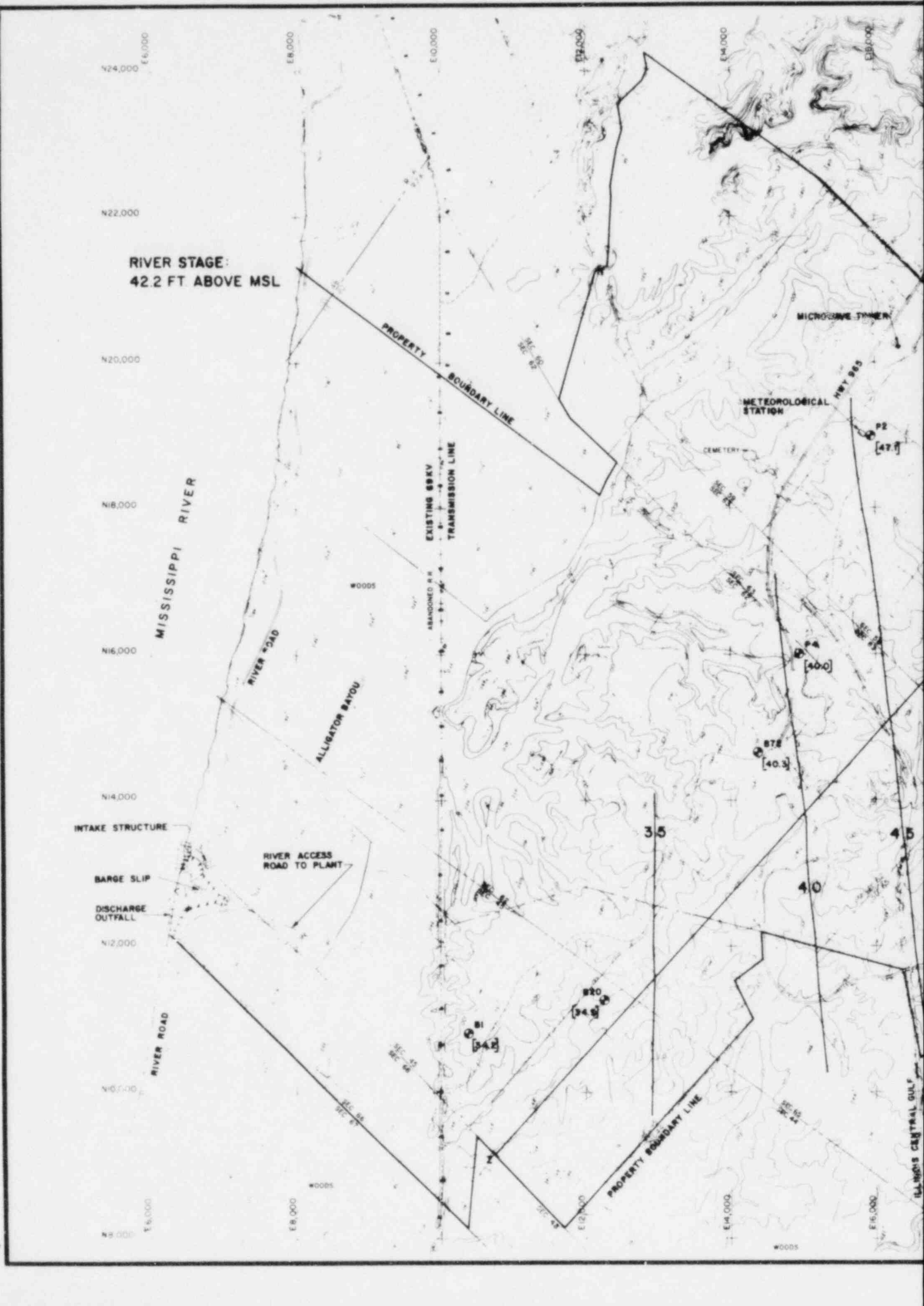


FIGURE 2.3-24

PIEZOMETRIC SURFACE OF THE UPLAND TERRACE AQUIFER, MARCH 17, 1977

RIVER BEND STATION
ENVIRONMENTAL REPORT – OLS



RIVER STAGE:
42.2 FT ABOVE MSL
MISSISSIPPI RIVER
RIVER ROAD
ALLIGATOR BAYOU
INTAKE STRUCTURE
BARGE SLIP
DISCHARGE OUTFALL
RIVER ACCESS ROAD TO PLANT
PROPERTY BOUNDARY LINE
EXISTING 69 KV TRANSMISSION LINE
ABANDONED R.R.
METEOROLOGICAL STATION
CEMETERY
HWY 965
ILLINOIS CENTRAL GULF
N24,000
N22,000
N20,000
N18,000
N16,000
N14,000
N12,000
N8,000
E6,000
E8,000
E10,000
E12,000
E14,000
E16,000
35
40
45
[47.1]
[40.0]
[40.3]
[34.9]
[34.2]

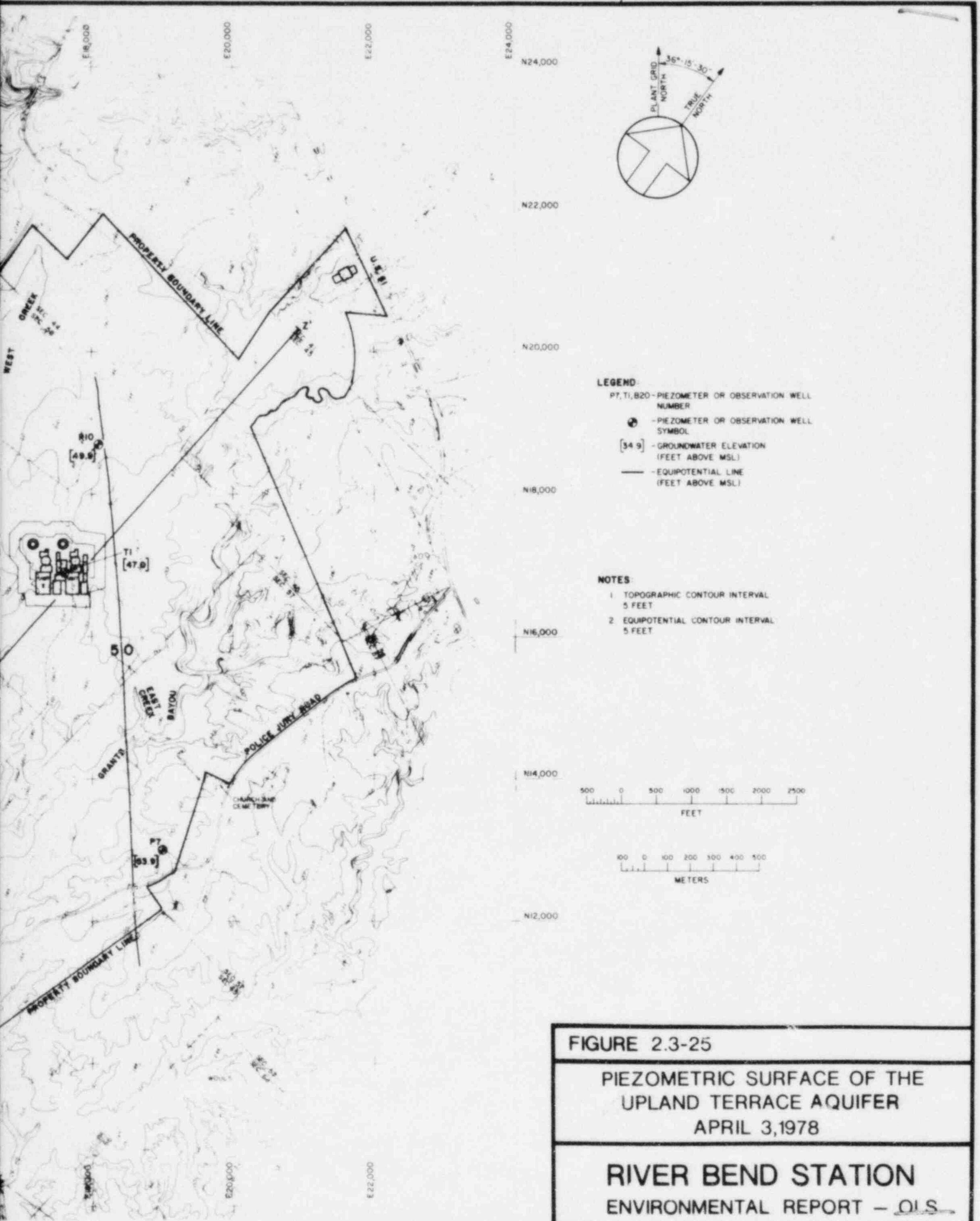
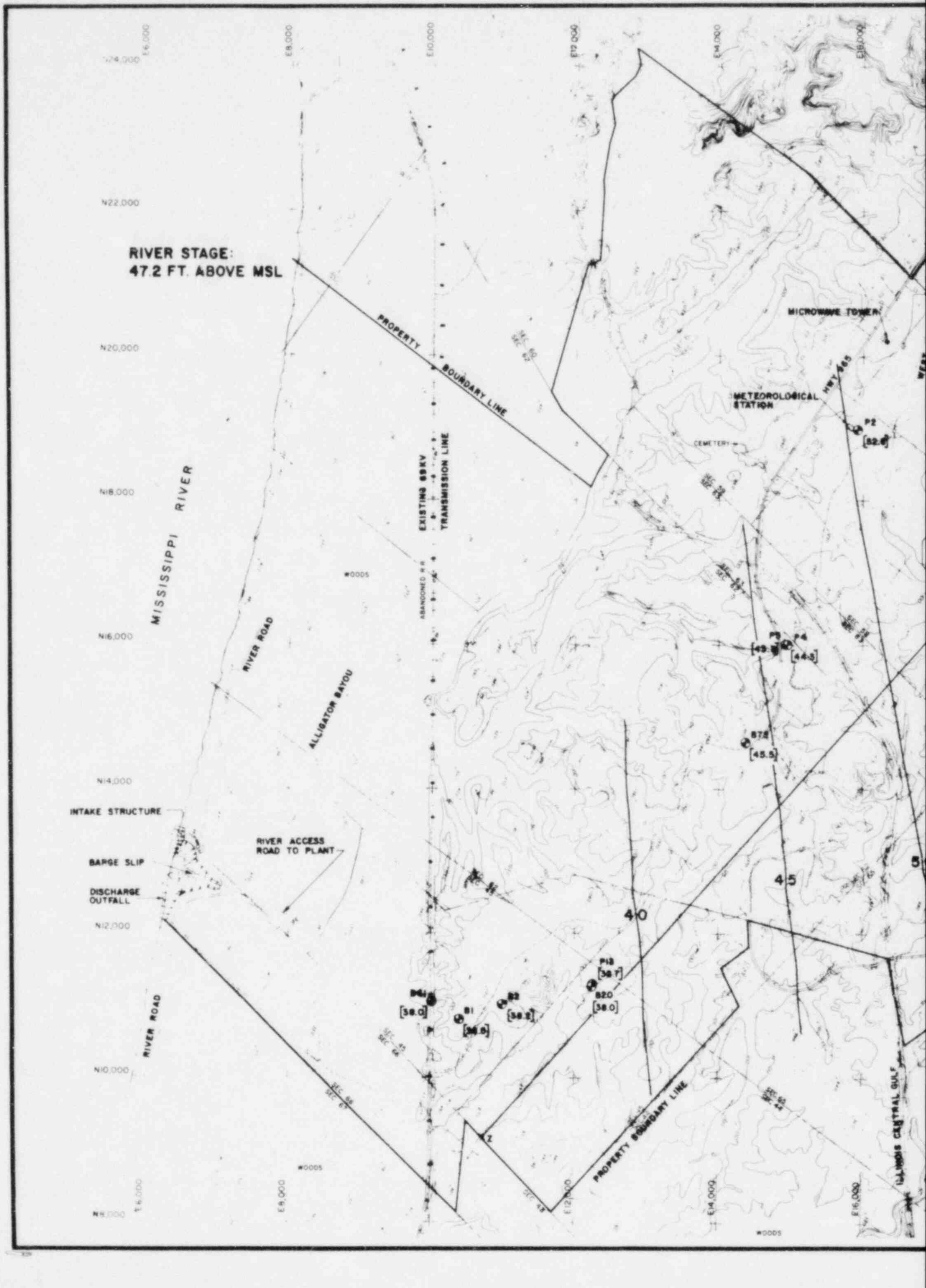


FIGURE 2.3-25

PIEZOMETRIC SURFACE OF THE UPLAND TERRACE AQUIFER APRIL 3,1978

RIVER BEND STATION
ENVIRONMENTAL REPORT – OLS



RIVER STAGE:
47.2 FT. ABOVE MSL
MISSISSIPPI RIVER
RIVER ROAD
ALLIGATOR BAYOU
PROPERTY BOUNDARY LINE
EXISTING 69KV TRANSMISSION LINE
MICROWAVE TOWER
METEOROLOGICAL STATION
CEMETERY
INTAKE STRUCTURE
BARGE SLIP
DISCHARGE OUTFALL
RIVER ACCESS ROAD TO PLANT
ILLINOIS CENTRAL GULF
N24,000
N22,000
N20,000
N18,000
N16,000
N14,000
N12,000
N10,000
E8,000
E10,000
E12,000
E14,000
E16,000
40
45

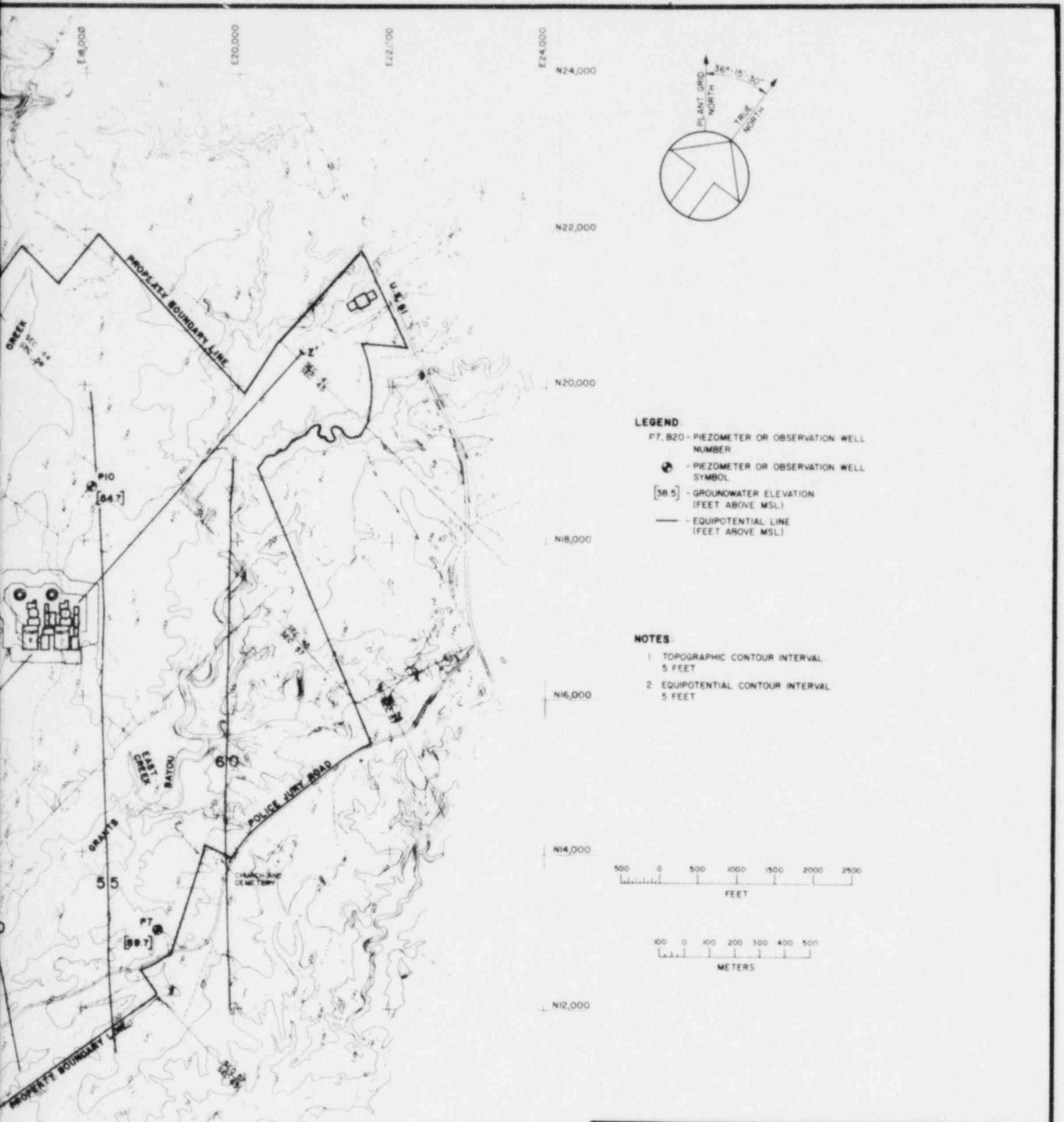
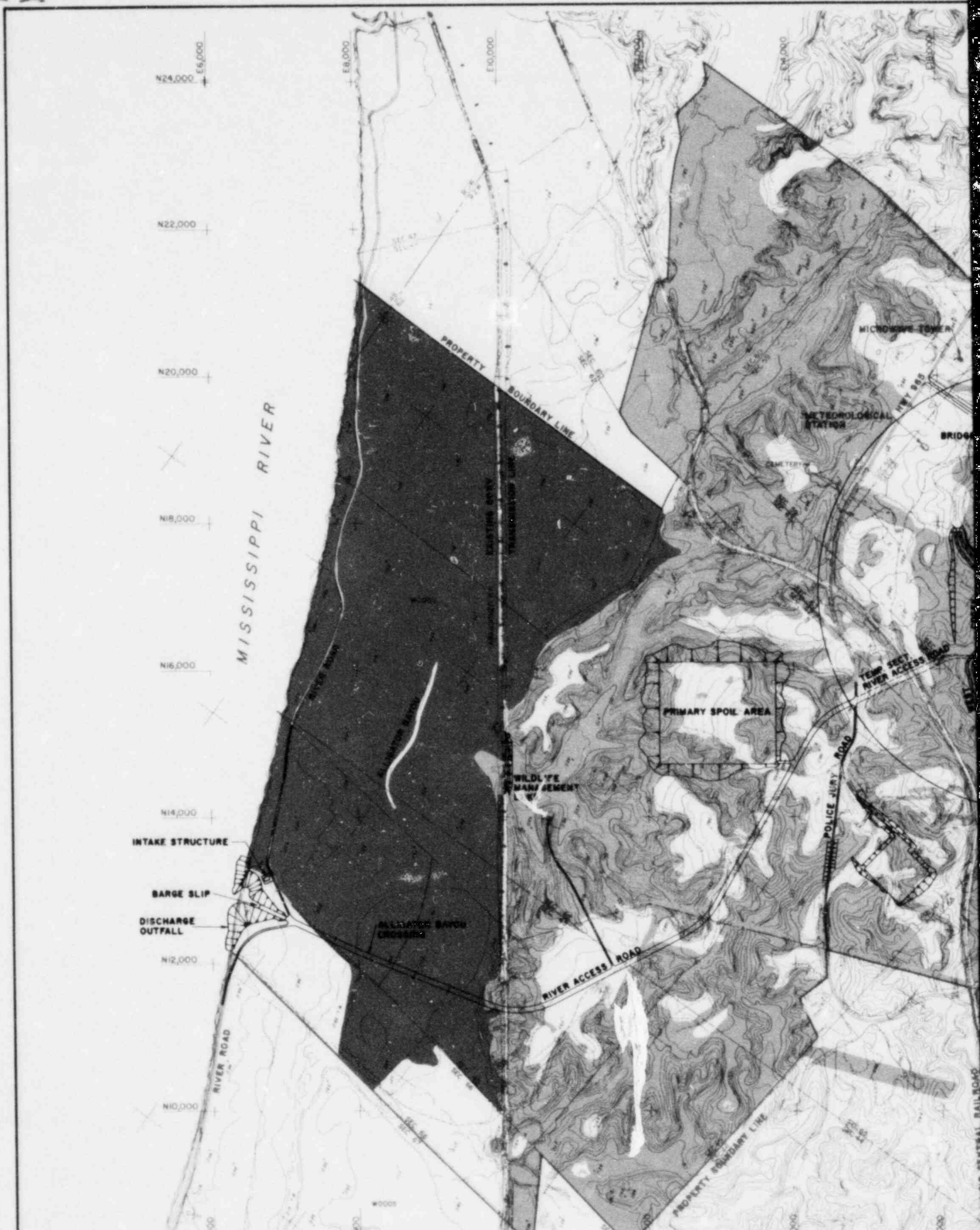


FIGURE 2.3-26

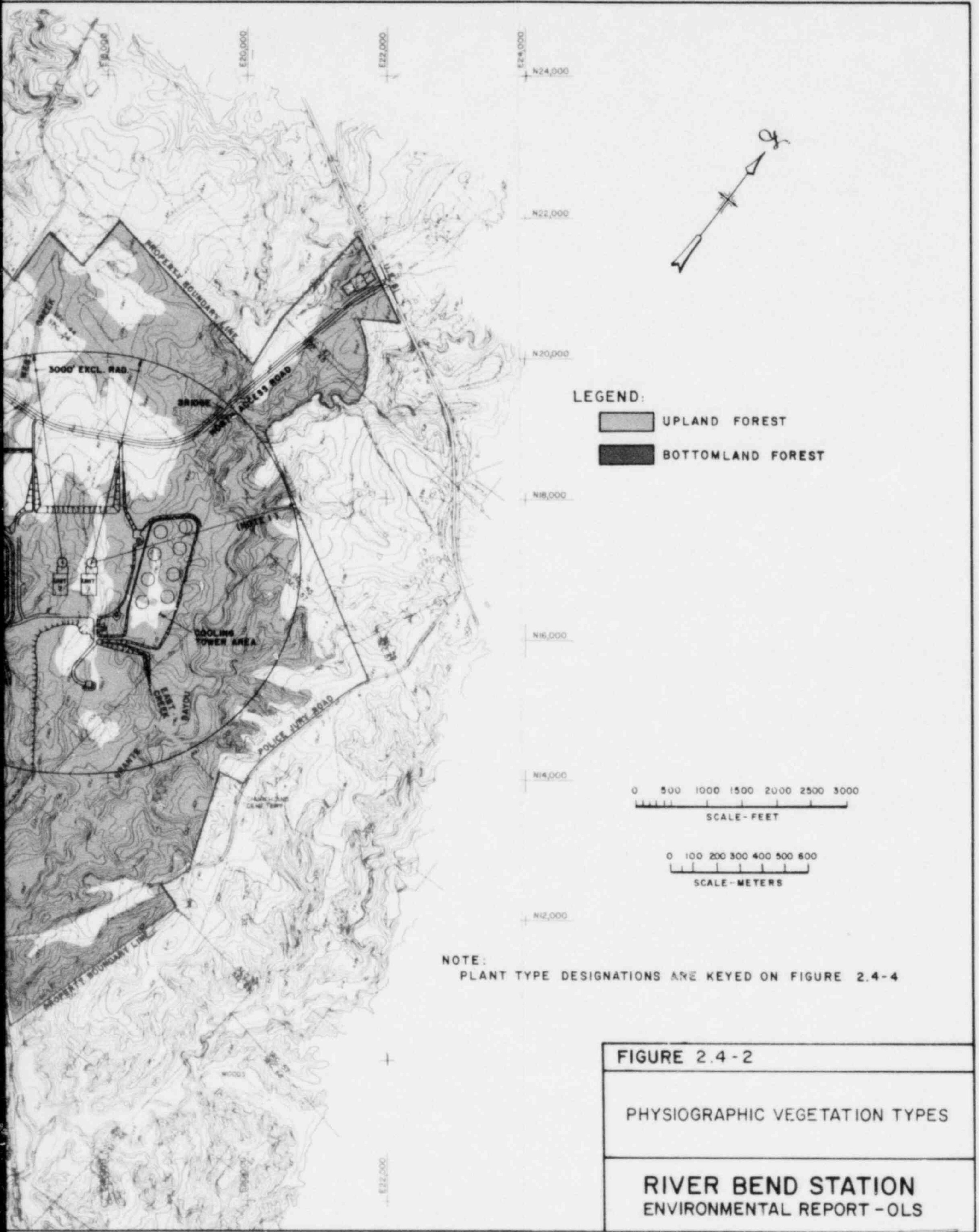
PIEZOMETRIC SURFACE OF THE UPLAND TERRACE AQUIFER, MARCH 16, 1979

RIVER BEND STATION

ENVIRONMENTAL REPORT – OLS



N24,000
N22,000
N20,000
N18,000
N16,000
N14,000
N12,000
N10,000
E6,000
E8,000
E10,000
MISSISSIPPI RIVER
PROPERTY BOUNDARY LINE
MICROWAVE TOWER
METEOROLOGICAL STATION
CEMETERY
BRIDGE
PRIMARY SPOIL AREA
TEMP SECT. RIVER ACCESS ROAD
POLICE JURY ROAD
INTAKE STRUCTURE
BARGE SLIP
DISCHARGE OUTFALL
RIVER ACCESS ROAD
RIVER ROAD
WOODS



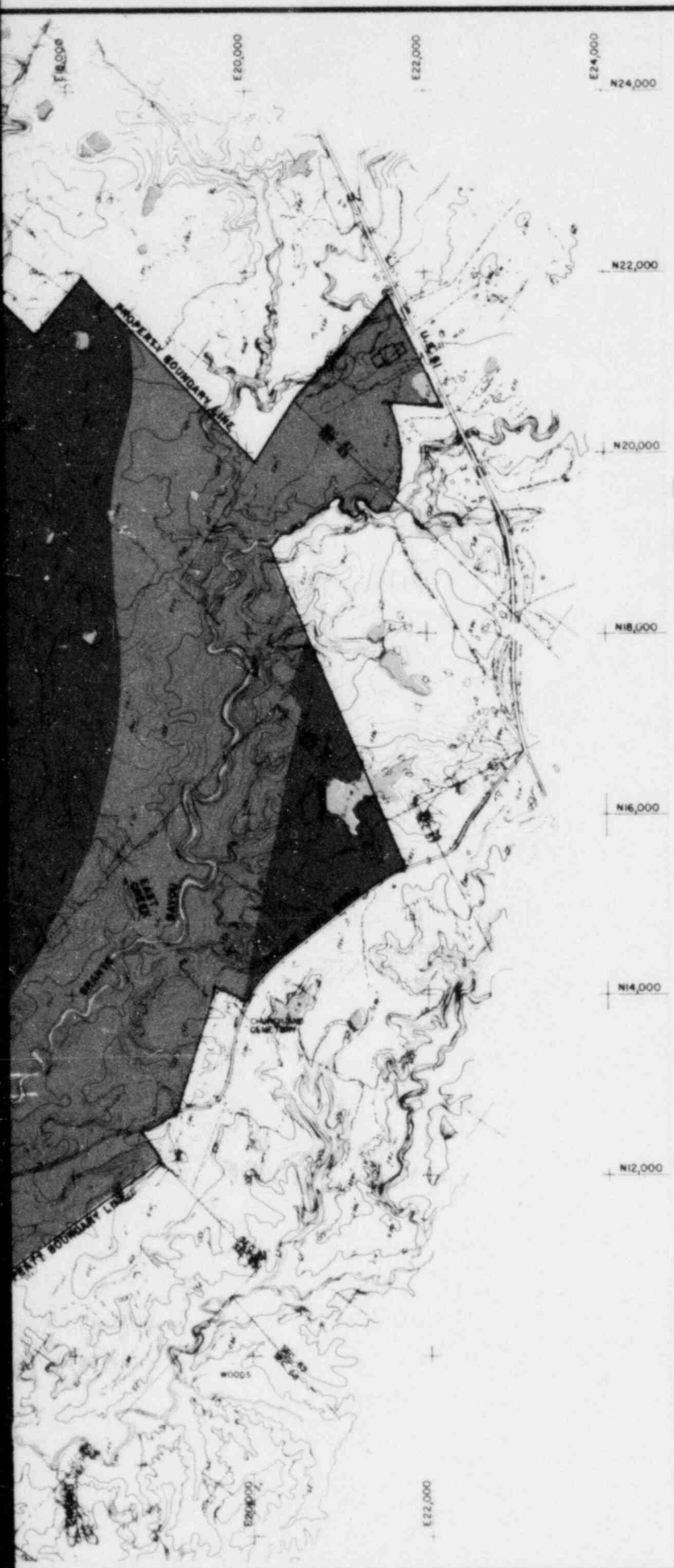
NOTE:
PLANT TYPE DESIGNATIONS ARE KEYED ON FIGURE 2.4-4

FIGURE 2.4-2

PHYSIOGRAPHIC VEGETATION TYPES

RIVER BEND STATION
ENVIRONMENTAL REPORT - OLS

MISSISSIPPI RIVER
RIVER ROAD
PROPERTY BOUNDARY LINE
PROPERTY BOUNDARY LINE
EXISTING
ILLINOIS CENTRAL RAILROAD
WOODS
WOODS
N10,000
N12,000
N14,000
N16,000
N18,000
N20,000
N22,000
N24,000
E6,000
E8,000
E10,000
E12,000
E14,000
E16,000



PLANT NORTH

LEGEND

- VICKSBURG-COLLINS-WAVERLY ASSOCIATION (LEVEL TO NEARLY SILTY FLOODPLAIN SOIL)
- MEMPHIS-LORING ASSOCIATION (GENTLY TO STEEPLY SILTY SOIL)
- SHARKEY-COMMERCE ASSOCIATION (LEVEL TO NEARLY LEVEL, LOAMY FLOODPLAIN SOIL)

NOTES

1. VERTICAL DATUM
MEAN SEA LEVEL AS ESTABLISHED BY U.S. COAST AND GEODETIC SURVEY

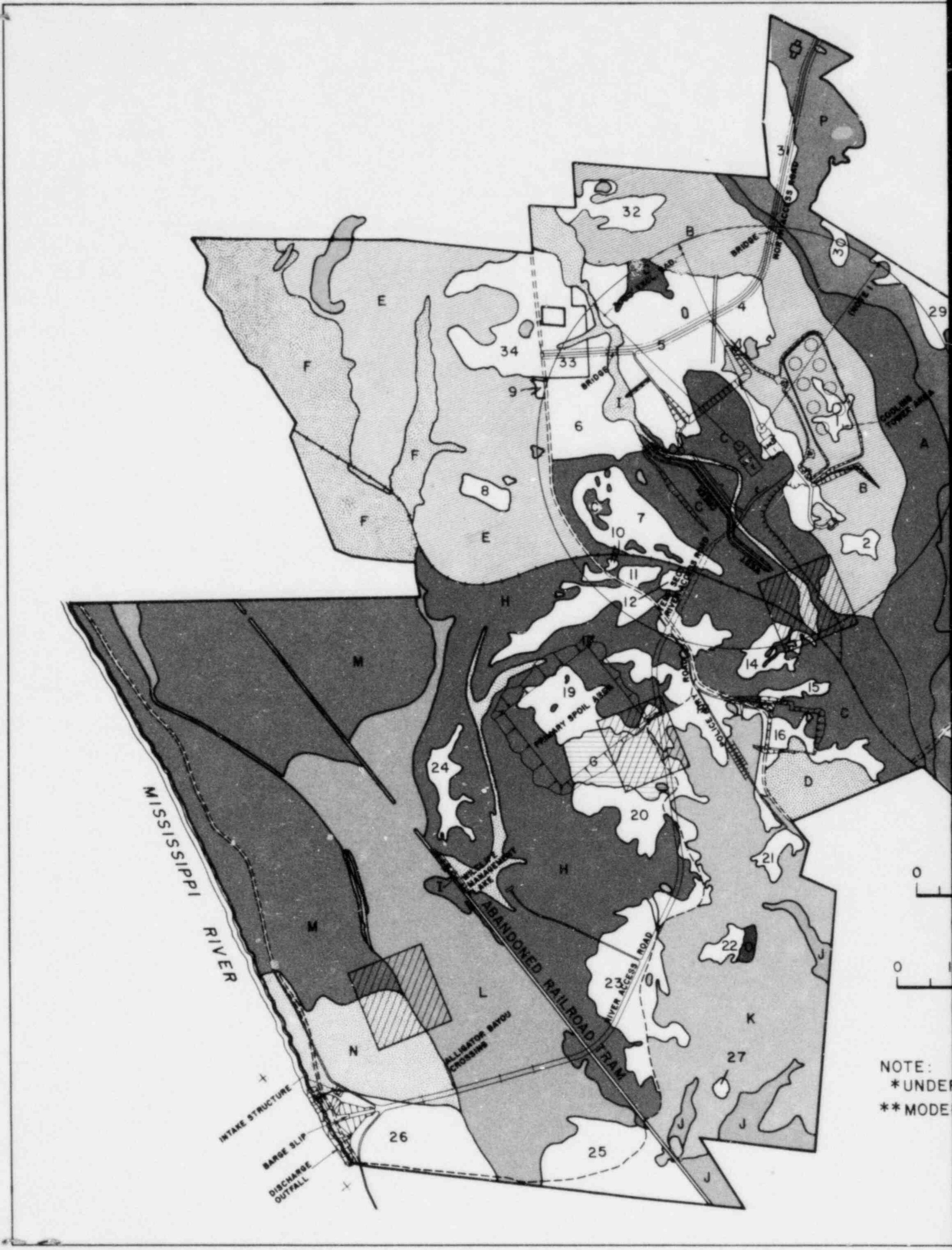
0 500 1000 1500 2000 2500
SCALE - FEET

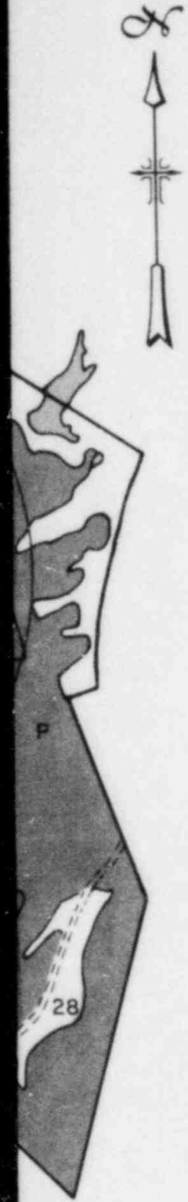
0 200 400 600 800
SCALE - METERS

FIGURE 2.4-3

SITE SOIL ASSOCIATIONS

RIVER BEND STATION
ENVIRONMENTAL REPORT — ~~OLS~~


MISSISSIPPI RIVER
ABANDONED RAILROAD TRAM
ALLIGATOR BAYOU CROSSING
INTAKE STRUCTURE
BARGE SLIP
DISCHARGE OUTFALL
PRIMARY SPOIL AREA
RIVER ACCESS ROAD
NORTH ACCESS ROAD
COOLING TOWER AREA
BRIDGE
NOTE:
*UNDER
**MODE



UPLAND FOREST

- A — SWEETGUM
- I — SWEETGUM, AMERICAN ELM, HACKBERRY
- E — SWEETGUM, CHERRYBARK OAK, WATER OAK, WINGED ELM
- P — SWEETGUM, WATER OAK, CHERRYBARK OAK, HICKORY**
- K — SWEETGUM, WATER OAK, CHERRYBARK OAK, HICKORY*
- F — SWEETGUM, WATER OAK, GREEN ASH, SYCAMORE
- G — SWEETGUM, WATER OAK, HACKBERRY, SHUMARD OAK
- H — SWEETGUM, WATER OAK, CHERRYBARK OAK, WHITE ASH, HACKBERRY, COW OAK
- J — BOXELDER, HACKBERRY, SWEETGUM, SYCAMORE
- C — SWEETGUM, LOBLOLLY PINE
- B — LOBLOLLY PINE, SWEETGUM
- D — LOBLOLLY PINE, AMERICAN BEECH, SWEETGUM
- O — LOBLOLLY PINE

BOTTOMLAND FOREST

- L — TUPELOGUM, BALDCYPRESS
- M — TUPELOGUM, HACKBERRY, ASH
- N — HACKBERRY, BOXELDER, ASH, SYCAMORE

- PONDS
- SMALL MAMMAL TRAPPING AREAS (HABITATS I, II, III)

MEADOWS AND PASTURES

1-24, 27-34 UPLAND MEADOWS AND PASTURES

25,26 BOTTOMLAND MEADOWS AND PASTURES

500 1000

SCALE - METERS

000 2000 3000 4000

SCALE - FEET

RSTOCKED - 51.3 FT^2 BASAL AREA/ACRE

RATELY STOCKED - 105 FT^2 BASAL AREA/ACRE

FIGURE 2.4-4

SITE VEGETATIVE COVER

RIVER BEND STATION

ENVIRONMENTAL REPORT - OLS

TABLE OF CONTENTS

Chapter	Section	Title	Volume
1		INTRODUCTION	1
	1.1	The Proposed Project	1
	1.2	Status of Reviews and Approvals	1
	1.3	Substantive Informational Changes from Construction Permit Stage	1
2		ENVIRONMENTAL DESCRIPTIONS	1
	2.1	Description of the Station Location	1
	2.2	Land	1
	2.3	Water	1
	2.4	Ecology	1
	2.5	Socioeconomics	2
	2.6	Geology	2
	2.7	Meteorology	2
	2.8	Ambient Air Quality	2
	2.9	Ambient Noise	2
	2.10	Related Federal Project Activities	2
	APPENDICES 2A, 2B, and 2C		3
3		PLANT DESCRIPTION	3
	3.1	External Appearance and Plant Layout	3
	3.2	Reactor Steam - Electric System	3
	3.3	Plant Water Use	3
	3.4	Cooling System	3
	3.5	Radioactive Waste Management Systems	3
	3.6	Nonradioactive Waste Systems	3
	3.7	Power Transmission Systems	3
	3.8	Transportation of Radioactive Materials	3
4		ENVIRONMENTAL IMPACTS OF CONSTRUCTION	3
	4.1	Land Use Impacts	3
	4.2	Hydrological Alterations and Water Use Impacts	3
	4.3	Ecological Impacts	3
	4.4	Socioeconomic Impacts	3
	4.5	Radiation Exposure to Construction Workers	3
	4.6	Measures and Controls to Limit Adverse Impacts During Construction	3

4

TABLE OF CONTENTS

Chapter	Section	Title	Volume
5		ENVIRONMENTAL IMPACTS OF STATION OPERATION	3
	5.1	Land Use Impacts	3
	5.2	Hydrological Alterations, Plant Water Supply, and Water Use Impacts	3
	5.3	Cooling System Impacts	3
	5.4	Radiological Impacts of Normal Operation	4
	5.5	Nonradioactive Waste System Impacts	4
	5.6	Transmission System Impacts	4
	5.7	Uranium Fuel Cycle Impacts	4
	5.8	Socioeconomic Impacts	4
	5.9	Decommissioning	4
	5.10	Measures and Controls to Limit Adverse Impacts During Operation	4
	APPENDIX 5A		4
6		ENVIRONMENTAL MEASUREMENTS AND MONITORING PROGRAMS	4
	6.1	Thermal	4
	6.2	Radiological	4
	6.3	Hydrological	4
	6.4	Meteorological	4
	6.5	Biological	4
	6.6	Chemical	4
	6.7	Other Monitoring Programs	4
7		ENVIRONMENTAL IMPACTS OF POSTULATED ACCIDENTS INVOLVING RADIOACTIVE MATERIALS	4
	7.1	Plant Accidents	4
	7.2	Transportation Accidents	4
8		THE NEED FOR THE PLANT	4
9		ALTERNATIVES TO THE PROJECT	4

CHAPTER 2

TABLE OF CONTENTS (Cont)

Section	Title	Page
2.8.5	EPA Attainment/Nonattainment and Class I Area Designations	2.8-3
2.8.6	Conclusions	2.8-3
2.9	AMBIENT NOISE	2.9-1
2.10	RELATED FEDERAL PROJECT ACTIVITIES	2.10-1
APPENDIX 2A	HYDROGRAPHIC STUDIES REPORT	
APPENDIX 2B	ALLIGATOR BAYOU FLOOD STUDY PRESENT BAYOU HYDROLOGY	
APPENDIX 2C	POPULATION DISTRIBUTION	4

CHAPTER 2

LIST OF TABLES

Table Number	Title
2.2-1	LAND USES OF PARISHES WITHIN 10 KM OF THE RIVER BEND STATION IN 1972
2.2-1	LAND USES OF PARISHES WITHIN 10 KM OF THE RIVER BEND STATION IN 1972
2.2-2	PIPELINES IN THE VICINITY OF RIVER BEND STATION
2.2-3	INDUSTRIAL AND MANUFACTURING FIRMS AND EXTRACTIVE OPERATIONS WITH 10 KM
2.2-4	MAJOR RECREATION AREAS WITH 10 KM
2.2-5	AGRICULTURAL PRODUCTION OF CROPS AND ANIMALS FOR FOUR PARISHES WITHIN 10 KM FOR 1978
2.2-6	LAND USE DATA ON ROUTE I
2.2-7	LAND USE DATA ON ROUTE II
2.2-8	LAND USE DATA ON ROUTE III
2.2-9	LAND TYPES CROSSED BY TRANSMISSION CORRIDORS
2.2-10	LAND USE CATEGORIES FOR LOUISIANA PARISHES WITHIN 80 KM OF RIVER BEND STATION IN 1972
2.2-11	MAJOR LAND USE CATEGORIES FOR MISSISSIPPI COUNTIES WITHIN 80 KM OF RIVER BEND STATION IN 1979
2.2-12	FOUR PRINCIPAL AGRICULTURAL PRODUCTS IN LOUISIANA: ACREAGE, YIELD, AND PRODUCTION IN 1978 FOR THE THREE FARMING AREAS IN LOUISIANA WITHIN 80 KM OF RIVER BEND STATION
2.2-12a	TOTAL KG CROPS (MAJOR) PER SECTOR, 1978
2.2-12b	TOTAL CATTLE AND CALF PRODUCTION (NO. OF HEAD) PER SECTOR, 1978

2

2.5 SOCIOECONOMICS

2.5.1 Demography

The demographic information presented in this chapter is derived from 1976 data which was the most current data when this report was originally compiled[1,2]. This information is used in Sections 2.2, 4.4.2, and 5.8.2. Reformatted and updated (based on 1980 census results) data on permanent population distribution is listed in Appendix 2C. This data is utilized in Sections 5.4 and Appendix 5A.

River Bend Station is located adjacent to the Mississippi River in the southwest portion of West Feliciana Parish, approximately 4 km (2.5 mi) southeast of the town of St. Francisville and about 28 km (17 mi) north of the nearest boundary of the city of Baton Rouge. In 1976 West Feliciana Parish had an estimated population of 8,619 at an average density of 7.8 people per sq km (21.3 people per sq mi)[1,2]. This population density is considerably lower than the state average of 34 people per sq km (86.6 people per sq mi), and lower than the average densities of the other parishes within 20 km (12 mi) of the station. The 1976 population and population density for the five parishes within 20 km of the station are shown in Table 2.5-1. Parish boundaries are shown in Fig. 2.5-1.

The 80-km (50-mi) area surrounding the station contains portions or all of 19 Louisiana parishes and 5 Mississippi counties. Also within 80 km are portions of the Baton Rouge Standard Metropolitan Statistical Area (SMSA) and the Lafayette SMSA. Political boundaries of parishes and population centers within 80 km are shown on Fig. 2.5-2.

The year 1985 is being used as the year of initial plant operation for population projection purposes. Since 1985 is 8 months past the expected commercial operation date of April 1984, it provides a conservative estimate of total population.

2.5.1.1 Population within 20 km (12 mi)

The total 1980 population within 20 km of the station is estimated to be 32,880, a 1 percent decrease over the 1970 total[1,3]. This population is projected to increase to approximately 34,604 by the year 2000 and to about 41,117 by 2030[1,3]. The 20-km area contains portions of West Feliciana, East Feliciana, East Baton Rouge, West Baton Rouge, and Pointe Coupee Parishes and portions or all of five population centers: St. Francisville, New Roads, Jackson, Slaughter, and Zachary. Parish boundaries and population centers are shown in Fig. 2.5-1.

Of the five population centers in the area, the town of Zachary, containing approximately 6,001 people in 1976, is the largest in population size[2]. Following Zachary in population size are New Roads, Jackson, St. Francisville, and Slaughter with estimated 1976 populations of 4,081, 3,199, 1,446, and 690 people, respectively[2]. Current and

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projected population estimates for the five parishes and five towns are shown in Table 2.5-2.

It is expected that a large proportion of the population growth in the 20-km area will occur around the northern fringes of the city of Baton Rouge, with the satellite communities absorbing much of the city's excess population. This expectation is reflected in the growth of the town of Zachary, which is expected to reach a population of 8,859 in the year 2030, a 79 percent population increase over its 1970 population[1,3]. Population growth between 1960 and 1976 in the five parishes composing the 20-km area is shown in Table 2.5-3.

Population distribution within 4 km of the station is based on a door-to-door survey conducted during December 1979 and January 1980[4]. Between 4 and 10 km, population distribution is based on a house count from Louisiana Department of Transportation maps and U.S. Geological Survey maps on which houses have been symbolically identified[5,6]. Houses were used to estimate the area population by applying a factor of 3.88 persons per household for each house in West Feliciana Parish and 3.74 persons per household for each house in Pointe Coupee Parish[7]. Population figures within 10 km of the site were then adjusted by multiplying the population value by the county growth factors, supplied by the University of New Orleans, which used the cohort-component method to obtain the required projection[1].

Polar-grid sector populations between 10 and 20 km are based on 1970 U.S. Census data and state population projections[1,3]. Sector populations were determined by assuming that the population of a minor civil division (e.g., ward or town) is evenly distributed over its geographic area. The proportion of each civil division's area in each grid sector was then determined and applied to each civil division's total population, yielding the population in each grid sector. Population projections, based on 1975 projections supplied by the University of New Orleans, were applied to each civil division, assuming that each portion would maintain its relative share of any population change. Population density was calculated by dividing the population in each sector by its land area. Population distribution within a 20-km radius of the plant for 1970 through 2030 is shown in Fig. 2.5-3 through 2.5-9 and listed in Tables 2.5-4 through 2.5-10.

Transient population within 20 km of the station is limited due to the rural character of the area. There are, however, a number of school, industry, and recreation facilities in the area that create daily and seasonal changes in sector

Grace Episcopal Church, Louisiana's second oldest Protestant church, was built in 1827 in St. Francisville, Acts of Incorporation and Investiture followed in 1829. Shelled during the Civil War, the church began a rebuilding program with final restoration in the 1880s. The church is located in the center of St. Francisville, approximately 5.7 km (3.5 mi) west-northwest of the site.

Both Propinquity and Grace Episcopal Church in St. Francisville are within the historic district that was nominated for inclusion in the National Register of Historic Places in the Spring of 1979. The area covers more than four blocks. Bounded by Royal and Ferdinand Streets, the district includes private homes, a court house, law offices, a bank, and town hall. The West Feliciana Historical Society is attempting to extend these boundaries in order to further preserve St. Francisville history[33].

The Cottage, a series of buildings erected from 1795 to 1859, was originally the home of "The Fighting Butler Family." Andrew Jackson is known to have stopped there after the Battle of New Orleans. The Cottage contains much of the original furniture, and 15 plantation outbuildings are still standing. It is situated on US Highway 61, approximately 11.2 km (7.0 mi) north-northwest of the site. Overnight accommodations are available in the home.

Rosedown Plantation, listed by the state of Louisiana as a place of historic interest, is located about 5.8 km (3.6 mi) northwest of the site on State Highway 10. Rosedown Plantation was a Spanish grant made in 1789. Daniel Turnbull built the present Rosedown in 1835. The house and the 17th century style gardens at Rosedown are completely restored and stand as a museum of the Old South.

2.5.3.2 Archaeological Significance

An archaeological investigation was performed through archival research and foot investigation in December 1971 and was updated on October 9, 1972. From these investigations it was learned that Indians traversed the area but no archaeological remains were found that were indicative of long-term village occupation[34]. Sites 4 and 5 on Fig. 2.5-18 locate the areas where historic campsite artifacts were found. Additional information is found in Section 2.5.3.4.

2.5.3.3 Natural Landmarks

There are no natural landmarks within 16 km (10 mi) of the site listed in the National Register of Natural Landmarks through December 1979.

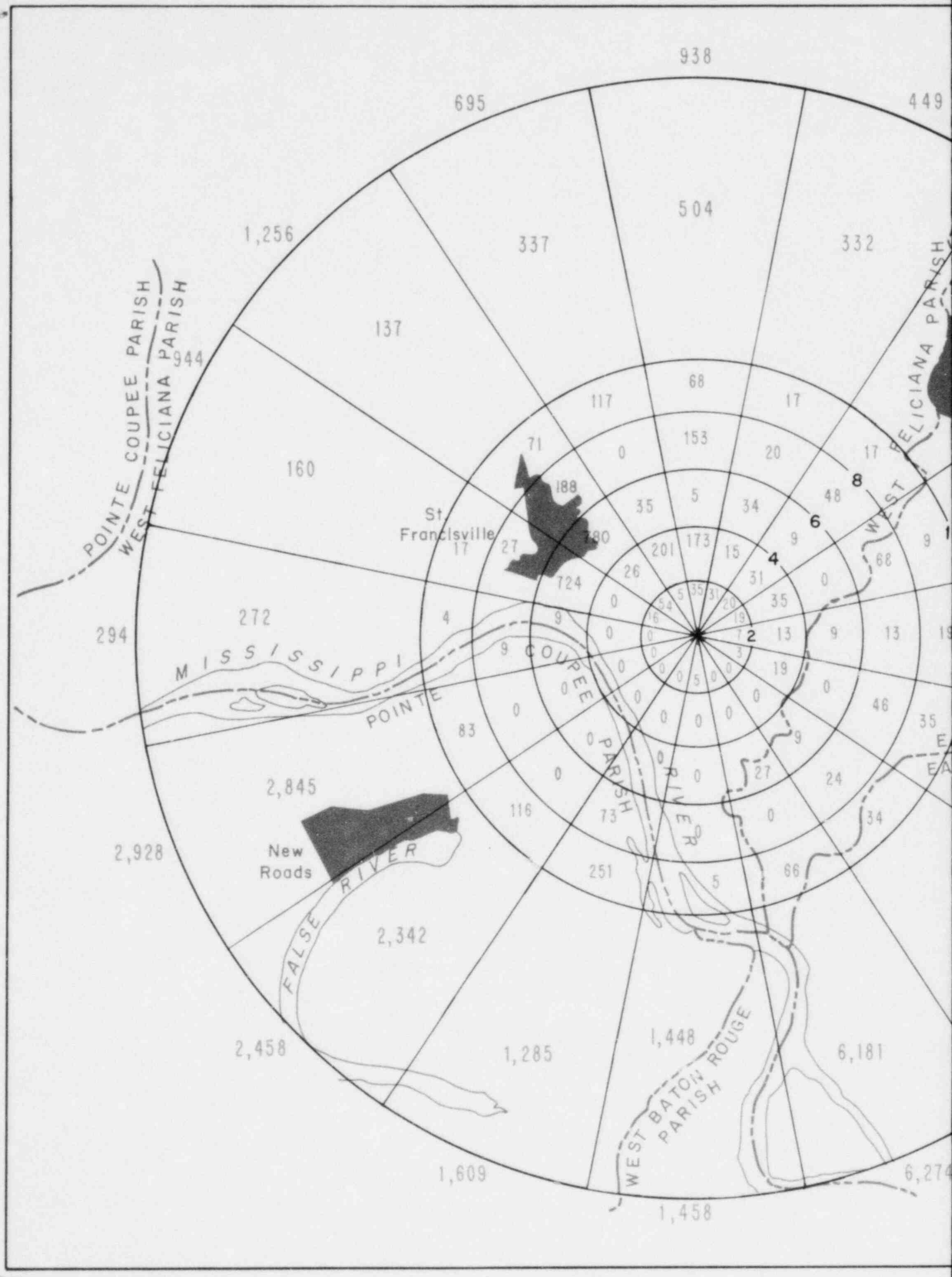
2.5.3.4 Historic and Archaeological Significance Along Transmission Rights-of-Way

The only National Register of Historic Places property within 2 km (1.2 mi) of any of the three transmission corridors is the Port Hudson Battlefield, which is 11.8 km (7.4 mi) south-southwest of River Bend, crossed by Route II. Section 2.2.2 describes the corridor. The archaeological significance of this area is discussed in the following paragraphs.

Route II passes within 2 km (1.2 mi) of the Baker Heritage Museum, a site of historic interest recognized by the state of Louisiana and local communities. The museum is on Mississippi and Adams Streets in Baker, Louisiana, one block east of State Road 19. The museum includes a general store and rural life exhibits housed in a turn-of-the-century home[35-37].

3 Eighteen archaeological and historical sites, five of which pertain to the Port Hudson Battlefield area, are located within 2 km (1.2 mi) of the transmission corridors. These sites were located through use of archaeological files and maps, and subsequent foot investigations and construction surveys by state archaeologists. The locations attest to the presence of peoples during prehistoric and historic eras and include mounds, campsites, forts, villages, and house sites. Table 2.5-36 and Fig. 2.5-18 locate and identify the archaeological and historical sites within 2 km (1.2 mi) of the transmission corridors.

Prior to construction, an archaeological investigation of the River Bend site was performed by Robert W. Neuman, a professional archaeologist from Louisiana State University. His investigation uncovered three campsite areas around Site 5 on Fig. 2.5-18. However, the artifacts did not indicate long-term village occupation or mound sites. Several other sites are located partially or totally within the
4 transmission corridors[38,39]. Among these are the Riddle Cemetery at Site 6, Spot Find No. 1, and the Civil War
3 breastworks at Sites 8, 9, and 18. Sites identified as 8 through 11 and 18 are located within the Port Hudson Battlefield site.


938
695
449
504
1,256
337
332
POINTE COUPEE PARISH
WEST FELICIANA PARISH
944
137
68
117
17
153
71
0
20
17
160
188
35
5
34
48
8
6
St. Francisville
17
27
780
201
173
15
9
4
9
68
724
26
31
0
272
4
0
35
294
9
0
13
9
13
2
MISSISSIPPI
9
COUPEE
0
19
POINTE
0
0
0
46
35
83
0
0
0
9
PARISH
2,845
0
0
27
24
116
73
0
34
RIVER
New Roads
2,928
FALSE RIVER
251
66
5
2,342
WEST BATON ROUGE PARISH
1,448
2,458
1,285
6,181
1,609
1,458
6,274

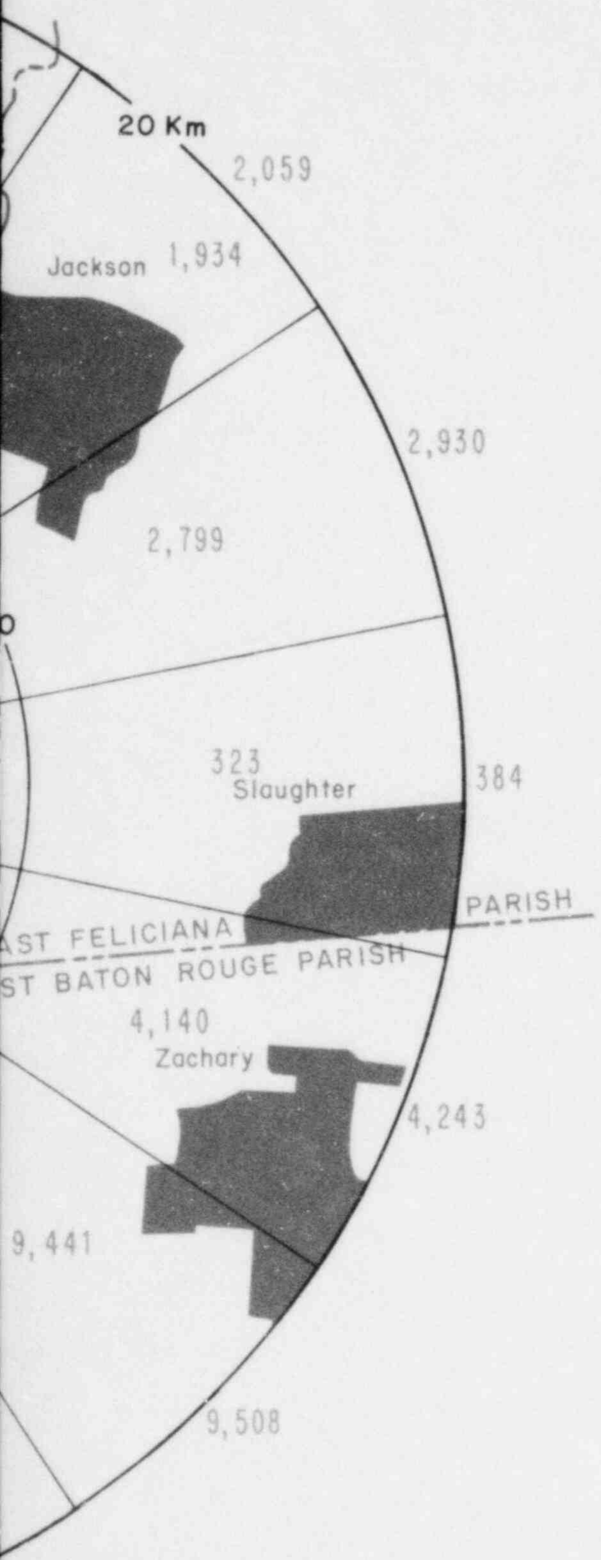
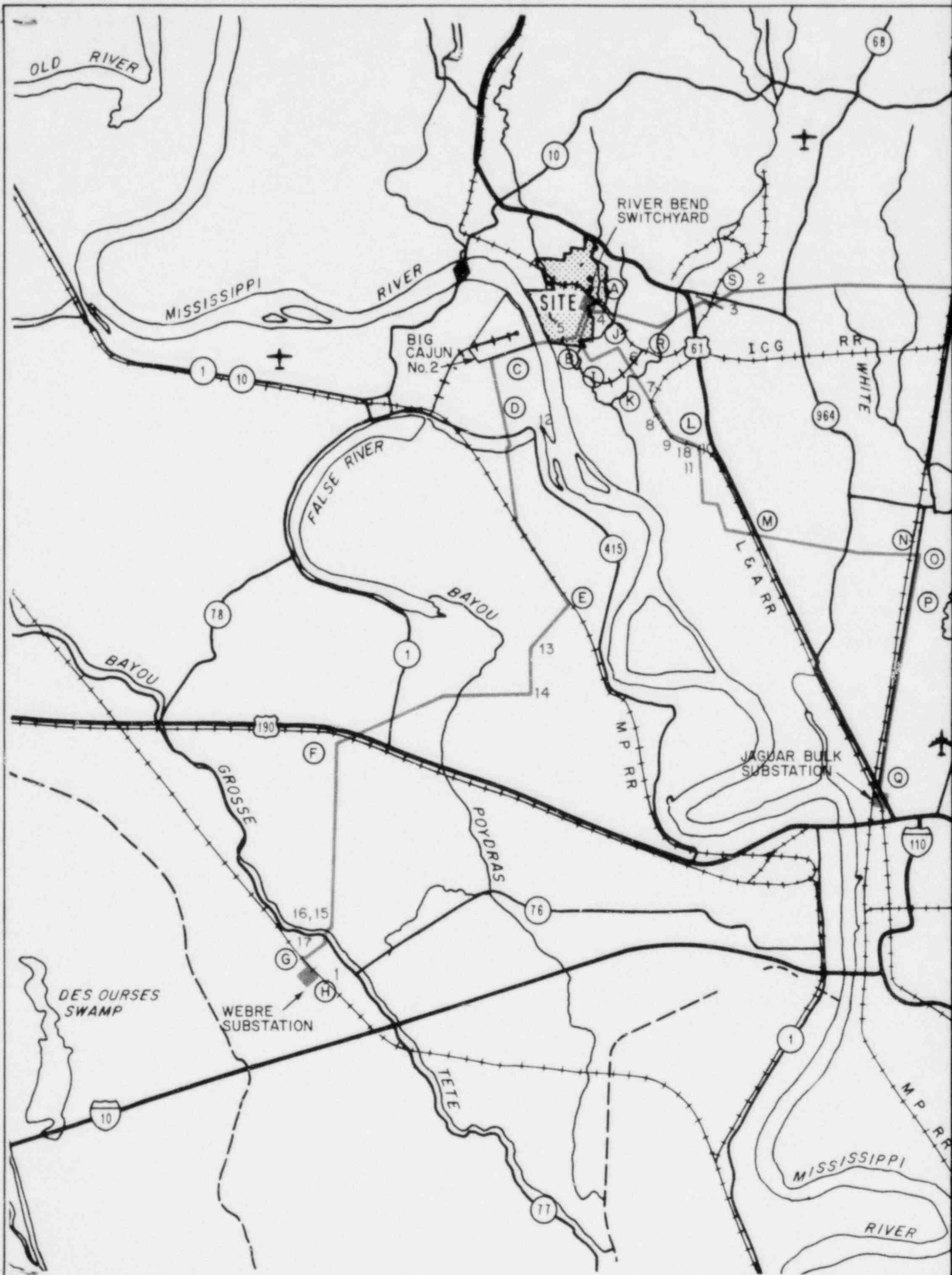


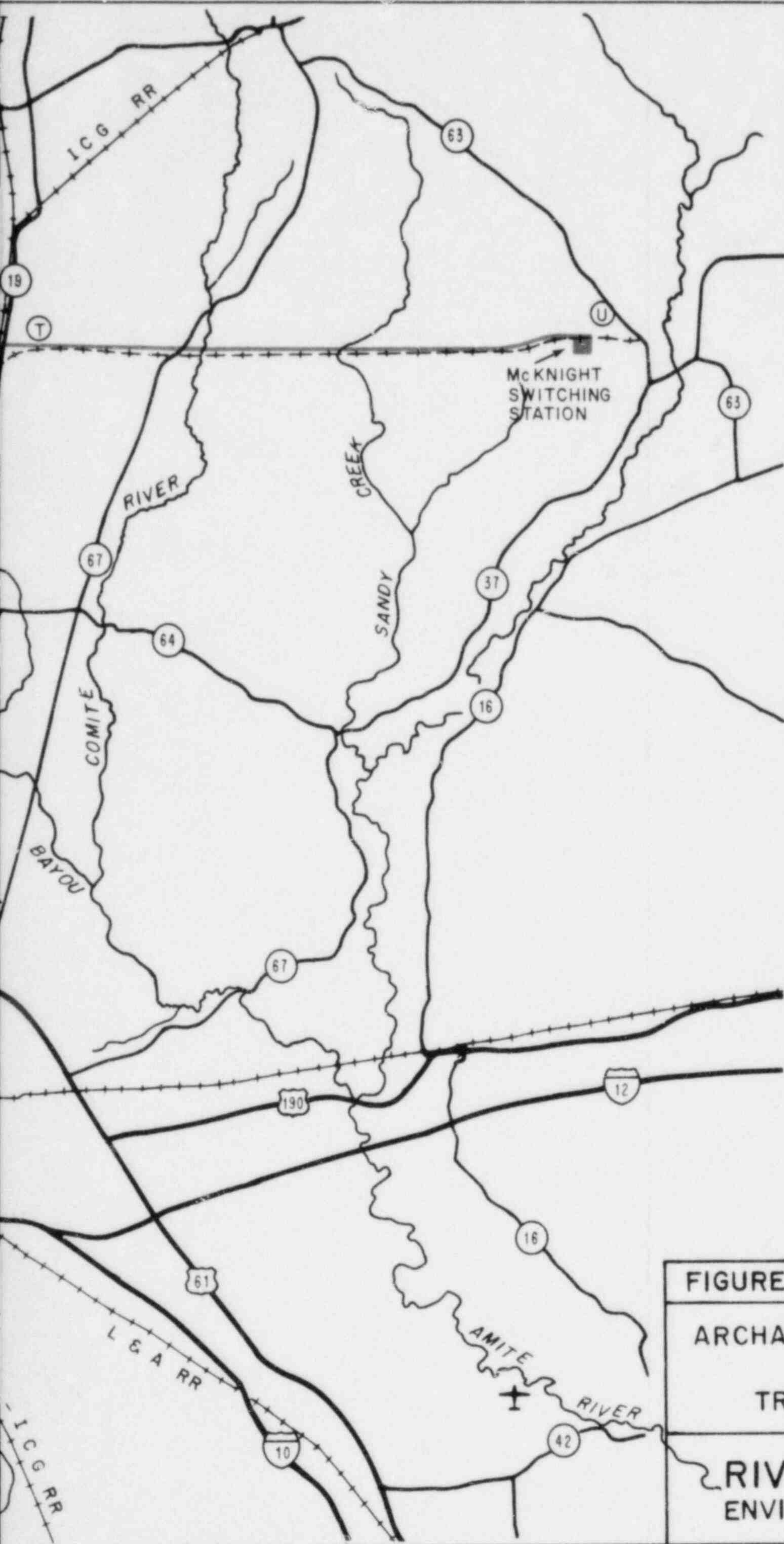
FIGURE 2.5-8

2020 POPULATION DISTRIBUTION WITHIN 20 KILOMETERS

RIVER BEND STATION
ENVIRONMENTAL REPORT-OLS



OLD RIVER
MISSISSIPPI RIVER
RIVER BEND SWITCHYARD
SITE
BIG CAJUN No. 2
FALSE RIVER
ICG RR
WHITE
L&A RR
BAYOU
GROSSE
POYDRAS
MP RR
JAGUAR BULK SUBSTATION
DES OURSES SWAMP
WEBRE SUBSTATION
TETE
MISSISSIPPI
RIVER



LEGEND:

TRANSMISSION LINE ROUTES

- ROUTE I
- ROUTE II
- ROUTE III
- (A) DESIGNATED LINE SEGMENT POINTS

NOTE

THE NUMBERS REFER TO ARCHEOLOGICAL SITES IN TABLE 2.5-36

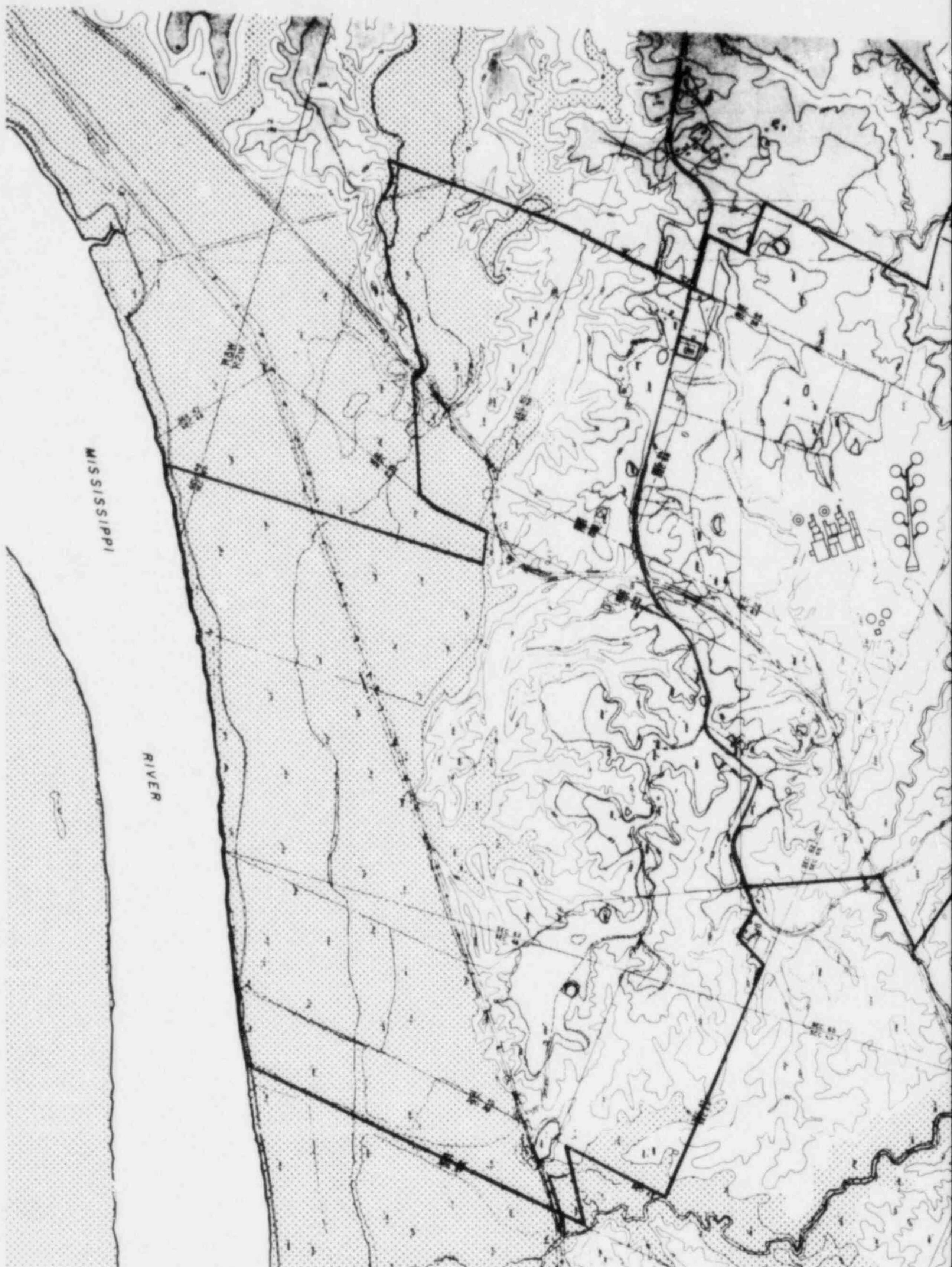
0 5 SCALE- MILES

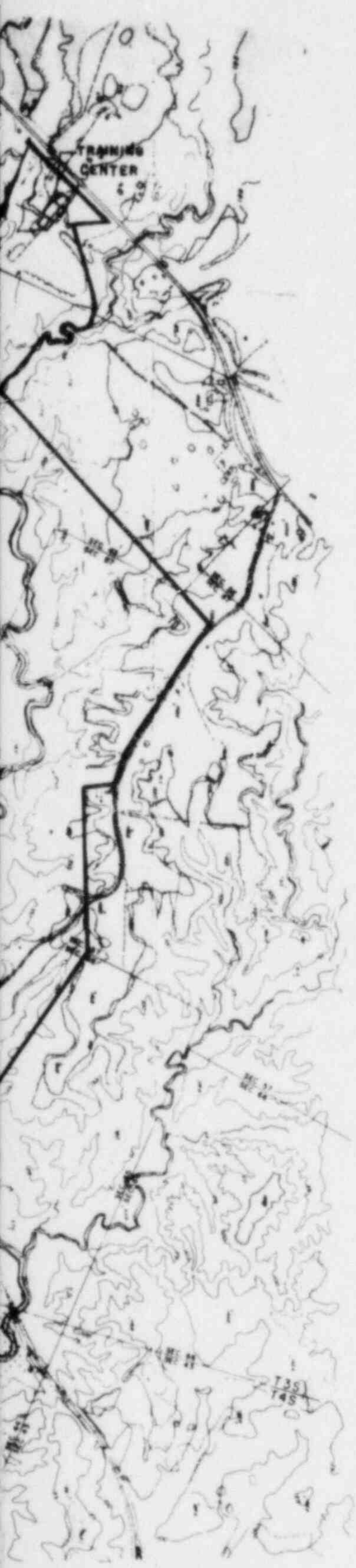
0 5 10 SCALE-KILOMETERS

FIGURE 2.5-18

ARCHAEOLOGICAL AND HISTORICAL SITES ALONG THE TRANSMISSION CORRIDORS

RIVER BEND STATION
ENVIRONMENTAL REPORT - OLS


MISSISSIPPI
RIVER



NOTE:
UPLANDS ARE ESSENTIALLY
COVERED WITH LOESS
EXCEPT IN ERODED STREAM
VALLEYS

LEGEND:

- CITRONELLE FORMATION
- PORT HICKEY FORMATION
- HOLOCENE FLOODPLAIN

0 500 1000 1500 2000 2500

SCALE - FEET

0 300 600 900

METERS

FIGURE 2.6-1

SITE GEOLOGIC MAP

RIVER BEND STATION

ENVIRONMENTAL REPORT – OLS

annual wind direction at the site and Ryan Airport was east during the concurrent 2-yr period. The least prevalent annual wind directions at the site and Ryan Airport during the concurrent period were southwest and south-southwest, respectively. The prevailing and least prevalent annual wind directions at Ryan Airport during the 30-yr period were southeast and west-northwest, respectively.

The differences between the frequent and least frequent aforementioned wind directions were due in part to the following:

Observer Bias: The observer at the National Weather Service (NWS) tended to report the wind direction to the primary 8 of the 16 compass points.

Conversion Bias: After January 1, 1964, wind directions were observed to tens of degrees and converted to the 16 point code for the meteorological data tape. Thirty deg sectors were considered for the north, east, south, and west compass points and 20-deg sectors for the remaining 12. The conversion procedure produced a frequency bias in the four principal compass points.

Averaging Period: For an hourly NWS wind direction observation, the observer estimates the wind direction during only a few minutes of the hour. After January 1, 1964, every 3-hr observations were used for the NWS meteorological data tape. An hourly onsite wind direction observation was determined by averaging the valid minute wind direction data (Section 6.4.1.5) recorded during the hour.

Summaries of 30- and 150-ft wind persistence episodes at the River Bend site for the period March 17, 1977 through March 16, 1979, are presented in Tables 2.7-31 and 2.7-32, respectively. The maximum wind persistence episodes at the 30- and 150-ft levels were 20 hr from the south and east-northeast, and 32 hr from the east-southeast, respectively. A summary of wind persistence episodes at Ryan Airport for the period January 1, 1949 through

December 31, 1964, is presented in Table 2.7-33. The maximum wind persistence episode was 89 hr from the southeast.

2.7.3.11 Stability

Atmospheric stability was classified according to the temperature gradient values listed for the seven Pasquill stability categories in Regulatory Guide 1.23[16]. Joint wind speed, wind direction, and atmospheric stability summaries, based on wind speed and wind direction at the 30-ft level on the meteorological tower for the period March 17, 1977 through March 16, 1979, are provided in Tables 2.7-34 through 2.7-41. Tables 2.7-42 through 2.7-73 provide seasonal joint frequency distributions for the 30-ft winds. Similar information for the same onsite data period for the 150-ft wind speed and wind direction parameters is presented in Tables 2.7-74 through 2.7-81 and Tables 2.7-82 through 2.7-113 for the annual and seasonal periods, respectively.

In the joint frequency summaries, separate tabulations are made for calm winds (hourly average wind speeds equal to or below anemometer or wind direction sensor threshold speed, whichever is higher) and for variable winds (hourly average wind speeds between threshold and 2 mi/hr when hourly average wind direction ranges are greater than or equal to 120 deg azimuth).

2.7.3.12 Topographical Description

The topography in the area is essentially flat, with some small rolling hills. The greatest elevation within 5 mi of the site is 220 ft msl which is 125 ft higher than plant grade. The general topography within 5 mi of the plant site is shown in Fig. 2.7-16 and topography out to 50 mi is provided in Fig. 2.7-17. Topographic cross sections for each of 16 22.5 deg sectors radiating from the plant are given in Fig. 2.7-18 through 2.7-25 for distances out to 5 mi.

The effect of topography on both short-term and long-term diffusion estimates for the site is expected to be insignificant because of the relatively flat terrain of the area.

2.7.5 Long-Term (Routine) Diffusion Estimates

2.7.5.1 Objective

Annual average CHI/Q and D/Q estimates for continuous and intermittent releases were calculated for each of the 16 22.5-deg sectors at receptor locations used to determine the maximum individual and population dose receptors. These CHI/Q and D/Q factors are used in Section 5.4 to estimate the radiation dose to man through a variety of pathways as described in that section. Grazing season values were represented by annual average values since the season was conservatively assumed to exist year-round. The methodology described in Regulatory Guide 1.111, Revision 1 provided guidance for the aforementioned analysis[18]. The distances by sector between the nearest significant receptor location (used to determine the maximum individual receptor) and the midpoint between the Units 1 and 2 containment buildings are provided in Table 2.7-115. The minimum distances by sector between the property and restricted area boundaries, and the routine release points are in Table 2.7-116. The release point design parameters are in Table 2.7-117. The resultant CHI/Q and D/Q values for the maximum individual receptors and the population dose receptors are displayed in Tables 2.7-118 through 2.7-129. 2

2.7.5.2 Calculation Techniques

2.7.5.2.1 Nomenclature

2.032 =	$(2/\pi)^{1/2}(2\pi/16)^{-1}$	(dimensionless)
π =	3.14159...	(dimensionless)
exp =	2.71828...	(dimensionless)
E_T =	Entrainment coefficient	(dimensionless)
Ω =	Terrain recirculation factor	(dimensionless)
C =	Building shape coefficient	(dimensionless)
x =	Downwind receptor distance	(m)
σ_z =	Vertical dispersion coefficient	(m)

$\bar{u}_{30}$ =	30-foot average wind speed	(m sec^{-1})
$\bar{u}_{150}$ =	150-foot average wind speed	(m sec^{-1})
(CHI/Q) =	Average concentration normalized by source strength	(sec m^{-3})
$(CHI/Q)_D$ =	Depleted CHI/Q	(sec m^{-3})
F_m =	Momentum flux	(m^4 sec^{-2})
h_b =	Building height	(m)
h_r =	Release height	(m)
h_e =	Effective release height	(m)
h_{pr} =	Nonbuoyant plume rise	(m)
h_t =	Topographic height of receptor above plant grade	(m)
d =	Stack or vent diameter	(m)
u_e =	Efflux velocity	(m sec^{-1})
N =	Total number of valid hours of wind in all sectors for applicable averaging period	(dimensionless)
δ/Q =	Relative deposition rate normalized by source strength	(m^{-1})
D/Q =	Relative deposition per unit area normalized by source strength	(m^{-2})
G =	Ground release (subscript)	(dimensionless)

2.9 AMBIENT NOISE

Two ambient surveys have been conducted in the vicinity of the River Bend site. The first survey was performed in June 1972 prior to construction and the latter in January 1980 during Unit 1 construction. Refer to Section 6.7 for the noise survey methodology and Section 5.8.1.2 for the assessment of the effects produced by the operational sound levels.

Noise Sampling Area

The noise sampling area is shown in Fig. 2.9-1. In general, the terrain surrounding the site is mostly wooded except for the Mississippi River, some open fields, and farmland. Eight measurement locations were selected to represent the acoustical environment in the vicinity of the site. Measurement location 1 is situated on the southeast edge of St. Francisville, approximately 2 km (1.25 mi) west-northwest of the site. This is the only population center within a 4.8-km (3-mi) radius of the site. Measurement locations 2, 3, 4, 5, and 7 were selected as typical of the rural-farm areas. Location 6 was selected at the intersection of Route 61, Route 966, and Police Jury Road to measure representative traffic noise in the vicinity of roads near the site. Location 8 is in the general proximity of the Crown Zellerbach Papermill on Route 964, which is one of the major industrial areas surrounding the site. The exact locations of the measurement positions are described in Table 2.9-1.

1972 Survey

This survey was conducted during June 15-16, 1972, prior to any construction at the River Bend site. The dominant noise source for the majority of the locations was insect noise, which masked all other sources with the exception of the papermill, the dominant noise source at location 8. With the insect noise, the minimum sound levels at all locations ranged from 49 to 56 dBA, which is equivalent to those found in a "Normal Suburban Residential" area[1]. However, when the sound levels were adjusted to eliminate insect noise, the minimum calculated sound levels ranged from 31 to 39 dBA and are typical of a "Rural Community," with the exceptions of measurement locations 3, 4, and 8, which have generally higher sound levels due to their proximity to the papermill[1]. The residual minimum A-weighted sound levels measured during the daytime and nighttime hours at the eight locations are presented in Table 2.9-2.

1980 Survey

During January 9-10, 1980, a second ambient noise survey was conducted. There was little construction activity ongoing at that time. The reactor mat was poured January 15 through 17, 1980. Accordingly, no significant contributing noise-producing construction activity was in progress at that time. Also, approximately two-thirds of the noise measurements were obtained during nonworking hours. The principal contributors to the noise environment remained basically the same as for the 1972 survey. Big Cajun No. 2 - Units 1, 2, and 3, a coal-fired power plant located across the Mississippi River approximately 2 km (1.25 mi) from the River Bend site, was not yet on-line at the time of this survey. These units are scheduled for startup in the early 1980s. The 1972 measurement locations remained the same with the exception of the following three adjustments. Location 2 was relocated approximately 900 m (3,000 ft) north of the radio tower on the perimeter of the new site boundary. Measurement location 3, inaccessible due to muddy roads, was relocated on the River Access Road, approximately 30 m (100 ft) west-southwest from a 69-kV transmission line onsite. Measurement location 8 had to be abandoned because of current inaccessibility to private property on which the papermill is located.

The significant noise sources of this survey were a papermill and highway traffic. The insect noise was absent due to the winter season. A comparison of the insect-corrected levels for the 1972 survey with the measured levels of the 1980 survey is presented in Table 2.9-2 and shows good agreement, with the exception of locations 2 and 6 which are 5-8 dBA higher. Highway traffic and the papermill noise contributed to the ambient sound levels at locations 2 and 6 being slightly higher than was anticipated in the 1972 survey estimate. The minimum ambient sound levels at all seven locations ranged from 34 to 41 dBA and are typical of a "Rural Community"[1]. The sound level data from the 1980 survey is reported in Table 2.9-2.

Table 2.9-3 presents the measured equivalent sound level data for the seven measurement locations which was used in the determination of outdoor day-night sound levels (Ldn). The day-night sound level is the A-weighted equivalent sound level with a 10 dB penalty applied to sound occurring at nighttime and was developed by the EPA in 1974 as a descriptor for assessing community noise[2]. Since the 1972 survey was conducted prior to the development of Ldn, only residual sound levels were acquired. The 1980 survey was designed to obtain both residual data for comparison with

the 1972 results and statistical data for the Ldn impact assessment. Whereas the residual sound levels only describe the background sound, the day-night sound level takes into account intrusive noise events as well as background sound.

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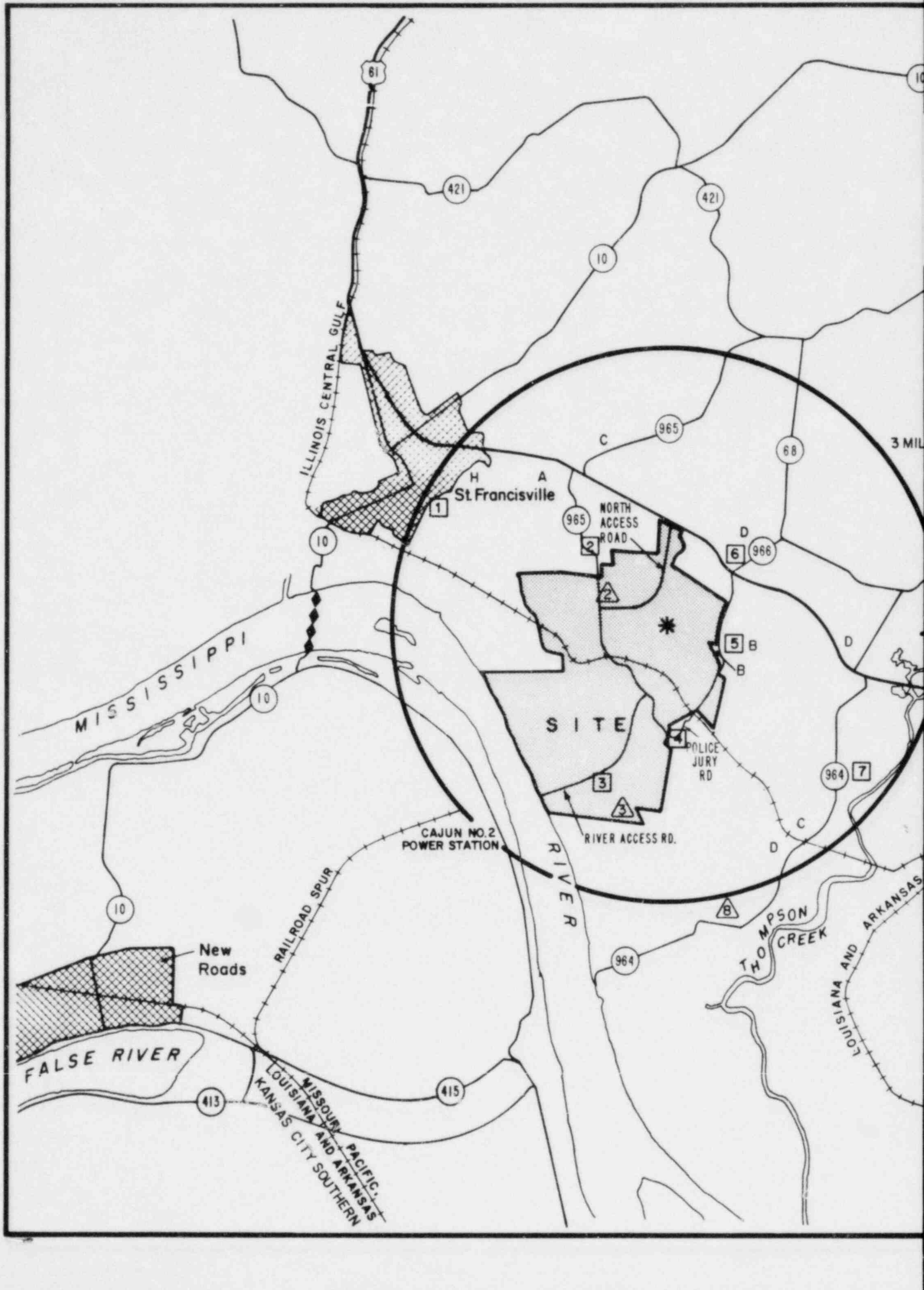


61
421
421
10
10
ILLINOIS CENTRAL GULF
965
68
3 MIL
C
H
A
St. Francisville
1
965
NORTH ACCESS ROAD
2
D
6
966
2
10
MISSISSIPPI
5
B
B
D
10
SITE
POLICE JURY RD
964
7
3
3
RIVER ACCESS RD.
C
CAJUN NO. 2 POWER STATION
D
RIVER
RAILROAD SPUR
10
8
THOMPSON CREEK
LOUISIANA AND ARKANSAS
New Roads
964
FALSE RIVER
415
413
MISSOURI PACIFIC
LOUISIANA AND ARKANSAS
KANSAS CITY SOUTHERN

POSITION NUMBER	DESCRIPTION
1.	PECAN GROVE DRIVE, ST. FRANCISVILLE
2.	ROUTE 965, 900M (3000FT.) NORTH OF RADIO TOWER
3	RIVER ACCESS ROAD, 30M (100FT.) WSW OF 69KV TRANSMISSION LINE
4.	POLICE JURY ROAD, POWELL FOREST PLANTATION, THE BROADBENTS
5.	POLICE JURY ROAD, STAR HILL CHURCH
6.	INTERSECTION OF ROUTE 61, POLICE JURY ROAD & ROUTE 966
7.	ROUTE 964, 1.3Km. (0.8Mi.) NORTH OF ILLINOIS CENTRAL GULF RR
△	1972 SURVEY POSITIONS 2,3 & 8
+++++	RAILROAD
H	HOSPITAL
D	CEMETARY
C	CHURCH
B	CHURCH AND CEMETARY
A	AUDIBON LAKES CAMP RESORT
✱	RIVER BEND STATION

FIGURE 2.9-1

AMBIENT SOUND LEVEL MEASUREMENT LOCATIONS

RIVER BEND STATION
ENVIRONMENTAL REPORT – OLS

TABLE OF CONTENTS

Chapter	Section	Title	Volume
1		INTRODUCTION	1
	1.1	The Proposed Project	1
	1.2	Status of Reviews and Approvals	1
	1.3	Substantive Informational Changes from Construction Permit Stage	1
2		ENVIRONMENTAL DESCRIPTIONS	1
	2.1	Description of the Station Location	1
	2.2	Land	1
	2.3	Water	1
	2.4	Ecology	1
	2.5	Socioeconomics	2
	2.6	Geology	2
	2.7	Meteorology	2
	2.8	Ambient Air Quality	2
	2.9	Ambient Noise	2
	2.10	Related Federal Project Activities	2
	APPENDICES 2A, 2B, and 2C		3
3		PLANT DESCRIPTION	3
	3.1	External Appearance and Plant Layout	3
	3.2	Reactor Steam - Electric System	3
	3.3	Plant Water Use	3
	3.4	Cooling System	3
	3.5	Radioactive Waste Management Systems	3
	3.6	Nonradioactive Waste Systems	3
	3.7	Power Transmission Systems	3
	3.8	Transportation of Radioactive Materials	3
4		ENVIRONMENTAL IMPACTS OF CONSTRUCTION	3
	4.1	Land Use Impacts	3
	4.2	Hydrological Alterations and Water Use Impacts	3
	4.3	Ecological Impacts	3
	4.4	Socioeconomic Impacts	3
	4.5	Radiation Exposure to Construction Workers	3
	4.6	Measures and Controls to Limit Adverse Impacts During Construction	3

4

TABLE OF CONTENTS

Chapter	Section	Title	Volume
5		ENVIRONMENTAL IMPACTS OF STATION OPERATION	3 3
	5.1	Land Use Impacts	3
	5.2	Hydrological Alterations, Plant Water Supply, and Water Use Impacts	3
	5.3	Cooling System Impacts	3
	5.4	Radiological Impacts of Normal Operation	4
	5.5	Nonradioactive Waste System Impacts	4
	5.6	Transmission System Impacts	4
	5.7	Uranium Fuel Cycle Impacts	4
	5.8	Socioeconomic Impacts	4
	5.9	Decommissioning	4
	5.10	Measures and Controls to Limit Adverse Impacts During Operation	4
	APPENDIX 5A		4
6		ENVIRONMENTAL MEASUREMENTS AND MONITORING PROGRAMS	4
	6.1	Thermal	4
	6.2	Radiological	4
	6.3	Hydrological	4
	6.4	Meteorological	4
	6.5	Biological	4
	6.6	Chemical	4
	6.7	Other Monitoring Programs	4
7		ENVIRONMENTAL IMPACTS OF POSTULATED ACCIDENTS INVOLVING RADIOACTIVE MATERIALS	4
	7.1	Plant Accidents	4
	7.2	Transportation Accidents	4
8		THE NEED FOR THE PLANT	4
9		ALTERNATIVES TO THE PROJECT	4

4

APPENDIX 2C

POPULATION DISTRIBUTION

FEBRUARY 1983

APPENDIX 2C

POPULATION DISTRIBUTION

LIST OF TABLES

Number	Title
2C-1	1980 Population Distribution Within 10 Miles of RBS
2C-2	1985 Population Distribution Within 10 Miles of RBS
2C-3	1990 Population Distribution Within 10 Miles of RBS
2C-4	2000 Population Distribution Within 10 Miles of RBS
2C-5	2010 Population Distribution Within 10 Miles of RBS
2C-6	2020 Population Distribution Within 10 Miles of RBS
2C-7	2030 Population Distribution Within 10 Miles of RBS
2C-8	Current and Projected Populations of Parishes and Towns Within 10 Miles
2C-9	1980 Population Distribution Within 50 Miles of RBS
2C-10	1985 Population Distribution Within 50 Miles of RBS
2C-11	1990 Population Distribution Within 50 Miles of RBS
2C-12	2000 Population Distribution Within 50 Miles of RBS
2C-13	2010 Population Distribution Within 50 Miles of RBS
2C-14	2020 Population Distribution Within 50 Miles of RBS
2C-15	2030 Population Distribution Within 50 Miles of RBS

APPENDIX 2C

POPULATION DISTRIBUTION

LIST OF FIGURES

Number	Title
2C-1	Population Sectors Within 10 Miles
2C-2	Population Sectors Within 50 Miles

APPENDIX 2C

Population distribution within a 10-mi radius of the River Bend Station for the years 1980, 1985, 1990, 2000, 2010, 2020, and 2030 is listed by distance and direction in Tables 2C-1 through 2C-7. Figure 2C-1 shows sector locations within the 10-mi area.

Current and projected population estimates of the portions of the five parishes, West Feliciana, East Feliciana, West Baton Rouge, East Baton Rouge, and Pointe Coupee, and all or major portions of the three towns, St. Francisville, New Roads, and Jackson, that comprise the 10-mi radius of the River Bend Station are listed in Table 2C-8.

Population distribution within a 50-mi radius of the River Bend Station for the years 1980, 1985, 1990, 2000, 2010, 2020, and 2030 is listed by distance and direction in Tables 2C-9 through 2C-15. Figure 2C-2 identifies sector locations between 10 and 50 mi of the River Bend Station.

Population distribution within 3 mi of the station is based on a door-to-door survey conducted during December 1979 and January 1980[1]. Between 3- and 10-mi population distribution is based on a house count from U.S. Geological Survey maps on which houses have been symbolically identified[2] and field reconnaissance in June 1982. Houses were used to estimate the area population by applying a persons per household factor to the dwellings in each minor civil division (e.g., a ward or town). Population figures within 10 mi of the site were then adjusted by multiplying the population value by the county growth factors, supplied by the University of New Orleans, which used the cohort-component method to obtain the required projection[3].

Polar-grid sector populations between 10 and 50 mi are based on 1980 U.S. Census data and state population projections[3,4,5,6,7]. Sector populations were determined by assuming that the population of a minor civil division (e.g., ward or town) is evenly distributed over its geographic area. The proportion of each civil division's area in each grid sector was then determined and applied to each civil division's total population, yielding the population in each grid sector. Population projections based on 1980 census figures supplied by the University of New Orleans were applied to each civil division, assuming that each portion would maintain its relative share of any population change.

2C References

1. Gulf South Research Institute. Livestock Survey for Radiation Exposure Pathways within a 3 1/10 mi (5 km) Radius of GSU's River Bend Nuclear Power Plant Site. March 1980.

2. U.S. Geological Survey Quadrangle Maps: Weyanoke, 1965 (P1-72); Elm Park, 1965 (P1-72); New Roads, 1962 (PR-80); Port Hudson, 1963 (PR-80); St. Francisville, 1965 (P1-72); Erwinville, 1962 (PR-80); LaCour, 1965 (P1-72); Jackson, 1954; Morganza, 1968; Zachary, 1963 (PR-80); Laurel Hill, 1965 (P1-72); and Walls, 1963 (Pr-70, 80).

3. Maruggi, V; Kemp, A; and Fletes, R. Interim Projections to 2000 for Louisiana and for Louisiana Parishes - Series 1 Report. University of New Orleans Division of Business and Economic Research and the Louisiana State Planning Office. August 1982.

4. Sivia, T. B., Regional Economic Projection Series: U.S. Regional Projections 1980-2000. National Planning Association. REPF 80-R-1, Summary Table 6.5, Mississippi.

5. U.S. Department of Commerce Bureau of the Census. Number of Inhabitants - Louisiana, 1980 Census of Population. PC 80-1-A20. Washington, DC.

6. U.S. Department of Commerce Bureau of the Census. Number of Inhabitants - Mississippi, 1980 Census of Population. PC 80-1-A26. Washington, DC, January 1982.

7. Stone and Webster Engineering Corporation. Computer Program EN-253 Population Allocation Program. Boston, MA, September 1982.

TABLE 2C-1

1980 POPULATION DISTRIBUTION
WITHIN 10 MILES OF RIVER BEND STATION

Direction	Distance (miles) 0-1	1-2	2-3	3-4	4-5	5-10	Total 0-10
N	0	86	82	29	352	491	1,040
NNE	12	231	27	39	6	222	537
NE	6	21	15	0	56	2,285	2,383
ENE	0	29	15	20	58	1,150	1,272
E	5	11	0	20	12	228	276
ESE	2	0	18	72	17	657	766
SE	0	0	4	0	110	1,943	2,057
SSE	0	0	2	0	0	354	356
S	0	4	0	0	0	980	984
SSW	0	0	0	7	274	989	1,270
SW	0	0	0	0	0	4,245	4,245
WSW	0	0	0	2	2	4,141	4,145
W	0	0	1	0	5	0	6
WNW	0	0	169	694	21	21	905
NW	20	19	93	620	412	383	1,547
NNW	15	131	82	33	30	434	725
TOTAL	60	532	508	1,536	1,355	18,523	22,514

TABLE 2C-2

1985 POPULATION DISTRIBUTION
WITHIN 10 MILES OF RIVER BEND STATION

Direction	Distance (miles) 0-1	1-2	2-3	3-4	4-5	5-10	Total 0-10
N	0	88	84	30	364	508	1,074
NNE	12	238	28	39	6	230	553
NE	6	22	15	0	58	2,432	2,533
ENE	0	30	16	20	61	1,226	1,353
E	5	11	0	21	14	244	295
ESE	2	0	18	77	18	713	828
SE	0	0	4	0	117	2,140	2,261
SSE	0	0	2	0	0	389	391
S	0	4	0	0	0	1,036	1,040
SSW	0	0	0	8	288	1,045	1,341
SW	0	0	0	0	0	4,477	4,477
WSW	0	0	0	3	3	4,358	4,364
W	0	0	1	0	5	0	6
WNW	0	0	175	750	21	21	967
NW	21	19	96	986	426	396	1,944
NNW	15	134	84	33	30	448	744
TOTAL	61	546	523	1,967	1,411	19,663	24,171

TABLE 2C-3

1990 POPULATION DISTRIBUTION WITHIN 10 MILES OF RIVER BEND STATION

Direction	Distance (miles) 0-1	1-2	2-3	3-4	4-5	5-10	Total 0-10
N	0	92	87	31	378	529	1,117
NNE	13	248	28	41	6	238	574
NE	6	22	16	0	60	2,614	2,718
ENE	0	31	16	21	64	1,317	1,449
E	5	12	0	22	15	261	315
ESE	2	0	19	82	19	773	895
SE	0	0	4	0	125	2,335	2,464
SSE	0	0	2	0	0	424	426
S	0	4	0	0	0	1,093	1,097
SSW	0	0	0	8	304	1,100	1,[illegible]12
SW	0	0	0	0	0	4,719	4,719
WSW	0	0	0	3	3	4,593	4,599
W	0	0	1	0	5	0	6
WNW	0	0	182	780	23	22	1,007
NW	21	20	99	1,035	442	413	2,030
NNW	16	140	88	35	32	468	779
TOTAL	63	569	542	2,058	1,476	20,899	25,607

TABLE 2C-4

2000 POPULATION DISTRIBUTION
WITHIN 10 MILES OF RIVER BEND STATION

Direction	Distance (miles) 0-1	1-2	2-3	3-4	4-5	5-10	Total 0-10
N	0	109	103	37	444	622	1,315
NNE	15	291	34	48	7	280	675
NE	8	26	19	0	72	3,058	3,183
ENE	0	36	19	25	26	1,543	1,699
E	6	14	0	26	17	306	369
ESE	3	0	23	96	23	902	1,047
SE	0	0	5	0	148	2,710	2,863
SSE	0	0	3	0	0	492	495
S	0	5	0	0	0	1,199	1,204
SSW	0	0	0	9	333	1,207	1,549
SW	0	0	0	0	0	5,173	5,173
WSW	0	0	0	3	3	5,056	5,062
W	0	0	2	0	6	0	8
WNW	0	0	214	918	27	27	1,186
NW	25	24	117	1,216	520	485	2,387
NNW	19	164	103	40	36	549	911
TOTAL	76	669	642	2,418	1,712	23,609	29,126

TABLE 2C-5

2010 POPULATION DISTRIBUTION
WITHIN 10 MILES OF RIVER BEND STATION

Direction	Distance (miles) 0-1	1-2	2-3	3-4	4-5	5-10	Total 0-10
N	0	124	118	42	509	711	1,504
NNE	17	333	39	54	8	321	772
NE	9	30	22	0	82	3,651	3,794
ENE	0	43	22	28	88	1,844	2,025
E	7	16	0	30	21	366	440
ESE	3	0	26	115	27	1,048	1,219
SE	0	0	6	0	176	3,091	3,273
SSE	0	0	3	0	0	564	567
S	0	6	0	0	0	1,324	1,330
SSW	0	0	0	10	368	1,331	1,709
SW	0	0	0	0	0	5,707	5,707
WSW	0	0	0	3	3	5,598	5,604
W	0	0	2	0	7	0	9
WNW	0	0	245	1,052	31	30	1,358
NW	29	28	134	1,394	596	555	2,736
NNW	22	189	118	46	42	629	1,046
TOTAL	87	769	735	2,774	1,958	26,770	33,093

TABLE 2C-6

2020 POPULATION DISTRIBUTION
WITHIN 10 MILES OF RIVER BEND STATION

Direction	Distance (miles) 0-1	1-2	2-3	3-4	4-5	5-10	Total 0-10
N	0	144	138	49	588	822	1,741
NNE	20	386	45	65	10	372	898
NE	10	35	25	0	95	4,381	4,546
ENE	0	48	25	33	101	2,215	2,422
E	8	18	0	35	24	439	524
ESE	3	0	30	138	33	1,213	1,417
SE	0	0	7	0	212	3,468	3,687
SSE	0	0	3	0	0	640	643
S	0	7	0	0	0	1,459	1,466
SSW	0	0	0	11	404	1,466	1,881
SW	0	0	0	0	0	6,278	6,278
WSW	0	0	0	4	4	6,183	6,191
W	0	0	2	0	7	0	9
WNW	0	0	284	1,216	35	35	1,570
NW	34	32	155	1,614	688	641	3,164
NNW	25	218	137	54	50	728	1,212
TOTAL	100	888	851	3,219	2,251	30,340	37,649

TABLE 2C-7

2030 POPULATION DISTRIBUTION WITHIN 10 MILES OF RIVER BEND STATION

Direction	Distance (miles) 0-1	1-2	2-3	3-4	4-5	5-10	Total 0-10
N	0	167	158	57	680	953	2,015
NNE	23	447	52	74	11	429	1,036
NE	12	41	29	0	109	5,246	5,437
ENE	0	56	29	38	118	2,658	2,899
E	10	21	0	41	30	528	630
ESE	4	0	35	166	39	1,394	1,638
SE	0	0	8	0	254	3,842	4,104
SSE	0	0	4	0	0	716	720
S	0	8	0	0	0	1,604	1,612
SSW	0	0	0	12	445	1,609	2,066
SW	0	0	0	0	0	6,899	6,899
WSW	0	0	0	4	4	6,821	6,829
W	0	0	3	0	8	0	11
WNW	0	0	328	1,407	40	40	1,815
NW	39	37	179	1,865	796	744	3,660
NNW	29	252	158	62	56	842	1,399
TOTAL	117	1,029	983	3,726	2,590	34,325	42,770

TABLE 2C-8

CURRENT AND PROJECTED POPULATIONS OF
PARISHES AND TOWNS WITHIN 10 MI

Parish or Town	1980[1]	1990	2000	2010[3]	2020[3]	2030[3]
East Baton Rouge Parish	366,191	444,076[2]	514,822[2]	581,429	642,697	698,826
East Feliciana Parish	19,015	21,807[2]	25,504[2]	30,503	36,645	43,956
Jackson (town)	3,133	3,593[3]	4,202[3]	5,026	6,038	7,242
Pointe Coupee Parish	24,045	26,740[2]	29,306[2]	32,329	35,574	39,081
New Roads (town)	3,924	4,364[3]	4,783[3]	5,276	5,805	6,378
West Baton Rouge Parish	19,086	22,241[2]	24,959[2]	28,268	31,756	35,492
West Feliciana Parish	12,186	13,476[2]	15,761[2]	18,005	20,773	23,971
St. Francisville (town)	1,471	1,958[3]	2,234[3]	2,505	2,839	3,225

Sources:

1. Bureau of the Census. Number of Inhabitants - Louisiana, 1980 Census of Population. PHC80-V-20, Louisiana. U.S. Dept. of Commerce, Washington, D.C.
2. Maruggi, V.; Kemp, A; and Fletes, R. Interim Projections to 2000 for Louisiana and for Louisiana Parishes - Series 1 Report. University of New Orleans Division of Business and Economic Research and the Louisiana State Planning Office. August, 1982.
3. Stone & Webster Engineering Corporation. Computer Program EN253 Pop. Alloc.Program. Boston, MA. September 1982.

TABLE 2C-9

1980 POPULATION DISTRIBUTION
WITHIN 50 MILES OF RIVER BEND STATION

Direction	Distance (miles) 0-10	10-20	20-30	30-40	40-50	Total 0-50
N	1,040	732	2,524	1,205	3,787	9,288
NNE	537	529	984	2,141	2,267	6,458
NE	2,383	2,403	3,173	2,710	3,209	13,878
ENE	1,272	3,678	3,099	2,215	2,971	13,235
E	276	2,831	5,059	3,116	12,575	23,857
ESE	766	16,151	17,095	9,386	11,375	54,773
SE	2,057	33,718	90,914	37,980	19,150	183,819
SSE	356	28,932	156,266	30,299	22,983	238,836
S	984	2,798	6,378	12,500	4,410	27,070
SSW	1,270	2,923	3,978	2,429	6,046	16,646
SW	4,245	3,599	2,378	5,202	17,203	32,627
WSW	4,415	14,165	2,643	4,875	35,262	40,390
W	6	1,409	3,139	2,480	4,925	11,959
WNW	905	631	1,560	4,753	11,176	19,015
NW	1,547	1,816	4,764	1,424	3,744	13,295
NNW	725	813	947	1,496	2,554	6,535
TOTAL	22,514	104,428	304,901	124,201	163,637	719,681

TABLE 2C-10

1985 POPULATION DISTRIBUTION
WITHIN 50 MILES OF RIVER BEND STATION

Direction	Distance (miles) 0-10	10-20	20-30	30-40	40-50	Total 0-50
N	1,074	753	2,574	1,232	3,938	9,571
NNE	553	546	1,004	2,168	2,231	6,592
NE	2,533	2,561	3,252	2,732	3,234	14,312
ENE	1,353	3,920	3,301	2,254	3,050	13,878
E	295	3,025	5,536	3,151	13,471	25,478
ESE	828	17,872	19,161	11,262	13,417	62,540
SE	2,261	37,363	101,324	44,001	22,531	207,480
SSE	391	32,022	172,955	33,320	26,144	264,832
S	1,040	3,026	6,894	13,052	4,661	28,673
SSW	1,341	3,110	4,174	2,650	6,724	17,999
SW	4,477	3,796	2,532	5,705	19,203	35,713
WSW	4,364	1,544	2,772	5,090	36,892	50,662
W	6	1,483	3,289	2,592	5,150	12,520
WNW	967	662	1,643	5,034	11,864	20,170
NW	1,944	1,878	4,924	1,509	3,963	14,218
NNW	744	839	965	1,542	2,628	6,718
TOTAL	24,171	114,400	336,300	137,294	179,191	791,356

TABLE 2C-11

1990 POPULATION DISTRIBUTION WITHIN 50 MILES OF RIVER BEND STATION

Direction	Distance (mi) 0-10	10-20	20-30	30-40	40-50	Total 0-50
N	1,117	782	2,669	1,278	4,116	9,962
NNE	574	568	1,041	2,227	2,391	6,801
NE	2,718	2,753	3,382	2,778	3,290	14,921
ENE	1,449	4,218	3,550	2,310	3,150	14,677
E	315	3,259	6,021	3,198	14,399	27,192
ESE	895	19,547	21,218	13,287	15,609	70,556
SE	2,464	40,891	111,533	50,281	26,153	231,322
SSE	426	35,020	189,149	36,336	29,503	290,434
S	1,094	3,263	7,428	13,651	4,930	30,369
SSW	1,412	3,307	4,383	2,886	7,454	19,442
SW	4,719	4,002	2,690	6,248	21,315	38,974
WSW	4,599	1,627	2,918	5,349	38,812	53,305
W	6	1,563	3,456	2,724	5,414	13,163
WNW	1,007	697	1,734	5,349	12,612	21,399
NW	2,030	1,956	5,129	1,602	4,202	14,919
NNW	779	871	1,001	1,600	2,711	6,962
TOTAL	25,607	124,324	367,302	151,104	196,061	864,398

TABLE 2C-12

2000 POPULATION DISTRIBUTION WITHIN 50 MILES OF RIVER BEND STATION

	Distance (miles)					Total
Direction	0-10	10-20	20-30	30-40	40-50	0-50
N	1,315	871	2,771	1,328	4,377	10,662
NNE	675	638	1,081	2,319	2,480	7,193
NE	3,183	3,221	3,597	2,900	3,433	16,334
ENE	1,699	4,935	4,151	2,415	3,352	16,552
E	369	3,810	6,983	3,254	16,285	30,701
ESE	1,047	22,667	25,254	17,925	20,579	87,472
SE	2,863	47,403	130,981	63,761	33,889	278,897
SSE	495	40,540	218,957	41,898	36,149	338,039
S	1,204	3,664	8,332	14,566	5,390	33,156
SSW	1,549	3,654	4,715	3,364	8,997	22,279
SW	5,173	4,365	2,995	7,404	25,654	45,611
WSW	5,062	1,784	3,206	5,889	42,799	58,740
W	8	1,719	3,803	2,998	5,967	14,495
WNW	1,186	777	1,903	5,967	14,074	23,907
NW	2,387	2,288	5,955	1,783	4,662	17,075
NNW	911	1,000	1,040	1,690	2,858	7,499
TOTAL	29,126	143,356	425,724	179,461	230,945	1,008,612

TABLE 2C-13

2010 POPULATION DISTRIBUTION
WITHIN 50 MILES OF RIVER BEND STATION

Direction	Distance (miles) 0-10	10-20	20-30	30-40	40-50	Total 0-50
N	1,504	996	3,175	1,518	4,832	12,025
NNE	772	730	1,237	2,583	2,689	8,011
NE	3,794	3,851	4,109	3,145	3,723	18,622
ENE	2,025	5,902	4,960	2,600	3,646	19,133
E	440	4,536	8,008	3,395	18,348	34,727
ESE	1,219	25,656	29,265	23,091	26,065	105,296
SE	3,273	53,537	149,808	78,239	42,677	327,534
SSE	567	45,789	247,317	47,662	43,943	385,278
S	1,330	4,144	9,433	15,876	5,988	36,771
SSW	1,709	4,070	5,170	3,929	10,765	25,643
SW	5,707	4,840	3,359	8,759	30,549	53,214
WSW	5,601	1,969	3,581	6,642	48,293	66,089
W	9	1,904	4,267	3,381	6,727	16,288
WNW	1,358	868	2,102	6,732	15,882	26,942
NW	2,736	2,614	6,787	2,006	5,240	19,383
NNW	1,046	1,145	1,187	1,867	3,081	8,326
TOTAL	33,093	162,551	483,765	211,425	272,448	1,163,282

TABLE 2C-14

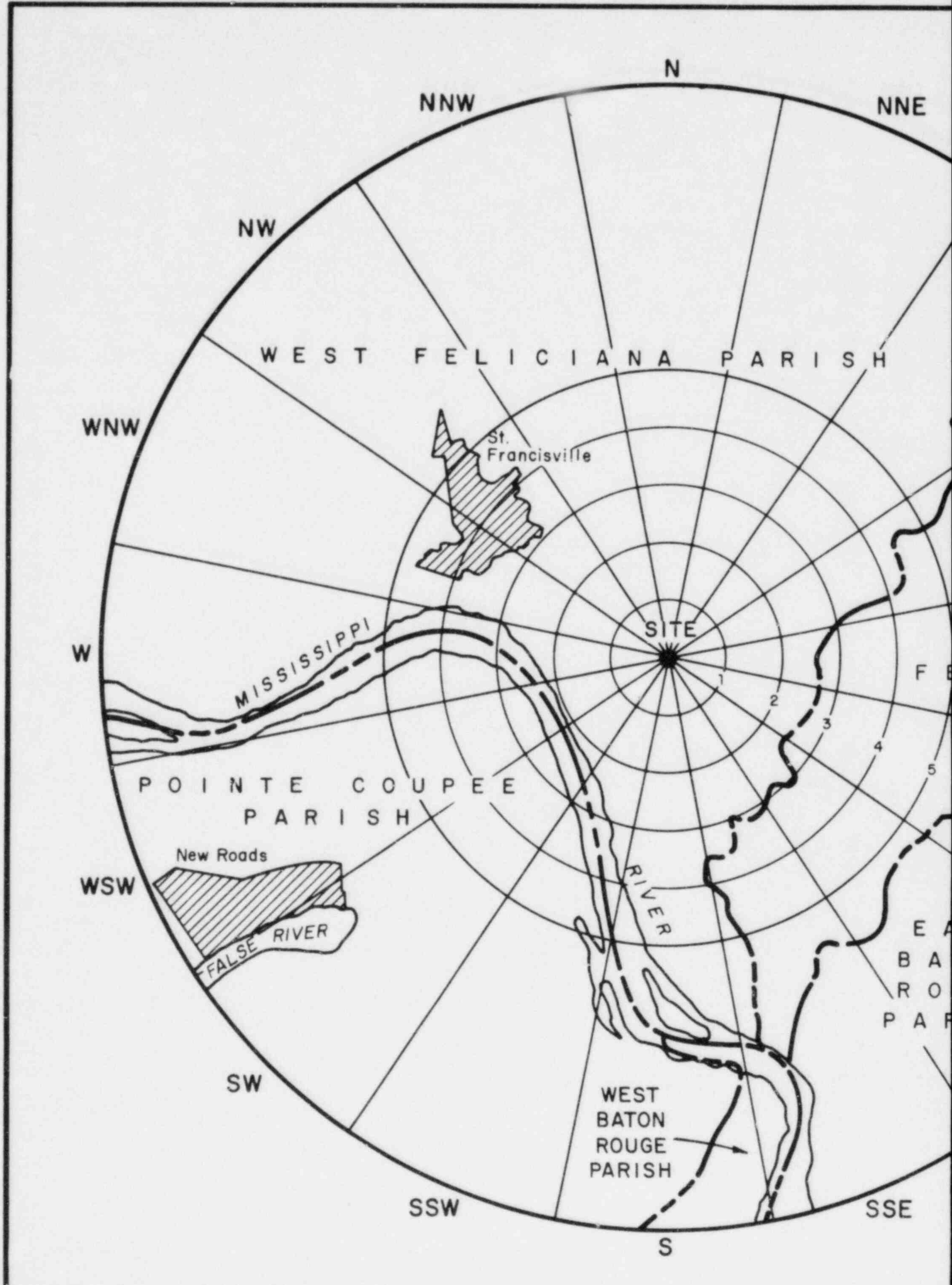
2020 POPULATION DISTRIBUTION
WITHIN 50 MILES OF RIVER BEND STATION

Direction	Distance (miles) 0-10	10-20	20-30	30-40	40-50	Total 0-50
N	1,741	1,163	3,739	1,782	5,371	13,796
NNE	898	851	1,458	2,956	2,952	9,115
NE	4,546	4,621	4,802	3,489	4,127	21,585
ENE	2,422	7,088	5,958	2,838	4,008	22,814
E	524	5,414	9,067	3,571	20,540	39,116
ESE	1,417	28,455	33,222	28,862	32,156	124,112
SE	3,687	59,178	167,790	93,781	52,389	376,825
SSE	643	50,652	273,578	53,357	52,477	430,707
S	1,466	4,650	10,594	17,323	6,643	40,676
SSW	1,881	4,514	5,666	4,556	12,724	29,341
SW	6,278	5,323	3,756	10,281	35,875	61,513
WSW	6,191	2,164	4,016	7,544	54,860	74,775
W	9	2,104	4,813	3,840	7,637	18,403
WNW	1,570	969	2,315	7,588	17,905	30,347
NW	3,164	3,016	7,808	2,257	5,888	22,133
NNW	1,212	1,332	1,391	2,091	3,349	9,375
TOTAL	37,649	181,494	539,973	246,116	318,901	1,324,133

TABLE 2C-15

2030 POPULATION DISTRIBUTION
WITHIN 50 MILES OF RIVER BEND STATION

Direction	Distance (miles) 0-10	10-20	20-30	30-40	40-50	Total 0-50
N	2,015	1,366	4,492	2,131	6,017	16,021
NNE	1,036	1,002	1,752	3,446	3,278	10,514
NE	5,437	5,545	5,694	3,932	4,651	25,259
ENE	2,899	8,502	7,144	3,131	4,437	26,113
E	630	6,448	10,171	3,796	22,870	43,915
ESE	1,638	31,076	37,138	35,230	38,835	143,917
SE	4,104	64,347	184,972	110,383	63,049	426,855
SSE	720	55,142	297,846	59,029	61,814	474,551
S	1,612	5,180	11,837	18,949	7,372	49,950
SSW	2,066	4,991	6,222	5,246	14,879	33,404
SW	6,899	5,848	4,196	11,972	41,647	7C 562
WSW	6,829	2,377	4,514	8,606	62,580	84,906
W	11	2,324	5,448	4,381	8,709	20,873
WNW	1,815	1,081	2,549	8,545	20,163	34,153
NW	3,660	3,480	8,993	2,537	6,612	25,282
NNW	1,399	1,548	1,662	2,368	3,667	10,644
TOTAL	42,770	200,257	594,630	283.682	370,580	1,491,919


N
NNW
NNE
NW
WNW
W
WSW
SW
SSW
S
SSE
WEST FELICIANA PARISH
St. Francisville
SITE
1
2
3
4
5
MISSISSIPPI
RIVER
POINTE COUPEE PARISH
New Roads
FALSE RIVER
WEST BATON ROUGE PARISH

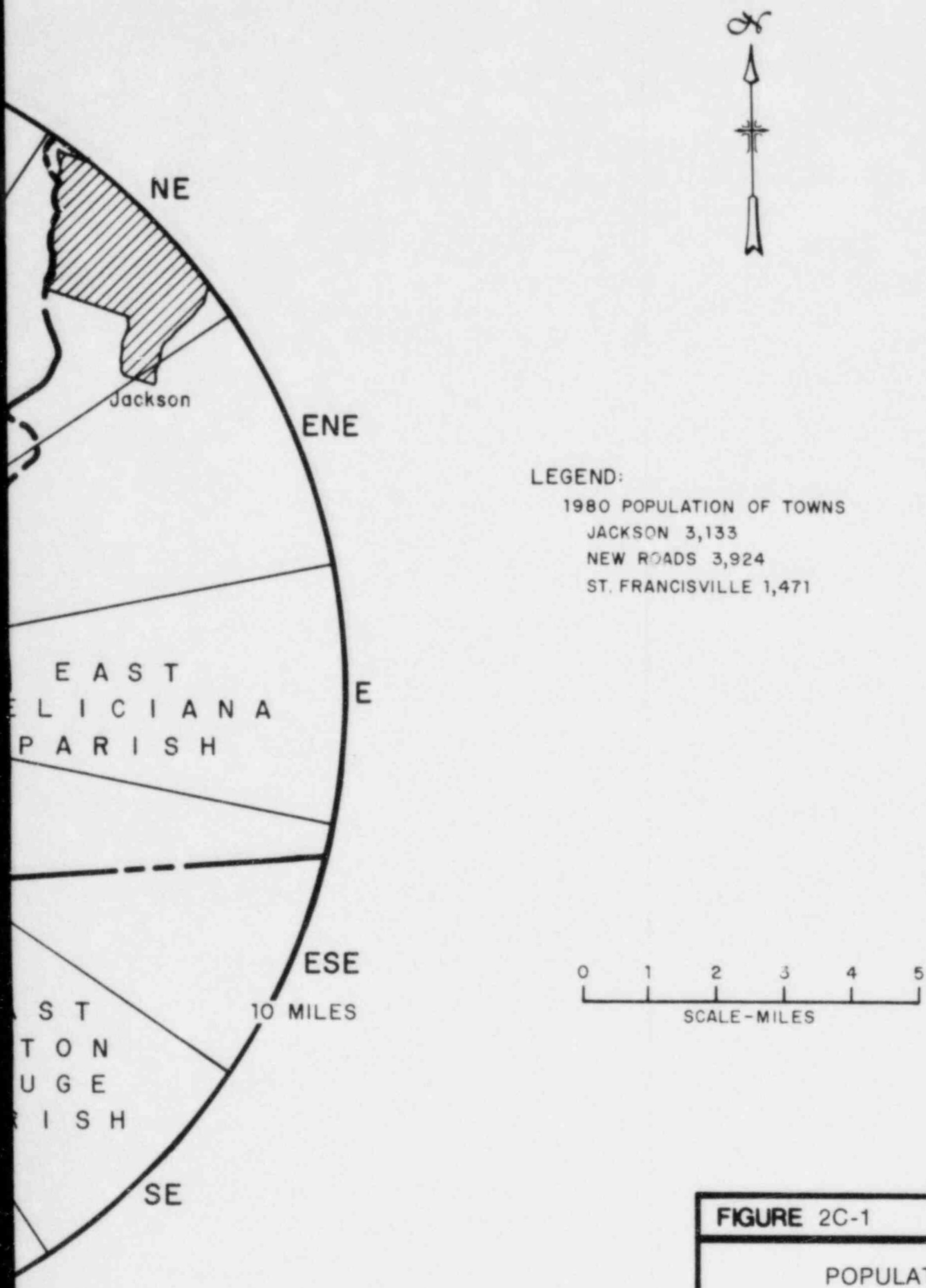
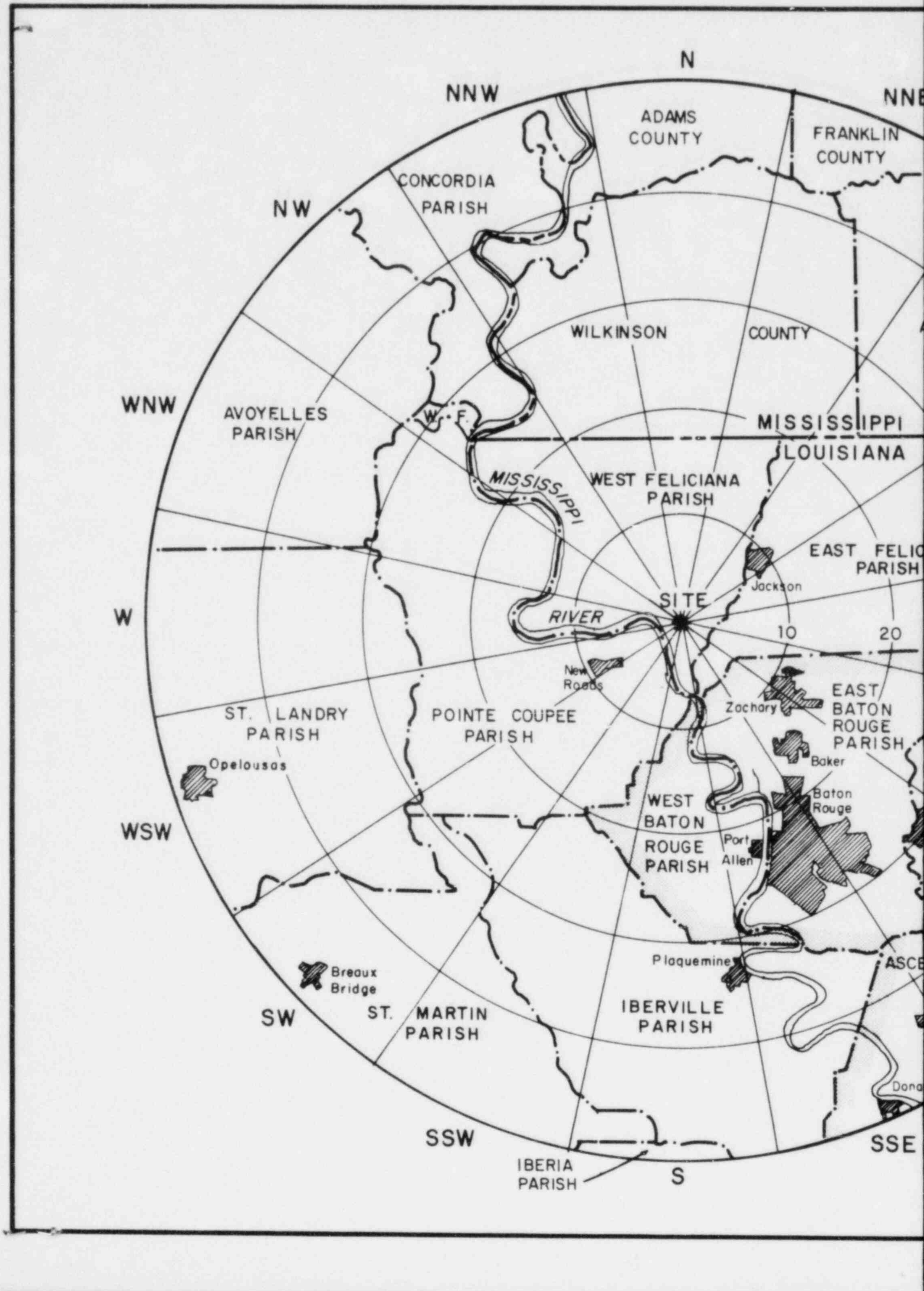


FIGURE 2C-1

POPULATION SECTORS
WITHIN 10 MILES

RIVER BEND STATION
ENVIRONMENTAL REPORT – OLS



N
NNW
NNE
NW
WNW
W
WSW
SW
SSW
S
SSE
ADAMS COUNTY
FRANKLIN COUNTY
CONCORDIA PARISH
WILKINSON COUNTY
AVOYELLES PARISH
W. F.
MISSISSIPPI
LOUISIANA
MISSISSIPPI RIVER
WEST FELICIANA PARISH
EAST FELIC PARISH
Jackson
SITE
10
20
New Roads
Zachary
EAST BATON ROUGE PARISH
Baker
Baton Rouge
ST. LANDRY PARISH
POINTE COUPEE PARISH
Opelousas
WEST BATON ROUGE PARISH
Port Allen
Plaquemine
ASCE
Breaux Bridge
ST. MARTIN PARISH
IBERVILLE PARISH
Dona
IBERIA PARISH

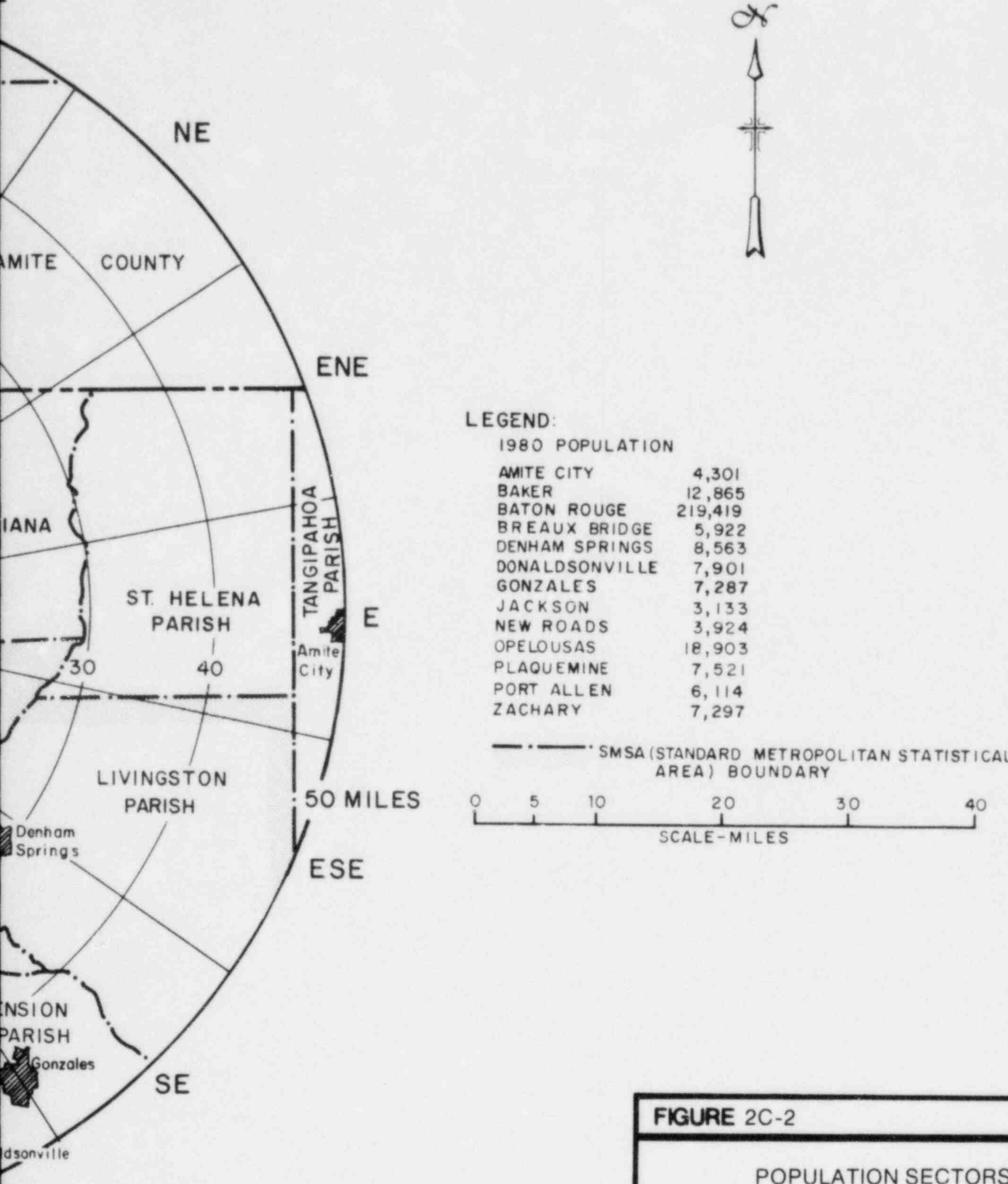


FIGURE 2C-2

POPULATION SECTORS
WITHIN 50 MILES

RIVER BEND STATION
ENVIRONMENTAL REPORT – OLS

CHAPTER 2

QUESTIONS AND RESPONSES

TABLE OF CONTENTS

NRC Question No.	Supplement No.	Q&R Page No.
E470.1	2	2.1-1
E310.7	2	2.1-2
E470.2	2	2.2-1
E290.6	2	2.2-2
E240.1	1	2.3-1
E240.2	1	2.3-2
E240.3	1	2.3-3
E240.4	1	2.3-6
E240.5	2	2.3-7
E240.6	1	2.3-8
E240.7	1	2.3-9
E240.8	1	2.3-10
E240.9	2	2.3-11
E240.10	1	2.3-12
E240.11	1	2.3-13
E240.12	1	2.3-14
E240.13	1	2.3-15
E240.14	2	2.3-16
E291.1	2	2.3-17
E291.2	2	2.3-18
E291.3	2	2.3-19
E291.4	2	2.3-20
E291.12	2	2.3-21
E240.27	3	2.3-22
E240.28	3	2.3-23
E240.34	3	2.3-24
E291.13	2	2.4-1
E310.9	2	2.5-1
E310.10	4	2.5-2
E451.1	1	2.7-1
E451.2	1	2.7-2
E451.3	2	2.7-3

CHAPTER 2

QUESTIONS AND RESPONSES

TABLE OF CONTENTS

NRC Question No.	Supplement No.	Q&R Page No.
E290.1	2	2.9-1
E290.2	4	2.9-2
E290.3	2	2.9-3
E290.4	2	2.9-4
E240.15	1	2B-1
E240.32	3	2B-3
E240.33	3	2B-4

QUESTION E310.9 (2.5)

Identify any impacts to cultural resources which could potentially result from the operation and maintenance activities related to the plant and transmission lines.

RESPONSE

Refer to Section 5.1.3 for the information requested.

QUESTION E310.10 (2.5)

Refer to question 311.5 which requested that population data be provided in the English system of miles. In addition, use the 1980 Census to update the projected population figures presented in Table 2.5-2, Tables 2.5-5 through Table 2.5-10, Tables 2.5-17 through Table 2.5-22. Also, update Figures 2.5-4 through Figure 2.5-16. Describe the methodology and assumptions used for updating.

RESPONSE

4 The response to this request is provided in new Appendix 2C.

QUESTION E451.3 (2.7.4)

The total accuracy of each time-averaged variable should include the errors due to sensors, processors, recorders, and data reduction. Provide the error in each hourly averaged variable due to data reduction.

RESPONSE

There are no reduction errors in data collected by a digital data collection system. Temperature, dewpoint, and vertical temperature difference are sampled once per minute as "grab samples." Precipitation is totaled for each minute. Wind speed and wind direction are processed through a 60-second analog filter (the filter errors were considered in the overall errors presented in the ER resulting in minute values. All these minute values are placed on the magnetic tape from which hourly averaged values are determined.

Infrequently (approximately 4 percent of the 2-year period), values could not be obtained from the data logger; thus, the strip charts (analog data collection system) were used. There is error in reducing a strip chart trace to produce hourly average values. Analog data reduction errors which were used to determine the total errors in each hourly averaged variable and the total data processing errors, are presented in revised Section 6.4.1.5. 2

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QUESTION E290.1 (2.9)

Provide a brief listing or discussion of noise-sensitive land uses within three miles of the River Bend Station (i.e., residences, schools, hospitals, churches, cemeteries). Indicate their locations with respect to the station and with respect to the ambient noise survey sampling locations.

RESPONSE

There are a total of ten (10) noise-sensitive land uses within three (3) miles of the River Bend site. Figure 2.9-1 has been modified to define and indicate the locations of noise-sensitive land uses and their proximity with respect to the ambient noise measurement locations.

QUESTION E290.2 (2.9)

Indicate the kinds of outdoor construction activities that were ongoing at the station during the 1980 sound level survey. Indicate the extent to which any of the sample data may have been influenced by the construction activity.

RESPONSE

4 The response to this request is provided in revised Section 2.9.

CHAPTER 3

PLANT DESCRIPTION

3.1 EXTERNAL APPEARANCE AND PLANT LAYOUT

The complex of buildings that make up River Bend Station is located in a thickly wooded area on a slight rise east of the Mississippi River. The main plant buildings are more than 1.6 km (1 mi) away from US Highway 61, which passes northeast of the 1,352-ha (3,342-acre) GSU property. The dense native growth along the roadside and scattered patches of timber, such as sweetgum, loblolly pine, hickory, Shumard oak, and water oak, screen the station from highway traffic. The highway elevation is about 25 ft above the site grade.

As the plant is approached from North Access Road leading off US Highway 61, the buildings are first seen above the treetops, and then the station appears as a composition of large, simple concrete masses dominated by the twin cylindrical forms of the reactor building structures. The upper portions of the turbine building, normal switchgear building, and auxiliary boiler and water treatment building are enclosed in fluted-metal siding. These buildings, together with open metal frame structures such as switchyards, yard tanks, and transformers, are painted with a dominant color to provide contrast with the natural color of untextured concrete. The plant exhaust duct rises about 195 ft (290 ft msl) above plant grade and is covered by fluted-metal siding. This duct releases waste gases to the atmosphere above all other plant structures. Locations and elevations of all plant gaseous release points are shown in Fig. 3.1-1.

The major plant structures cover approximately 51 ha (126 acres) and are arranged as shown in Fig. 3.1-2. The station is entered through the office and service building, which contains principal personnel space. It is a three-story building with a facade of bronzed glass to reflect the surrounding trees and the sky. The building is constructed of precast concrete panels, which contrast with the bronzed glass. 2

The reactor building structure housing the steel containment is the dominant feature of this station. The smooth finish of the concrete walls accentuates their curvature which terminates in a shallow dome. This cylindrical structure is a large vertical element which tends to balance the

proportions of the lower, rectangular buildings grouped around it and completes the geometric composition of the station.

The Training Center, which will also house the Emergency
Operations Facility, will be located outside the plant
security boundary but on GSU property near the intersection
2 of U.S. Highway 61 and the North Access Road. This
basically commercial type building has a "plantation" facade
designed to blend with the antebellum culture of the area.

Permanent station roads and parking areas are asphalt paved, with lane markings painted in either yellow or white. A spur track from the Illinois Central Gulf Railroad line links the turbine and fuel buildings to the major railroad network for transporting waste products and other materials.

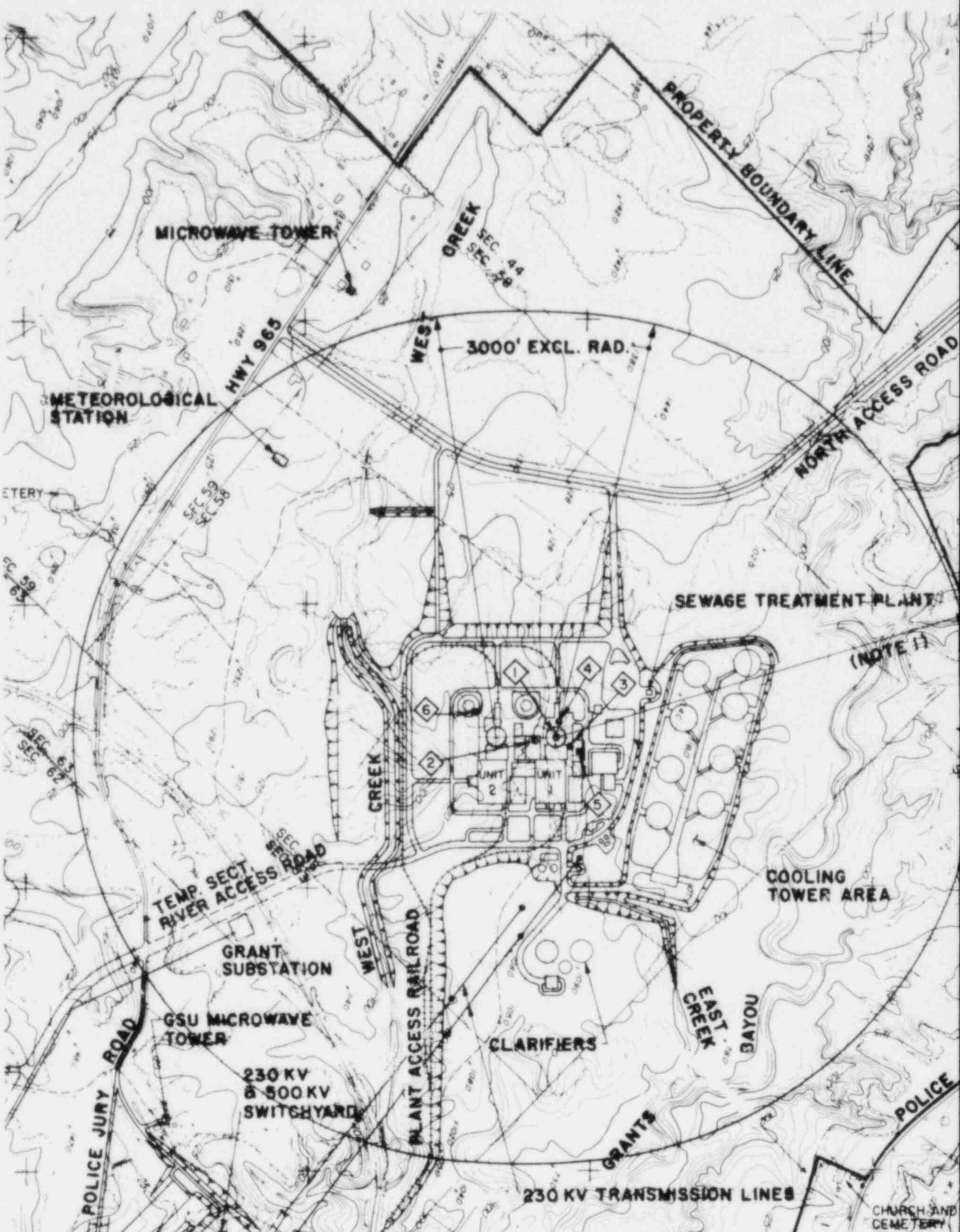
The site is landscaped to enhance the appearance of the buildings. Except at the entrances, where grass and shrubs of low profile are used to define walkways, the natural aspect of the wooded slopes and fields of meadow grass is retained. Trees frame vistas as well as baffle utilitarian areas, where possible, when consistent with security requirements.

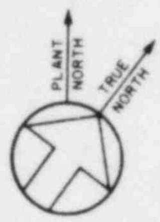
At the conclusion of the construction activities, the facilities used for temporary construction buildings, laydown of equipment, construction switchyard, and parking during the construction stage will be removed and the land restored. The land will be graded and seeded to promote the return of vegetative cover.

Sedimentation basins and pits for the disposal of wastes from concrete operations, will be backfilled with soil when full. Areas used for the stockpiling of spoils will be allowed to revert to a natural state. The area occupied by the landfill facility will be reseeded when the facility is no longer required. Details of the site restoration plan are provided in Section 4.1.

Visual Impact on Surrounding Areas

In order to assess visual impact, visually sensitive and intensive land uses within 10 km (6.25 mi) of River Bend Station were identified. These included residential concentrations, major transportation routes, historic sites, and recreational attractions within approximately 10 km and properties listed on the National Register of Historic Places within 16 km (10 mi) of River Bend Station. All are


PROPERTY BOUNDARY LINE
MICROWAVE TOWER
WEST CREEK
SEC 44
SEC 58
3000' EXCL. RAD.
HWY 965
METEOROLOGICAL STATION
NORTH ACCESS ROAD
SEC 59
SEC 58
SEWAGE TREATMENT PLANT
(NOTE 1)
UNIT 2
UNIT 1
COOLING TOWER AREA
TEMP. SECT. RIVER ACCESS ROAD
GRANT SUBSTATION
WEST
PLANT ACCESS RAILROAD
EAST CREEK
BAYOU
GSU MICROWAVE TOWER
CLARIFIERS
230 KV & 500 KV SWITCHYARD
POLICE JURY ROAD
GRANTS
230 KV TRANSMISSION LINES
POLICE
CHURCH AND CEMETERY



GASEOUS EFFLUENT RELEASE POINTS

NO.	VENT	MIN. DISTANCE TO BOUNDARY LINE	RELEASE ELEVATION (msl)
1	TURBINE BLDG. STANDBY GAS TRMNT. CONTAINMENT PIPE TUNNELS AUXILIARY BLDG.	3000 ± FT	290 ± FT
2	RADWASTE BLDG.	2850 ± FT	211 ± FT
3	CONTROL BLDG. SMOKE REMOVAL BATTERY RMS MECH. RM. UTILITY RMS.	2850 ± FT	102 ± FT
4	FUEL BLDG.	2900 ± FT	177 ± FT
5	CONTROL RM. INTAKE	2800 ± FT	161 ± FT
6	CONTROL RM REMOTE AIR INTAKE	2750 ± FT	154 ± FT

500 0 500 1000 1500 2000 2500

FEET

100 0 100 200 300 400 500

METERS

NOTE

1. DISTANCE FROM CENTERLINE REACTOR NO. 1 TO PROPERTY BOUND = 3035.15'

FIGURE 3.1-1

LOCATION OF GASEOUS RELEASE POINTS

RIVER BEND STATION

ENVIRONMENTAL REPORT – OLS

3.3 PLANT WATER USE

3.3.1 Water Consumption

Fig. 3.3-1 presents a schematic flow diagram of station water use and includes expected maximum, average, and minimum flowrates. Systems described are discussed in detail in Sections 3.4, 3.5, and 3.6.

3.3.1.1 Station Cooling Systems

The station cooling systems consist of the circulating water system for main condenser cooling, the normal service water system for various station heat exchangers, and the standby service water system used in the event of an accident or during abnormal conditions. Condenser cooling water and normal service water for each unit are cooled by four mechanical-draft cooling towers.

The standby service water system operates in conjunction with the standby cooling towers and the water storage facilities of the ultimate heat sink (UHS).

A circulating water pump discharge flowrate of 511,560 gpm per unit is required for condenser cooling and tower blowdown during normal operation. Cooling water is pumped from the cooling tower basins through the tube side of each main condenser and then returned to the cooling towers. 1

To maintain the desired condenser circulating water quality, a constant 2,200 gpm of water per unit is discharged as blowdown to the Mississippi River from the circulating water system. To replace water losses resulting from blowdown, tower drift, and tower evaporation, makeup water is pumped at an average rate of 13,870 gpm per unit from the Mississippi River to the cooling tower basins through a water treatment system consisting of clarifiers. Sulfuric acid is added to the makeup water for pH adjustment, and sodium hypochlorite is applied intermittently to the circulating water to prevent fouling of heat exchanger surfaces and other piping by aquatic growth. 1

A sludge dilution tank is provided to receive the clarifier underflow. The sludge is diluted to a solids concentration range of 0.5 percent to 4 percent (by weight) using raw river water at a flowrate of approximately 500 gpm. The diluted mixture is then pumped to the Mississippi River.

Normal station service water is pumped from the cooling tower basins to the various station service water heat

exchangers and then returned to the cooling towers. Among the heat exchangers are those whose operation is considered essential to remove heat resulting from a loss-of-coolant accident or ensure a safe shutdown during abnormal conditions. The auxiliary building unit coolers, containment unit coolers, standby diesel generator coolers, and main control room air-conditioning water chillers are the essential heat exchangers supplied by the normal service water system. This system also supplies cooling water to four residual heat removal heat exchangers in the event of reactor shutdown. The normal service water system also supplies cooling water to the nonessential heat exchangers, including reactor plant component cooling water (RPCCW) heat exchangers, turbine plant component cooling water (TPCCW) heat exchangers, hydrogen coolers, an alternator cooler, turbine lube oil coolers, electrohydraulic control equipment coolers, air-conditioning water chillers in the turbine and radwaste buildings, and drywell unit coolers.

A normal flowrate of 50,900 gpm per unit is required for service water. An additional flow of 11,600 gpm per unit is required if the residual heat removal heat exchangers are in operation.

The extreme minimum river flow near the site is about 100,000 cfs, and sufficient makeup water is available on a continuous basis for the operation of station cooling systems.

Each unit has a complete standby service water system and
4 UHS complex consisting of a mechanical-draft cooling tower, with a 6,500,000 gallon water storage facility. A maximum flow of approximately 35,000 gpm is required to provide adequate cooling for essential equipment. System cooling requirements are reduced to approximately 22,000 gpm after the first day of operation, when a large portion of reactor residual heat is removed. Standby service water can be supplied to those essential components cooled by the normal service water system and the residual heat removal heat exchangers in the event that the normal service water system or normal cooling towers are inoperative. Each standby cooling tower and UHS can also be used to dissipate residual heat produced when a reactor is shut down for refueling and to provide makeup water to the fuel pool.

Interfaces between the normal cooling water supply and the standby service water system allow for automatic isolation of the normal service water system and initiation of standby cooling upon loss of normal cooling. Both service water

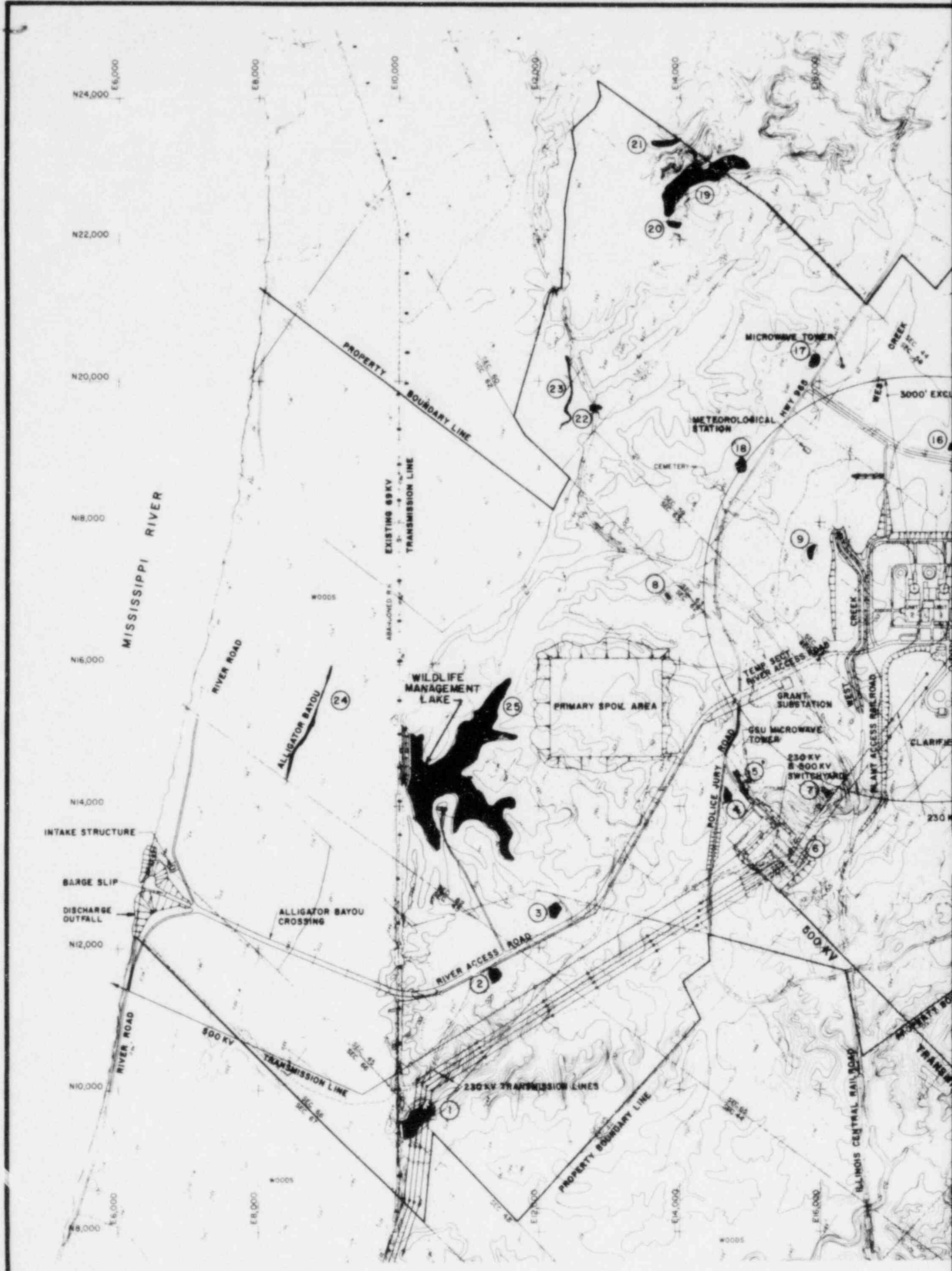
TABLE 3.5-5 (Cont)

B. Activation/Corrosion Products (independent of failed fuel)

Radio Nuclide	M.P.C.[1] (Conc. in Water) uCi/ml	D.C. (Conc. in Discharge) Canal uCi/cc	Dc/mpc (50,000 uCi/sec)
Na-24	2.0-04	1.7-09	8.5-06
P-32	2.0-05	1.3-10	6.5-06
Cr-51	2.0-03	4.0-09	2.0-06
Mn-54	1.0-04	4.8-11	4.8-07
Mn-56	1.0-04	1.3-09	1.3-05
Fe-55	8.0-04	6.8-10	8.5-07
Fe-59	6.0-05	2.0-11	3.3-07
Co-58	1.0-04	1.4-10	1.4-06
Co-60	5.0-05	2.7-10	5.4-06
Ni-63	3.0-05	6.9-13	2.3-08
Ni-65	1.0-04	7.5-12	7.5-08
Cu-64	3.0-04	4.4-09	1.5-05
Zn-65	1.0-04	1.4-10	1.4-06
Zn-69m	7.0-05	3.2-10	4.6-06
Zr-95	6.0-05	5.4-12	9.0-08
Zr-97	2.0-05	1.1-12	5.5-08
Nb-95	1.0-04	5.3-12	5.3-08
Ag-110m	3.0-05	6.8-13	2.3-08
W-187	7.0-05	7.5-11	1.1-06
H-3	3.0-03	1.0-05	3.3-03

4

(1) Source: 10CFR20, Appendix B, Table II, Column 2.
(2) Exponents to Base 10 such as 3×10^{-6} are listed as 3.0-06.


MISSISSIPPI RIVER
PROPERTY BOUNDARY LINE
EXISTING 69 KV TRANSMISSION LINE
RIVER ROAD
ALLIGATOR BAYOU
WILDLIFE MANAGEMENT LAKE
PRIMARY SPOIL AREA
INTAKE STRUCTURE
BARGE SLIP
DISCHARGE OUTFALL
ALLIGATOR BAYOU CROSSING
RIVER ACCESS ROAD
500 KV TRANSMISSION LINE
230 KV TRANSMISSION LINES
MICROWAVE TOWER
METEOROLOGICAL STATION
CEMETERY
HWY 965
WEST CREEK
GRANT SUBSTATION
GSU MICROWAVE TOWER
230 KV & 500 KV SWITCHYARD
POLICE JURY ROAD
TEMP SECT RIVER ACCESS ROAD
PLANT ACCESS RAILROAD
ILLINOIS CENTRAL RAILROAD
500 KV
WOODS
N24,000
N22,000
N20,000
N18,000
N16,000
N14,000
N12,000
N10,000
N8,000
E6,000
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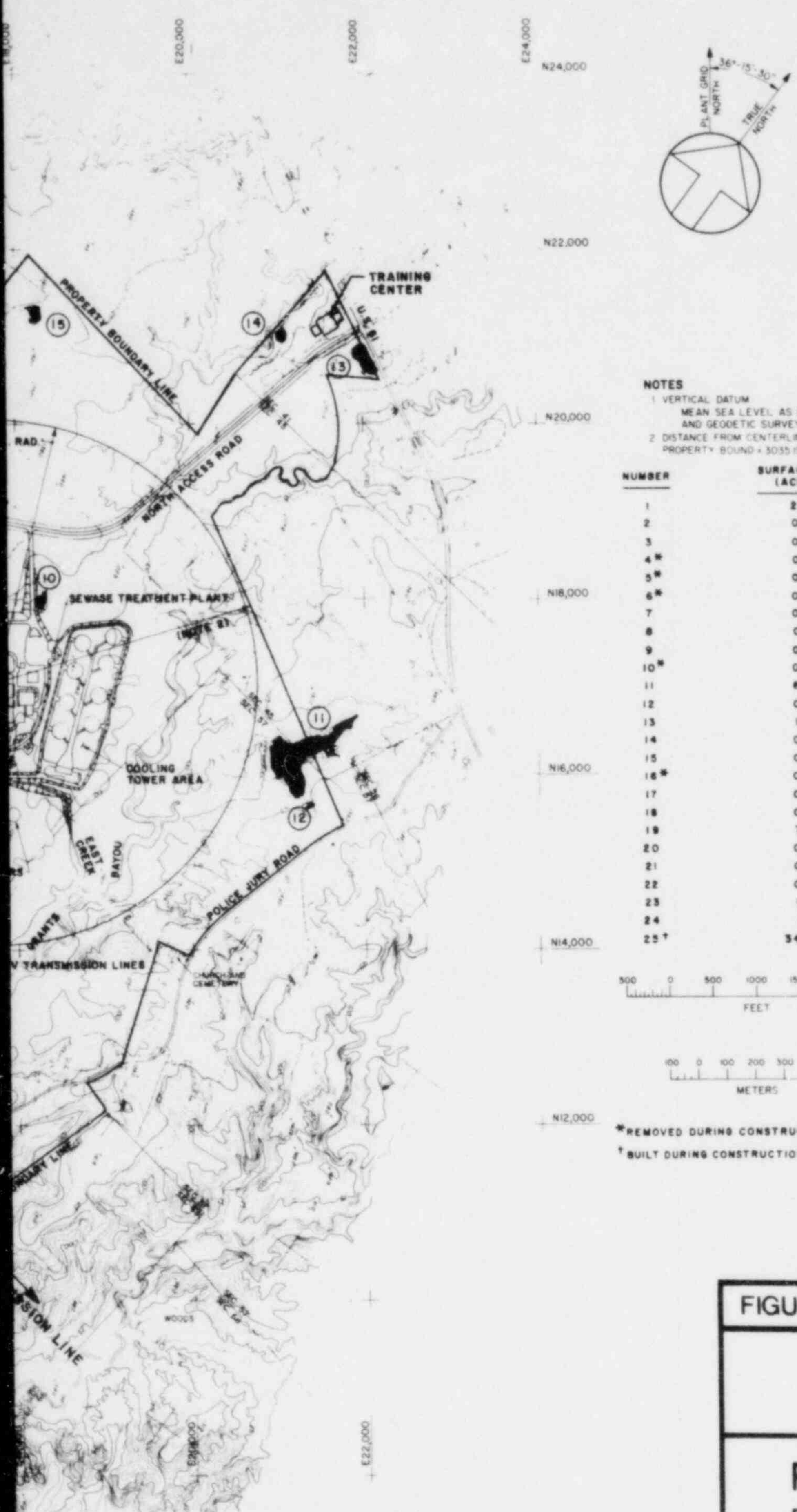
E12,000
E14,000
E16,000



NOTES

1. VERTICAL DATUM
   MEAN SEA LEVEL AS ESTABLISHED BY U.S. COAST AND GEODETIC SURVEY
2. DISTANCE FROM CENTERLINE REACTOR NO. 1 TO PROPERTY BOUND = 3035.15

NUMBER	SURFACE AREA (ACRES)
1	2.5
2	0.7
3	0.7
4*	0.5
5*	0.3
6*	0.2
7	0.3
8	0.2
9	0.5
10*	0.3
11	8.7
12	0.1
13	1.3
14	0.2
15	0.7
16*	0.2
17	0.6
18	0.3
19	7.5
20	0.4
21	0.8
22	0.3
23	1.4
24	1.5
25†	34.2

500 0 500 1000 1500 2000 2500
FEET

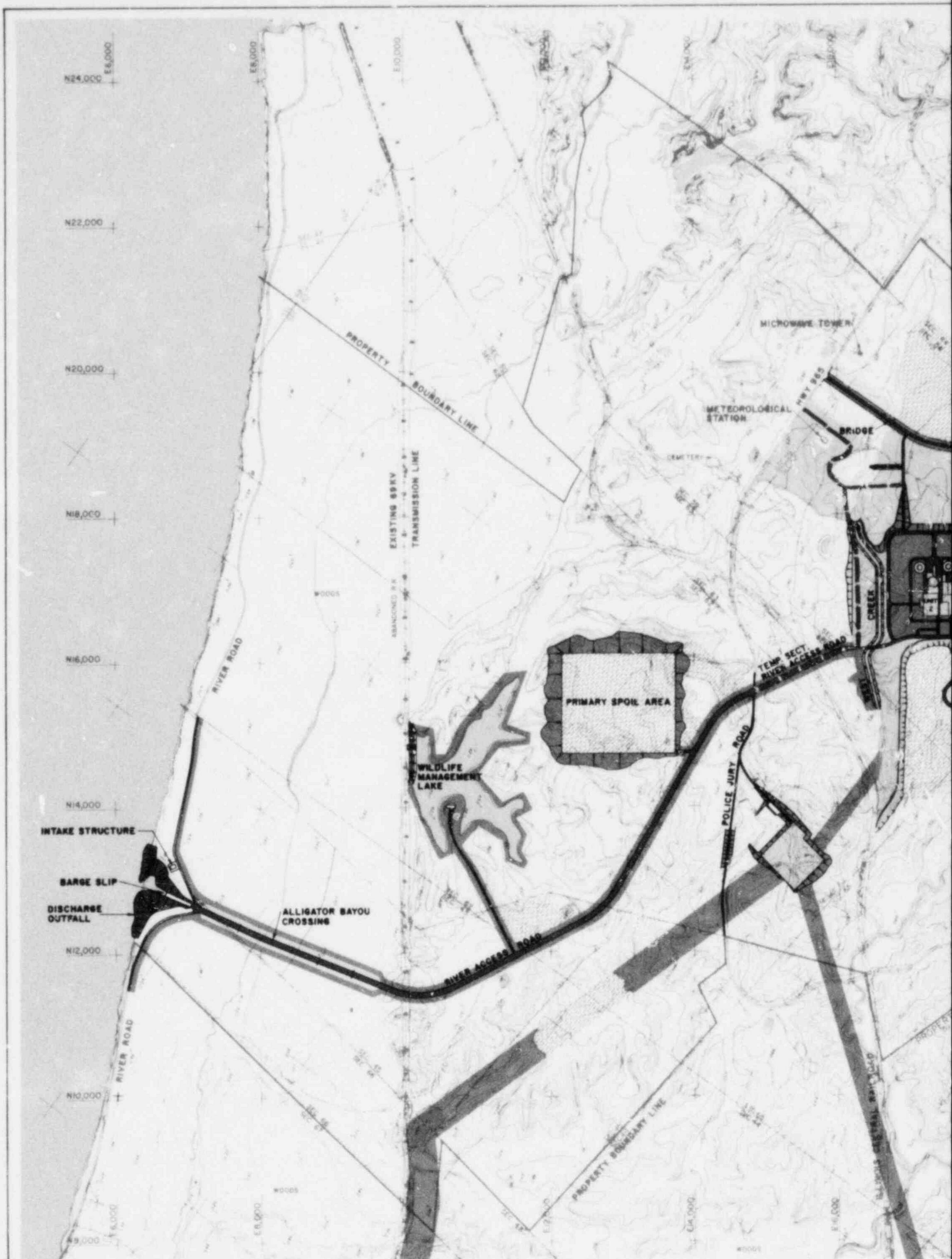
100 0 100 200 300 400 500
METERS

*REMOVED DURING CONSTRUCTION
†BUILT DURING CONSTRUCTION

FIGURE 4.2-1

SITE AREA PONDS

RIVER BEND STATION
ENVIRONMENTAL REPORT – OLS



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N22,000
N20,000
N18,000
N16,000
N14,000
N12,000
N10,000
N9,000
E6,000
E8,000
E10,000
E12,000
E14,000
E16,000
INTAKE STRUCTURE
BARGE SLIP
DISCHARGE OUTFALL
ALLIGATOR BAYOU CROSSING
RIVER ROAD
PROPERTY BOUNDARY LINE
EXISTING 69 KV TRANSMISSION LINE
WILDLIFE MANAGEMENT LAKE
RIVER ACCESS ROAD
PRIMARY SPOIL AREA
POLICE JURY ROAD
TEMP. SECT. RIVER ACCESS ROAD
MICROWAVE TOWER
METEOROLOGICAL STATION
HWY 965
BRIDGE
CREEK

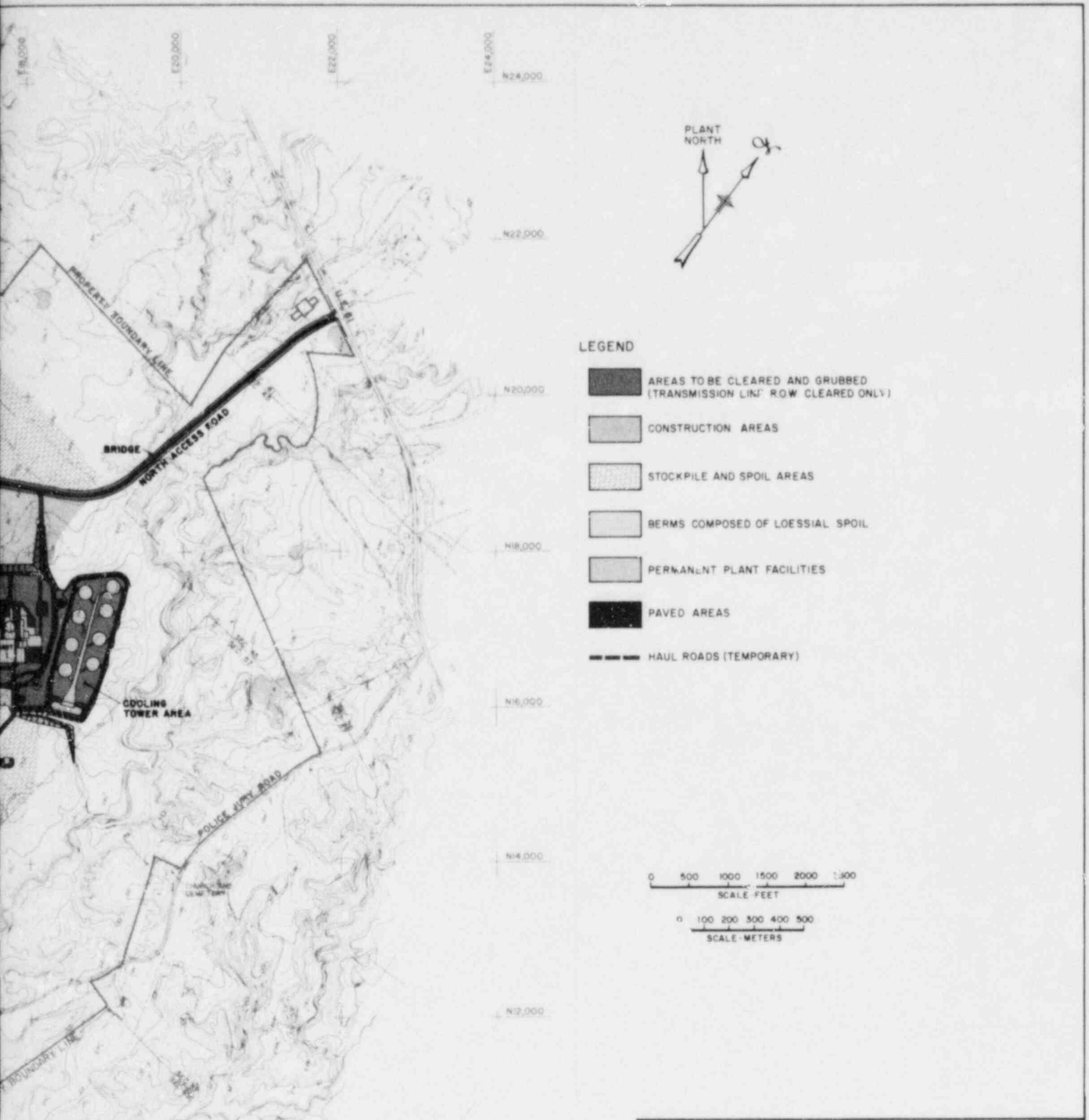
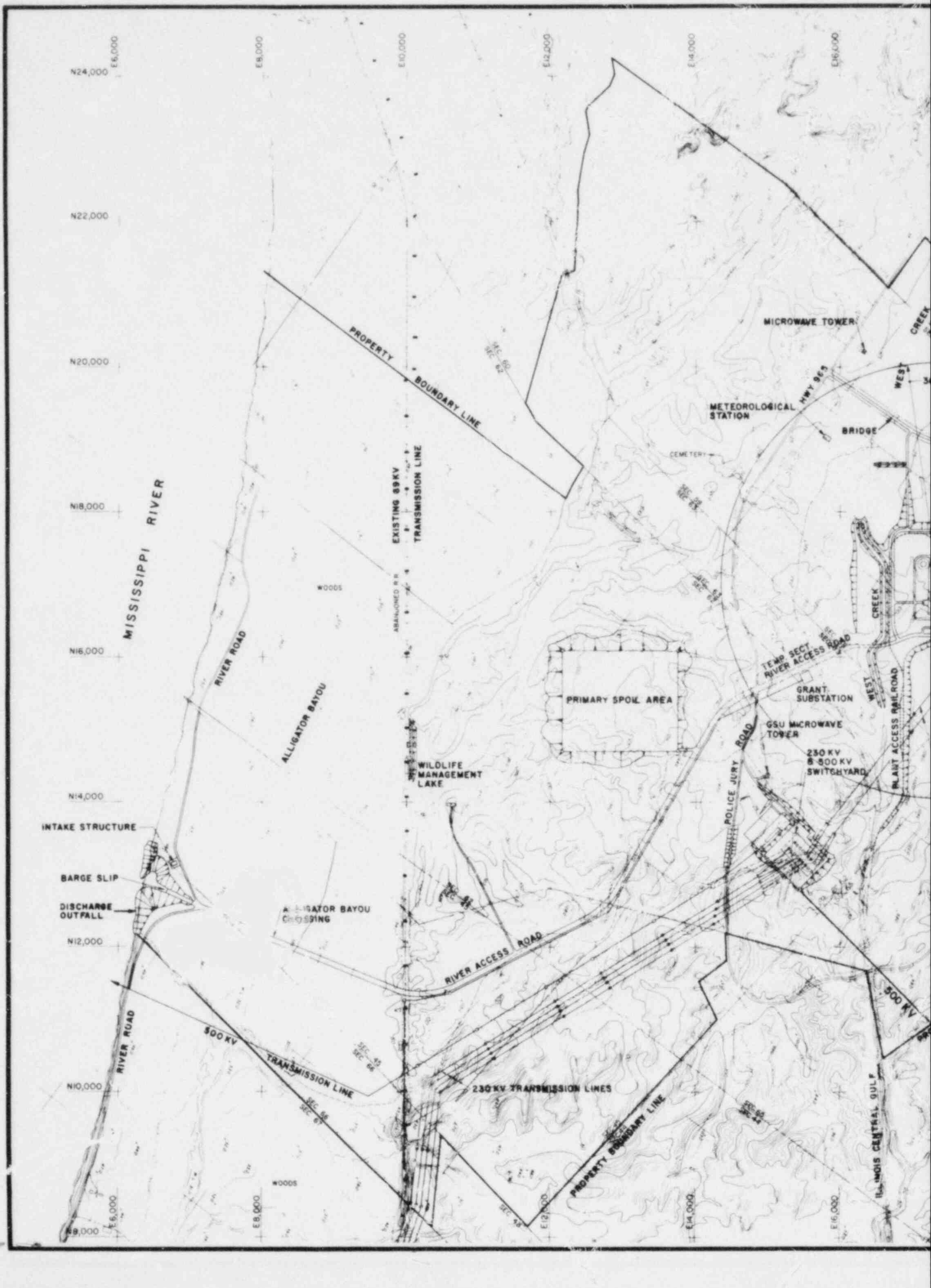


FIGURE 4.3-1

AREAS AFFECTED BY CONSTRUCTION

RIVER BEND STATION
ENVIRONMENTAL REPORT-OLS



N24,000
N22,000
N20,000
N18,000
N16,000
N14,000
N12,000
N10,000
E6,000
E8,000
E10,000
E12,000
E14,000
E16,000
MISSISSIPPI RIVER
RIVER ROAD
ALLIGATOR BAYOU
WOODS
PROPERTY BOUNDARY LINE
EXISTING 69KV TRANSMISSION LINE
ABANDONED R.R.
MICROWAVE TOWER
METEOROLOGICAL STATION
HWY 965
BRIDGE
CEMETERY
WEST CREEK
CREEK
PRIMARY SPOIL AREA
TEMP SECT. RIVER ACCESS ROAD
GRANT SUBSTATION
GSU MICROWAVE TOWER
230 KV & 500 KV SWITCHYARD
PLANT ACCESS RAILROAD
POLICE JURY ROAD
WILDLIFE MANAGEMENT LAKE
INTAKE STRUCTURE
BARGE SLIP
DISCHARGE OUTFALL
ALLIGATOR BAYOU CROSSING
RIVER ACCESS ROAD
500 KV TRANSMISSION LINE
230 KV TRANSMISSION LINES
ILLINOIS CENTRAL GULF
500 KV

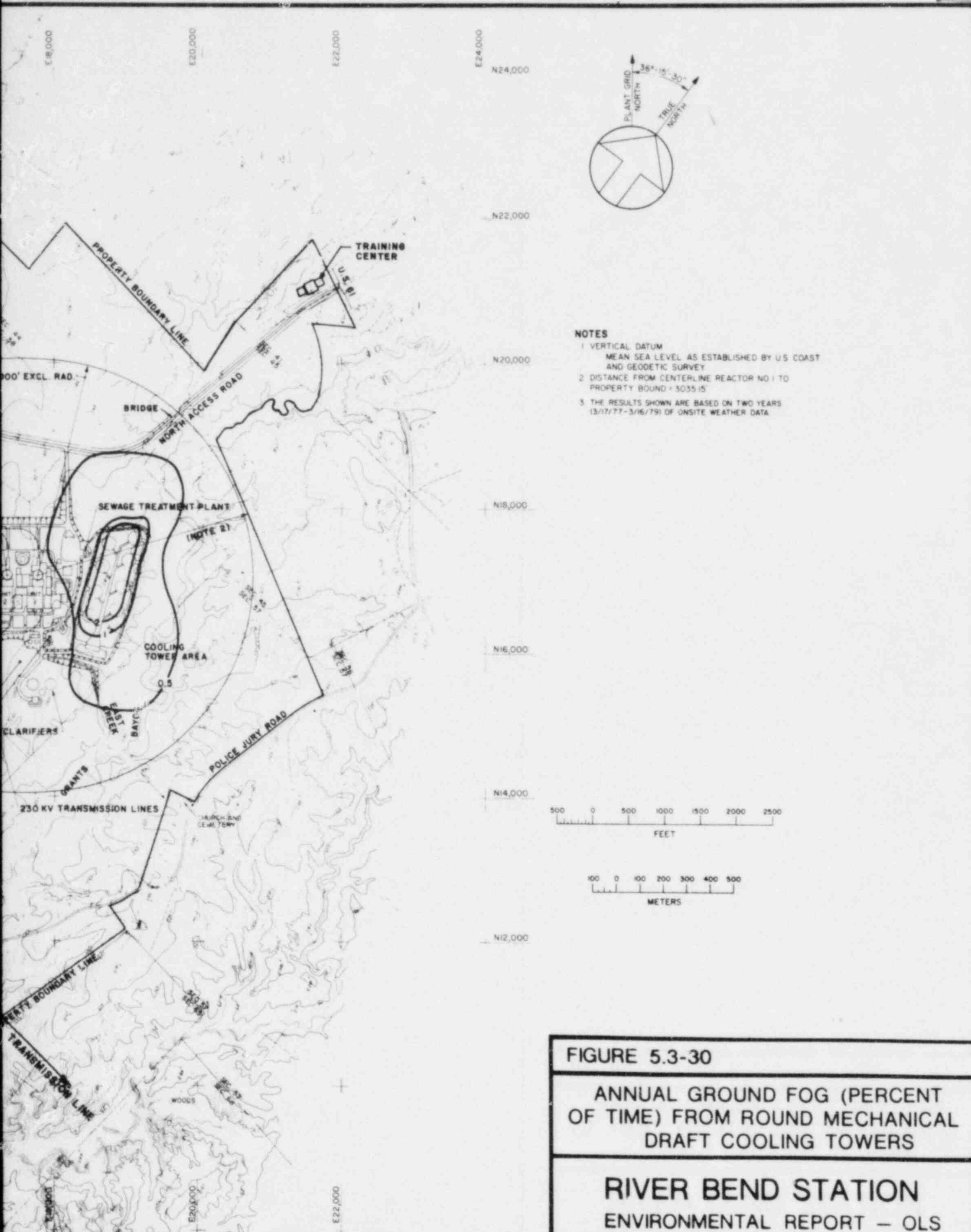
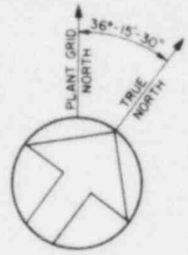


FIGURE 5.3-30

ANNUAL GROUND FOG (PERCENT OF TIME) FROM ROUND MECHANICAL DRAFT COOLING TOWERS

RIVER BEND STATION
ENVIRONMENTAL REPORT – OLS

MISSISSIPPI RIVER
RIVER ROAD
ALLIGATOR BAYOU
WOODS
PROPERTY BOUNDARY LINE
EXISTING 69KV TRANSMISSION LINE
ABANDONED R.R.
MICROWAVE TOWER
METEOROLOGICAL STATION
HWY 965
BRIDGE
CEMETERY
PRIMARY SPOIL AREA
TEMP. SECT. RIVER ACCESS ROAD
GRANT SUBSTATION
GSU MICROWAVE TOWER
230 KV & 500 KV SWITCHYARD
PLANT ACCESS RAILROAD
WEST
CREEK
POLICE JURY ROAD
WILDLIFE MANAGEMENT LAKE
INTAKE STRUCTURE
BARGE SLIP
DISCHARGE OUTFALL
ALLIGATOR BAYOU CROSSING
RIVER ACCESS ROAD
500 KV TRANSMISSION LINE
230 KV TRANSMISSION LINES
PROPERTY BOUNDARY LINE
ILLINOIS CENTRAL GULF
N24,000
N22,000
N20,000
N18,000
N16,000
N14,000
N12,000
N10,000
N8,000
E6,000
E8,000
E10,000
E12,000
E14,000
E16,000



NOTES

1. VERTICAL DATUM:
   MEAN SEA LEVEL AS ESTABLISHED BY U.S. COAST AND GEODETIC SURVEY
2. DISTANCE FROM CENTERLINE REACTOR NO.1 TO PROPERTY BOUND = 3035.15'
3. DRIFT RATE = 0.002% OF CIRCULATING WATER FLOW
4. THE RESULTS SHOWN ARE BASED ON THREE SPRING SEASONS (3/17/77-5/[illegible]/77, 3/17/78-5/31/78 AND 3/1/79-3/16/79) OF ONSITE WEATHER DATA

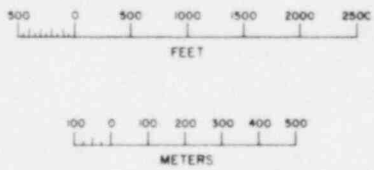
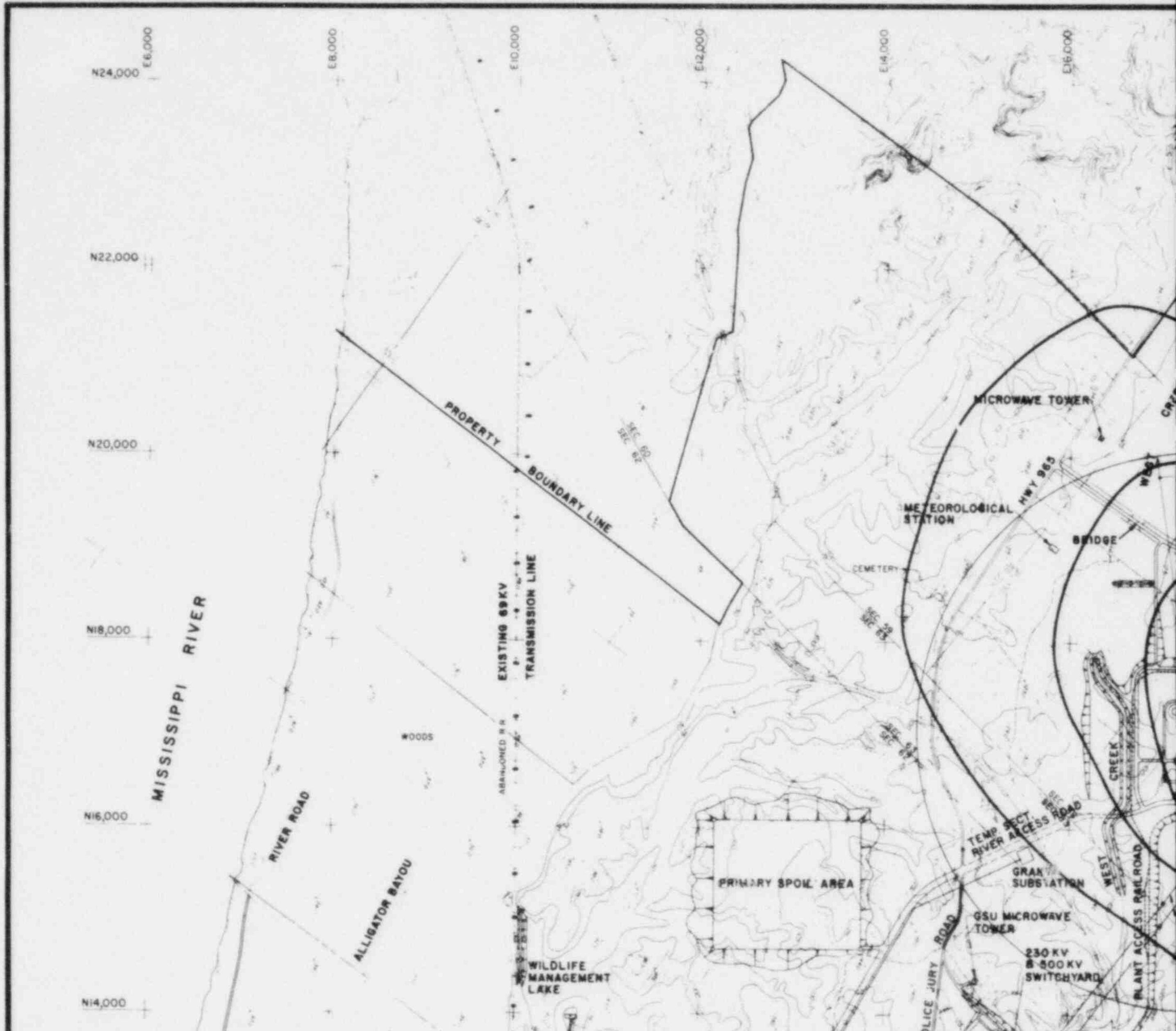


FIGURE 5.3-31

SPRING SALT DEPOSITION RATE (lb/acre/yr) FROM ROUND MECHANICAL DRAFT COOLING TOWERS

RIVER BEND STATION

ENVIRONMENTAL REPORT – OLS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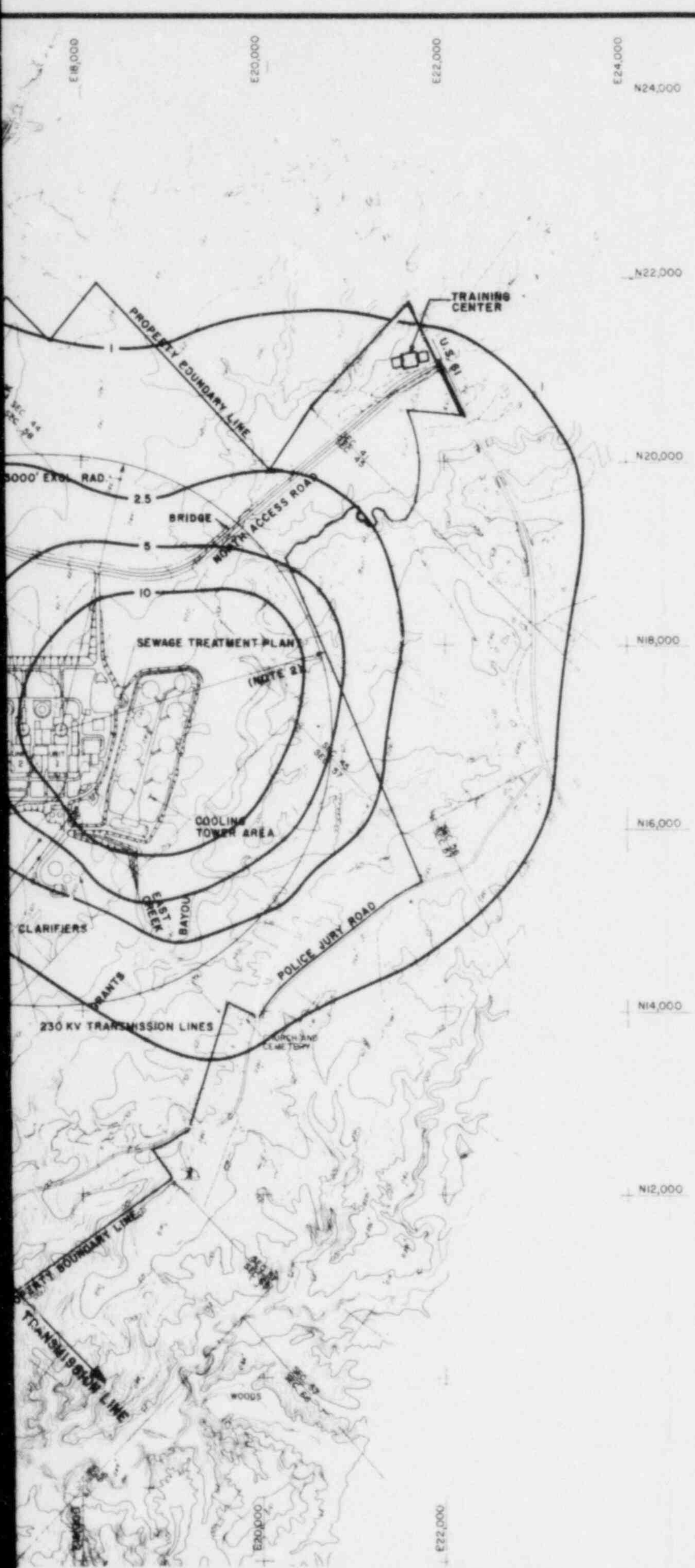
N20,000
N18,000
N16,000
N14,000
N12,000
N10,000
E6,000
E8,000
E10,000
E12,000
E14,000
E16,000
MISSISSIPPI RIVER
PROPERTY BOUNDARY LINE
EXISTING 69KV TRANSMISSION LINE
ABANDONED R.R.
WOODS
RIVER ROAD
ALLIGATOR BAYOU
WILDLIFE MANAGEMENT LAKE
INTAKE STRUCTURE
BARGE SLIP
DISCHARGE OUTFALL
ALLIGATOR BAYOU CROSSING
RIVER ACCESS ROAD
500 KV TRANSMISSION LINE
230 KV TRANSMISSION LINES
PRIMARY SPOIL AREA
MICROWAVE TOWER
METEOROLOGICAL STATION
HWY 965
BRIDGE
CEMETERY
TEMP SECT RIVER ACCESS ROAD
GSU MICROWAVE TOWER
230 KV & 500 KV SWITCHYARD
POLICE JURY ROAD
WEST CREEK
PLANT ACCESS RAILROAD
ILLINOIS CENTRAL GULF



PLANT GRID NORTH
36°-15'-30"
TRUE NORTH

NOTES

1. VERTICAL DATUM
   MEAN SEA LEVEL AS ESTABLISHED BY U.S. COAST AND GEODETIC SURVEY
2. DISTANCE FROM CENTERLINE REACTOR NO. 1 TO PROPERTY BOUND = 3035.15'
3. DRIFT RATE = 0.002% OF CIRCULATING WATER FLOW
4. THE RESULTS SHOWN ARE BASED ON TWO SUMMER SEASONS (6/1/77-8/31/77 AND 6/1/78-8/31/78) OF ONSITE WEATHER DATA

500 0 500 1000 1500 2000 2500
FEET

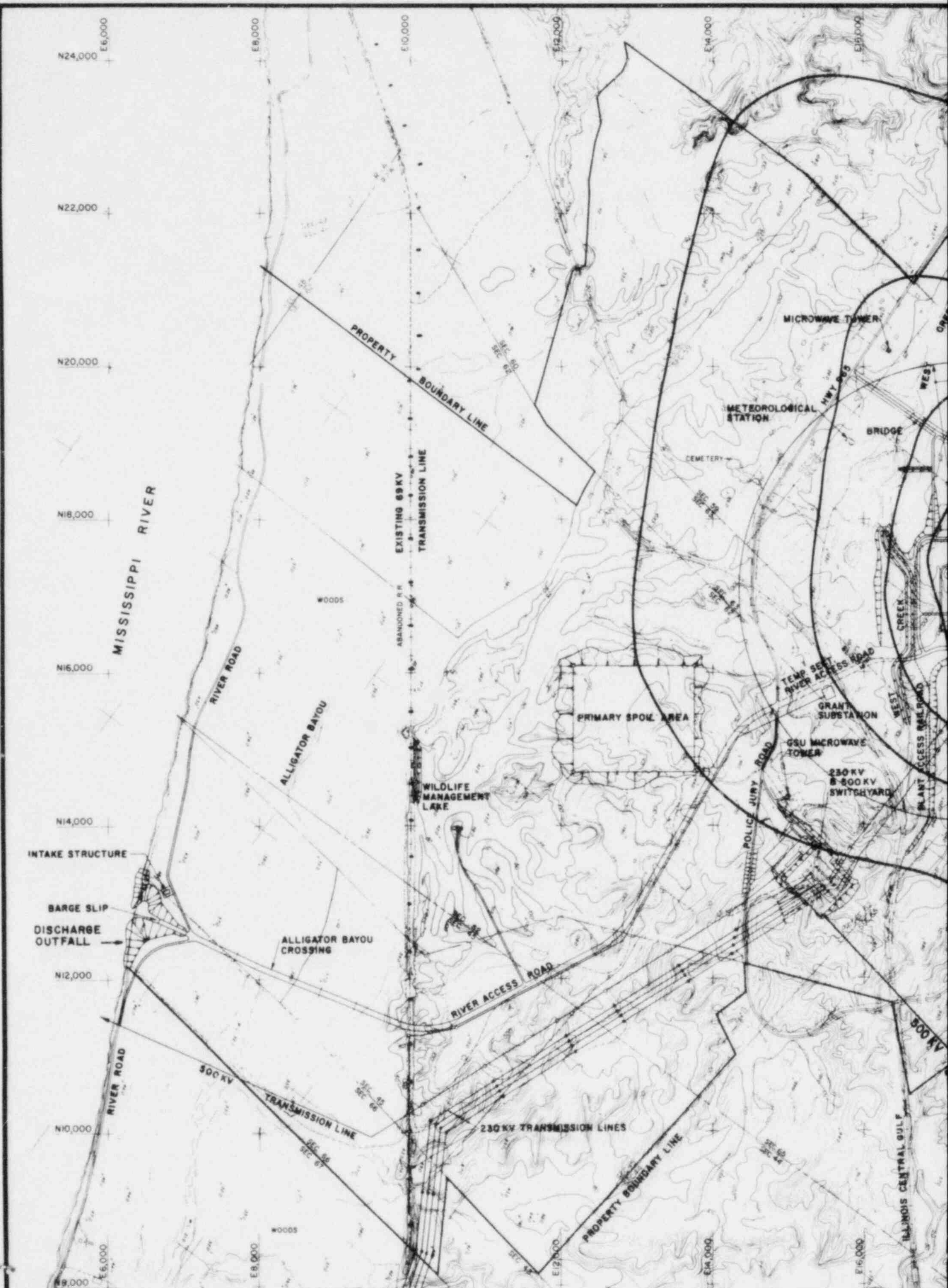
100 0 100 200 300 400 500
METERS

FIGURE 5.3-32

SUMMER SALT DEPOSITION RATE (lb/acre/yr) FROM ROUND MECHANICAL DRAFT COOLING TOWERS

RIVER BEND STATION

ENVIRONMENTAL REPORT – OLS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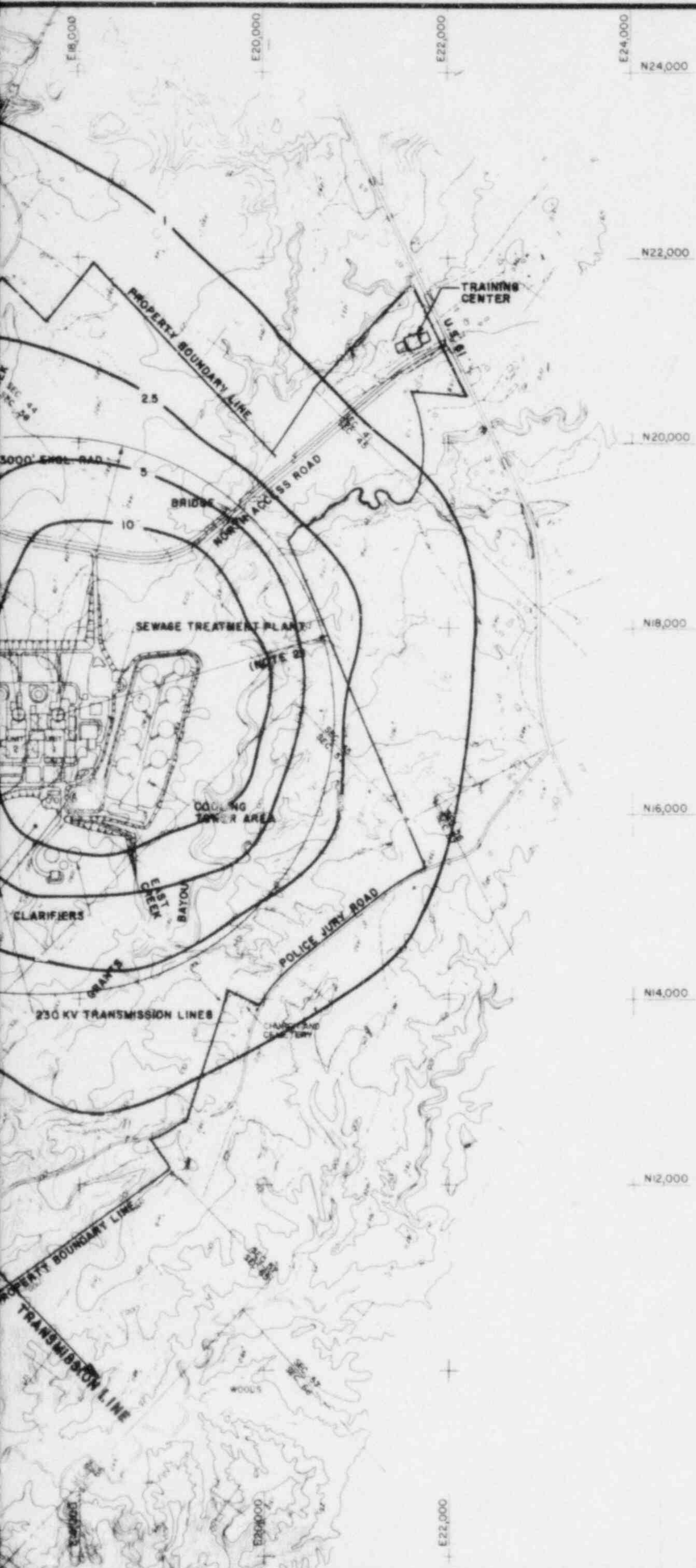
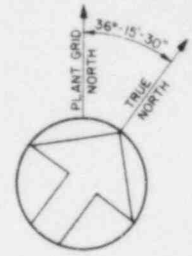
N20,000
N18,000
N16,000
N14,000
N12,000
N10,000
N8,000
E6,000
E8,000
E10,000
E12,000
E14,000
E16,000
MISSISSIPPI RIVER
RIVER ROAD
PROPERTY BOUNDARY LINE
EXISTING 69KV TRANSMISSION LINE
ABANDONED R.R.
WOODS
ALLIGATOR BAYOU
INTAKE STRUCTURE
BARGE SLIP
DISCHARGE OUTFALL
ALLIGATOR BAYOU CROSSING
WILDLIFE MANAGEMENT LAKE
RIVER ACCESS ROAD
500 KV TRANSMISSION LINE
230 KV TRANSMISSION LINES
PRIMARY SPOIL AREA
METEOROLOGICAL STATION
CEMETERY
MICROWAVE TOWER
HWY 965
BRIDGE
TEMP. SERV. RIVER ACCESS ROAD
GRANT SUBSTATION
GSU MICROWAVE TOWER
230 KV & 500 KV SWITCHYARD
POLICE JURY ROAD
PLANT ACCESS RAILROAD
WEST CREEK
ILLINOIS CENTRAL GULF
500 KV





NOTES

1. VERTICAL DATUM
   MEAN SEA LEVEL AS ESTABLISHED BY U.S. COAST AND GEODETIC SURVEY
2. DISTANCE FROM CENTERLINE REACTOR NO. 1 TO PROPERTY BOUND = 3035.15'
3. DRIFT RATE = 0.002% OF CIRCULATING WATER FLOW
4. THE RESULTS SHOWN ARE BASED ON TWO FALL SEASONS (9/1/77-11/30/77 AND 9/1/78-11/30/78) OF ONSITE WEATHER DATA

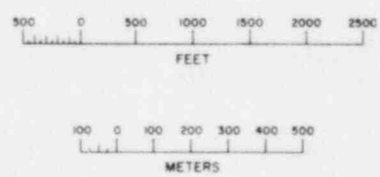
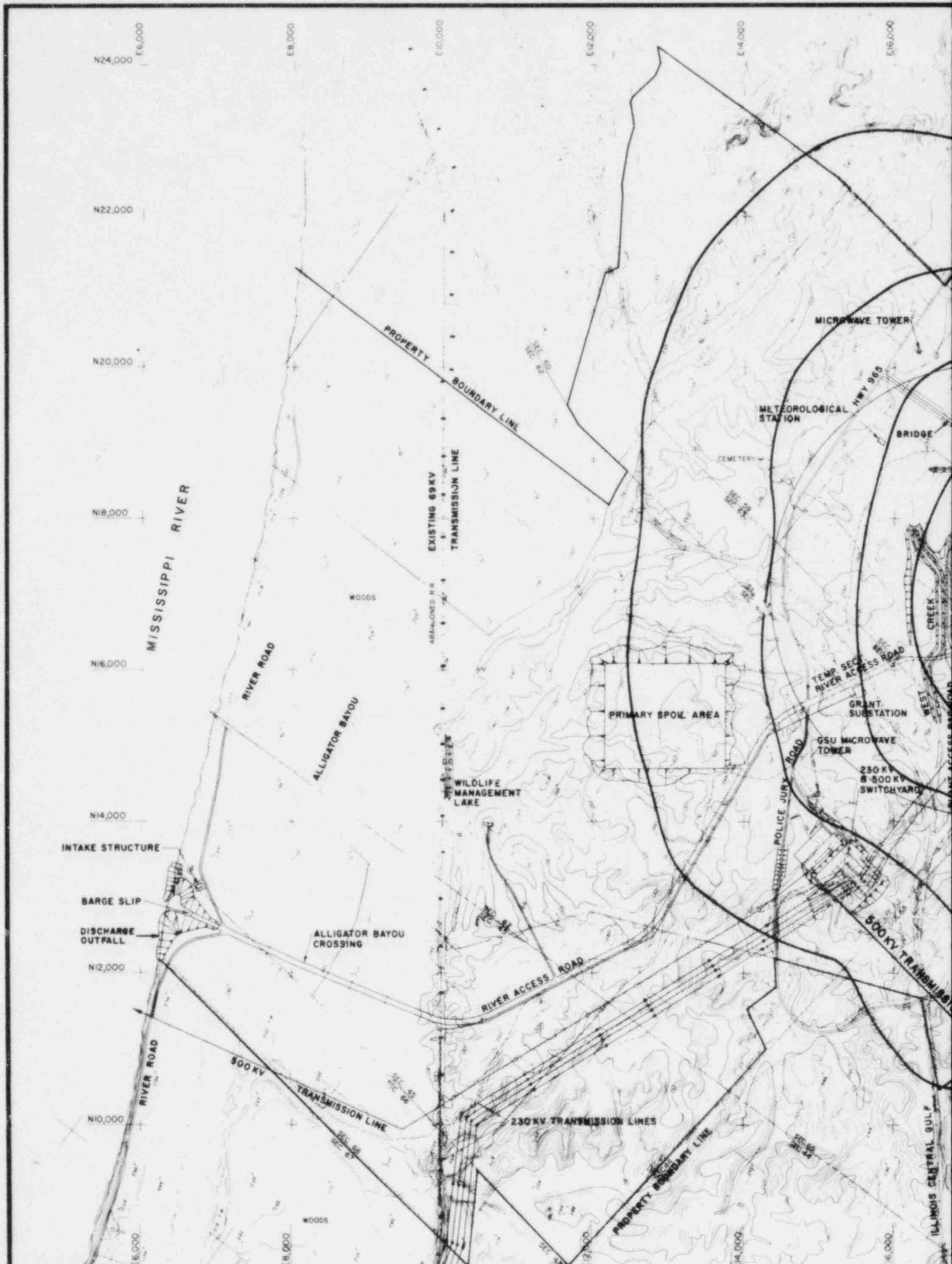


FIGURE 5.3-33

FALL SALT DEPOSITION RATE (lb/acre/yr) FROM ROUND MECHANICAL DRAFT COOLING TOWERS

RIVER BEND STATION
ENVIRONMENTAL REPORT — OLS



MISSISSIPPI RIVER
PROPERTY BOUNDARY LINE
EXISTING 69 KV TRANSMISSION LINE
RIVER ROAD
ALLIGATOR BAYOU
WOODS
INTAKE STRUCTURE
BARGE SLIP
DISCHARGE OUTFALL
ALLIGATOR BAYOU CROSSING
RIVER ACCESS ROAD
500 KV TRANSMISSION LINE
230 KV TRANSMISSION LINES
WILDLIFE MANAGEMENT LAKE
PRIMARY SPOIL AREA
POLICE JURY ROAD
MICROWAVE TOWER
METEOROLOGICAL STATION
HWY 965
BRIDGE
CEMETERY
TEMP. SEC. RIVER ACCESS ROAD
GRANT SUBSTATION
GSU MICROWAVE TOWER
230 KV & 500 KV SWITCHYARD
CREEK
WEST
ILLINOIS CENTRAL GULF
N24,000
N22,000
N20,000
N18,000
N16,000
N14,000
N12,000
N10,000
E6,000
E8,000
E10,000
E12,000
E14,000
E16,000

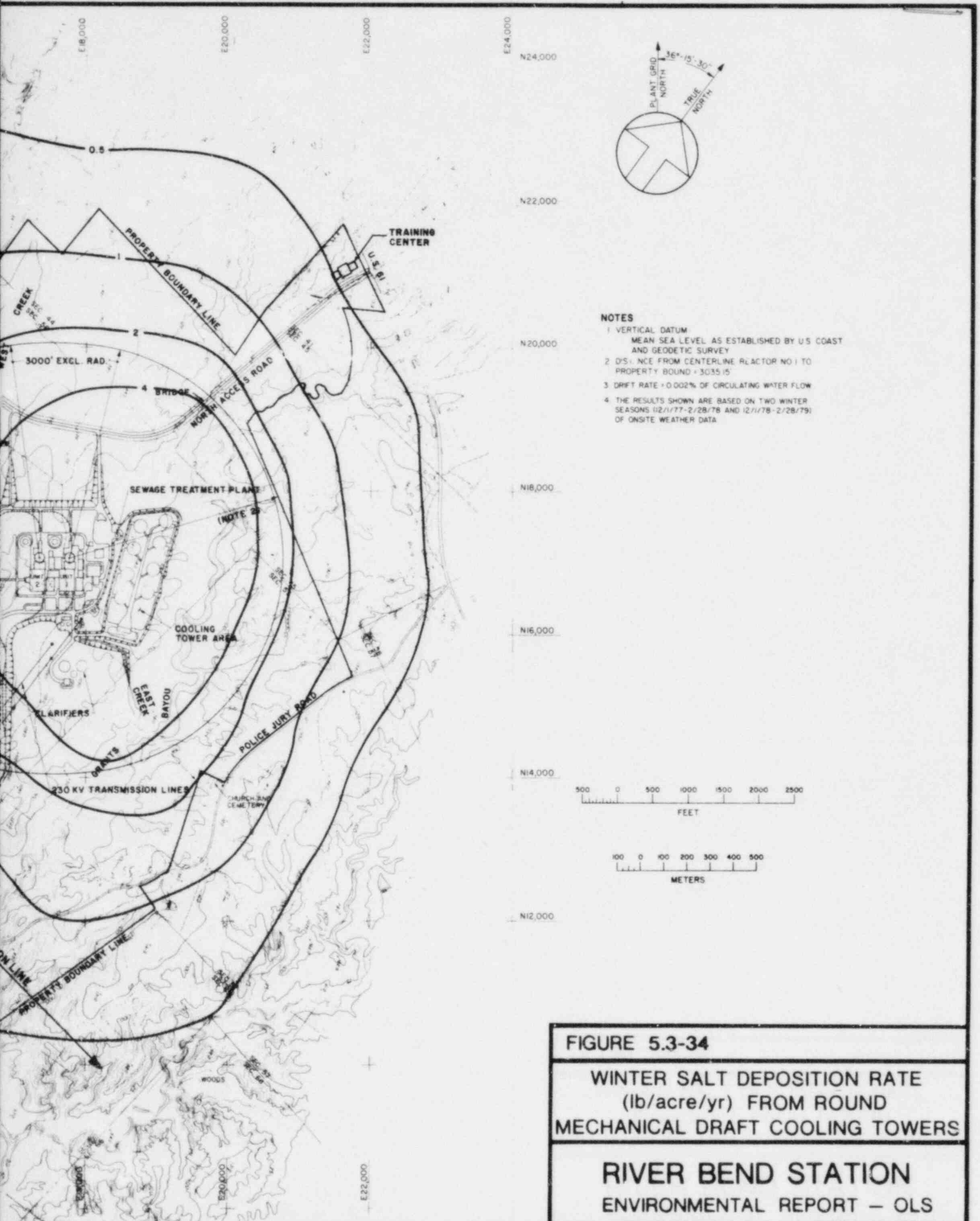
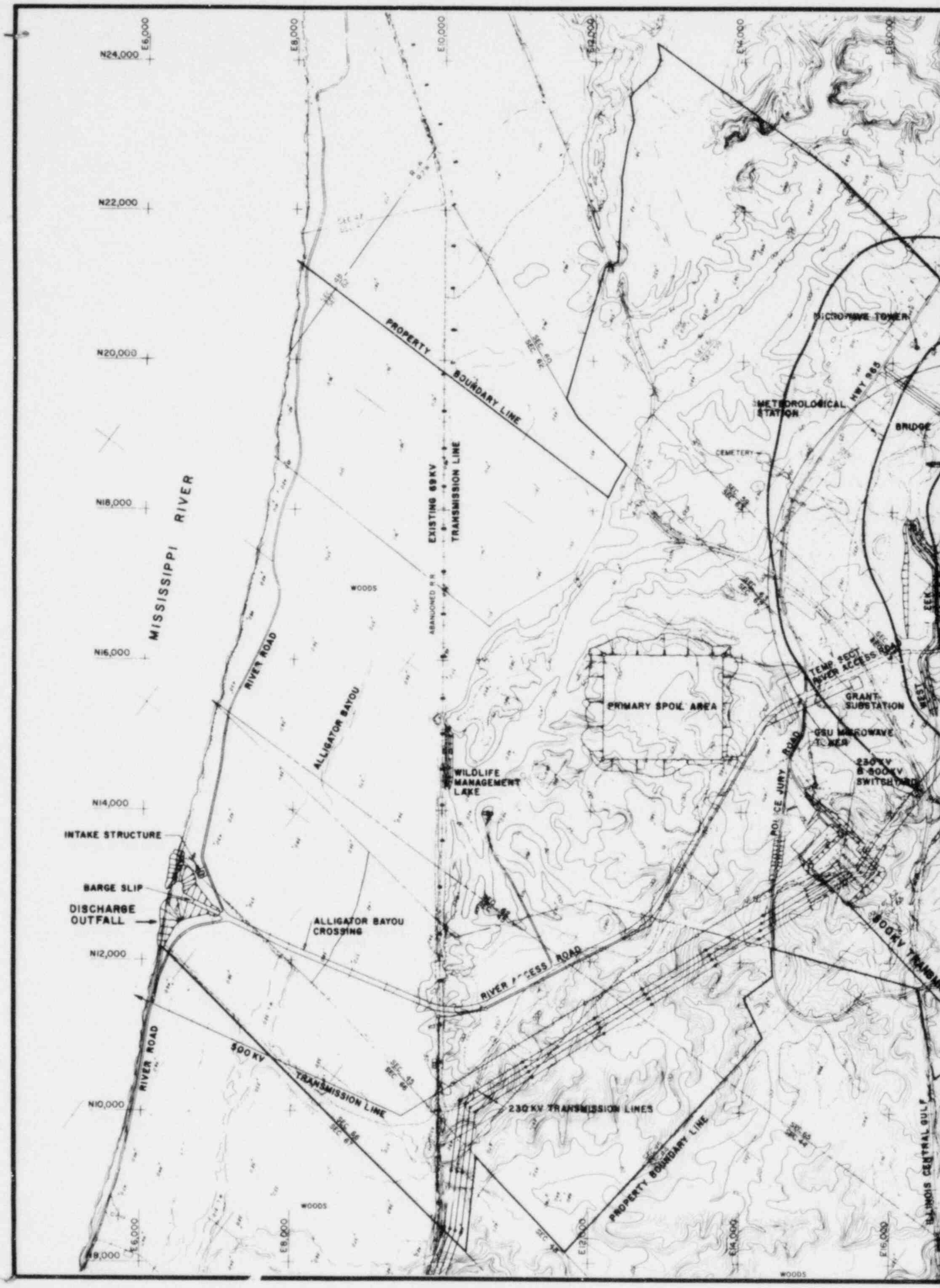


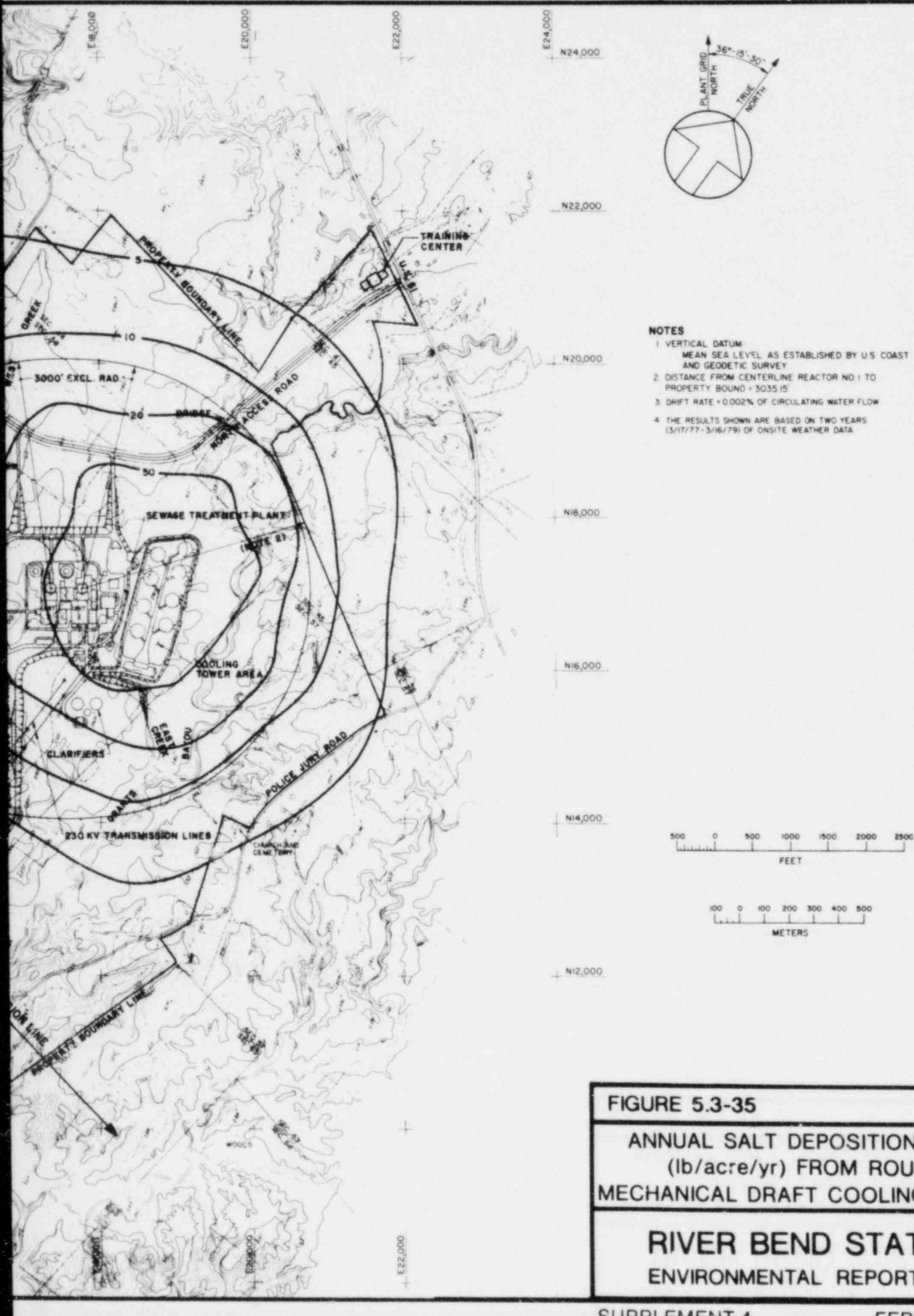
FIGURE 5.3-34

WINTER SALT DEPOSITION RATE (lb/acre/yr) FROM ROUND MECHANICAL DRAFT COOLING TOWERS

RIVER BEND STATION
ENVIRONMENTAL REPORT – OLS



N24,000
N22,000
N20,000
N18,000
N16,000
N14,000
N12,000
N10,000
N8,000
E6,000
E8,000
E10,000
E12,000
E14,000
E16,000
MISSISSIPPI RIVER
RIVER ROAD
ALLIGATOR BAYOU
WOODS
PROPERTY BOUNDARY LINE
EXISTING 69KV TRANSMISSION LINE
ABANDONED R.R.
MICROWAVE TOWER
METEOROLOGICAL STATION
HWY 965
BRIDGE
CEMETERY
PRIMARY SPOIL AREA
TEMP. SECT. RIVER ACCESS
GRANT SUBSTATION
GSU MICROWAVE TOWER
230 KV & 500 KV SWITCHYARD
POLICE JURY ROAD
WILDLIFE MANAGEMENT LAKE
INTAKE STRUCTURE
BARGE SLIP
DISCHARGE OUTFALL
ALLIGATOR BAYOU CROSSING
RIVER ACCESS ROAD
500 KV TRANSMISSION LINE
230 KV TRANSMISSION LINES
PROPERTY BOUNDARY LINE
ILLINOIS CENTRAL GULF



NOTES

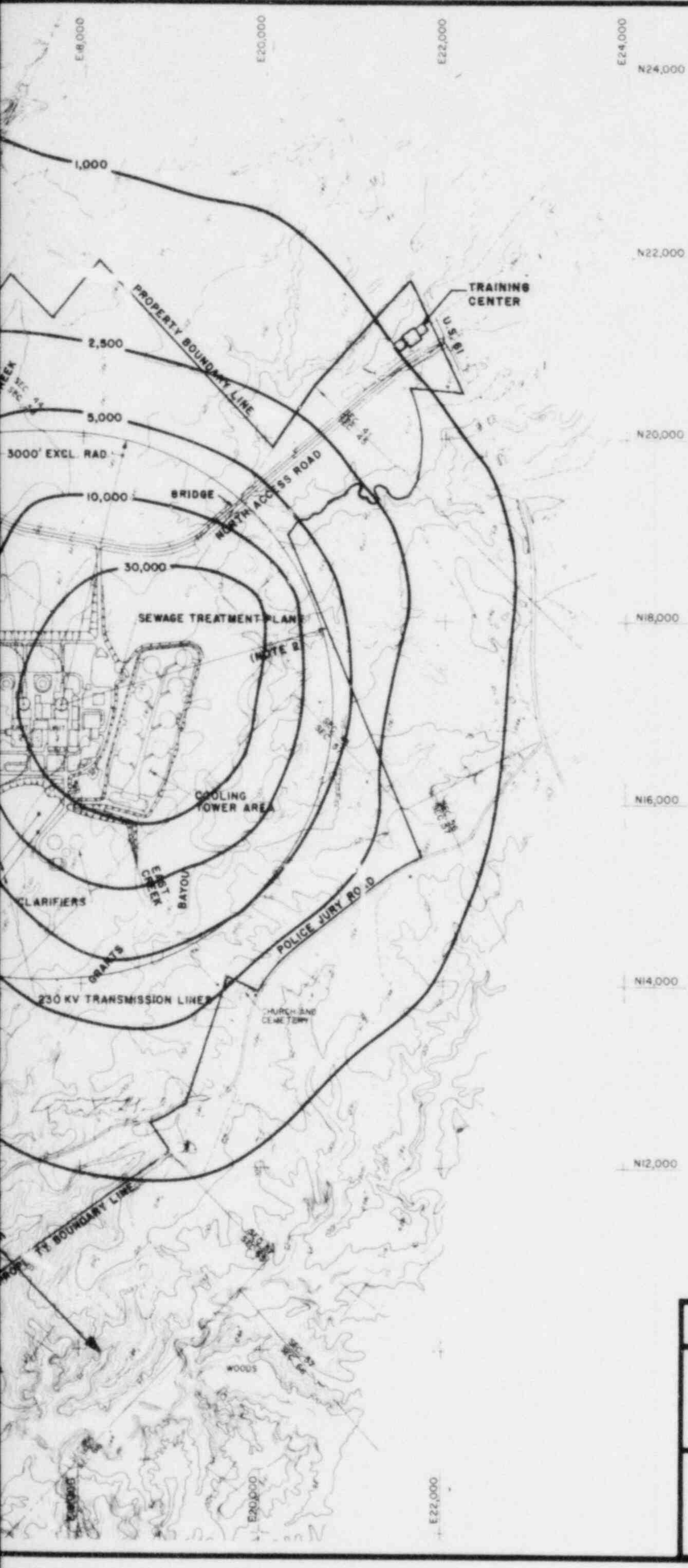
1. VERTICAL DATUM:
   MEAN SEA LEVEL AS ESTABLISHED BY U.S. COAST AND GEODETIC SURVEY
2. DISTANCE FROM CENTERLINE REACTOR NO. 1 TO PROPERTY BOUND = 3035.15'
3. DRIFT RATE = 0.002% OF CIRCULATING WATER FLOW
4. THE RESULTS SHOWN ARE BASED ON TWO YEARS (3/17/77 - 3/16/79) OF ONSITE WEATHER DATA

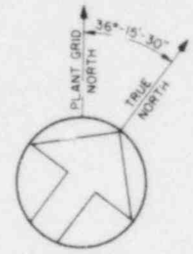
FIGURE 5.3-35

ANNUAL SALT DEPOSITION RATE (lb/acre/yr) FROM ROUND MECHANICAL DRAFT COOLING TOWERS

RIVER BEND STATION
ENVIRONMENTAL REPORT – OLS

N24,000
N22,000
N20,000
N18,000
N16,000
N14,000
N12,000
N10,000
N8,000
E6,000
E8,000
E10,000
E12,000
E14,000
E16,000
MISSISSIPPI RIVER
PROPERTY BOUNDARY LINE
EXISTING 69 KV TRANSMISSION LINE
ABANDONED R.R.
WOODS
RIVER ROAD
ALLIGATOR BAYOU
WILDLIFE MANAGEMENT LAKE
INTAKE STRUCTURE
BARGE SLIP
DISCHARGE OUTFALL
ALLIGATOR BAYOU CROSSING
RIVER ACCESS ROAD
500 KV TRANSMISSION LINE
230 KV TRANSMISSION LINES
PROPERTY BOUNDARY LINE
PRIMARY SPOIL AREA
POLICE JURY ROAD
MICROWAVE TOWER
METEOROLOGICAL STATION
HWY 965
BRIDGE
CEMETERY
RIVER ACCESS ROAD
GRANT SUBSTATION
GSU MICROWAVE TOWER
230 KV & 500 KV SWITCHYARD
500 KV TRANSMISSION LINE
PLANT ACCESS RAILROAD
CREEK
WEST
ILLINOIS CENTRAL GULF





NOTES

1. VERTICAL DATUM
   MEAN SEA LEVEL AS ESTABLISHED BY U.S. COAST AND GEODETIC SURVEY
2. DISTANCE FROM CENTERLINE REACTOR NO. 1 TO PROPERTY BOUND = 3035.15
3. DRIFT RATE = 0.002% OF CIRCULATING WATER FLOW
4. THE RESULTS SHOWN ARE BASED ON TWO YEARS (3/17/77 - 3/16/79) OF ONSITE WEATHER DATA

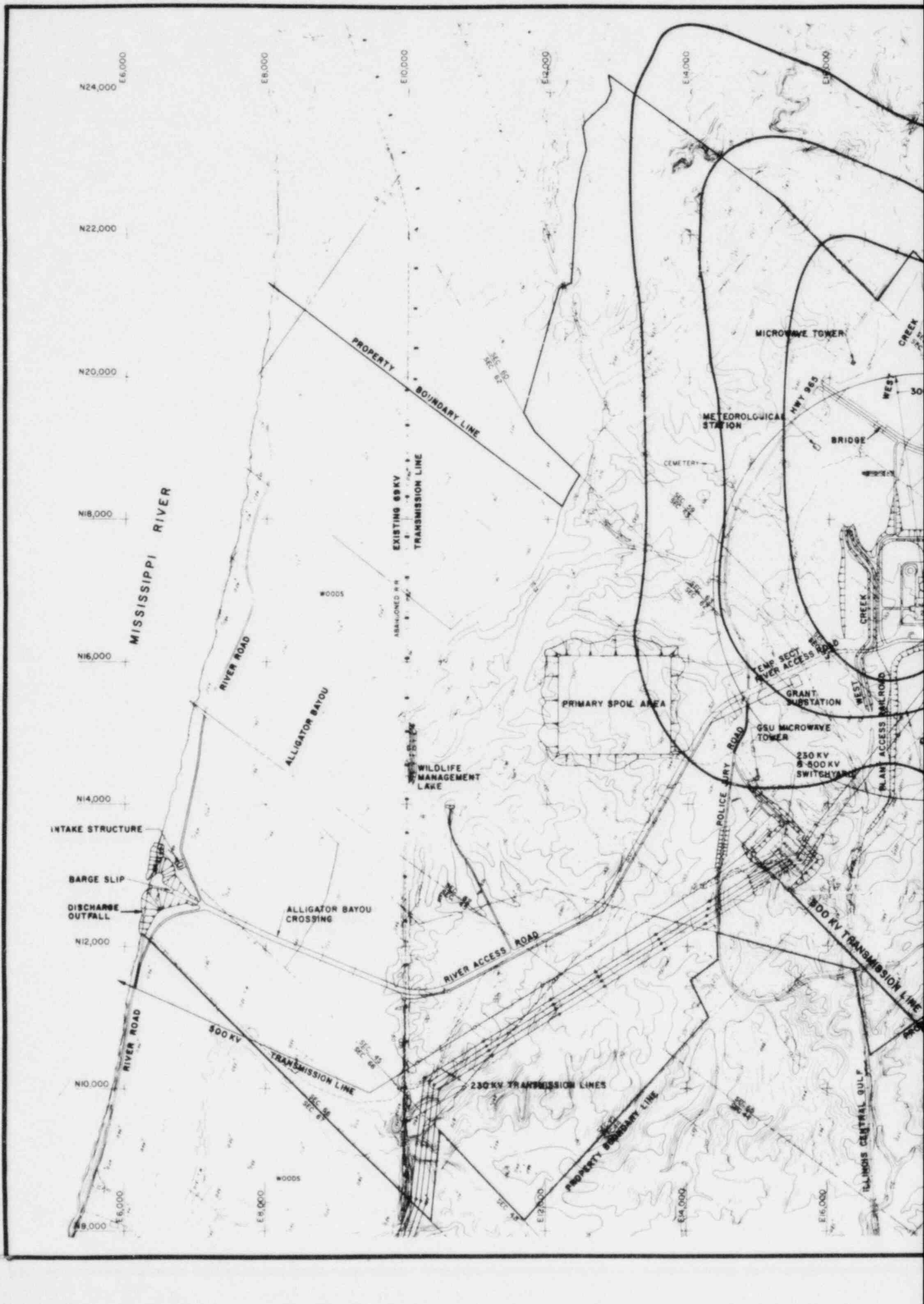
500 0 500 1000 1500 2000 2500
FEET

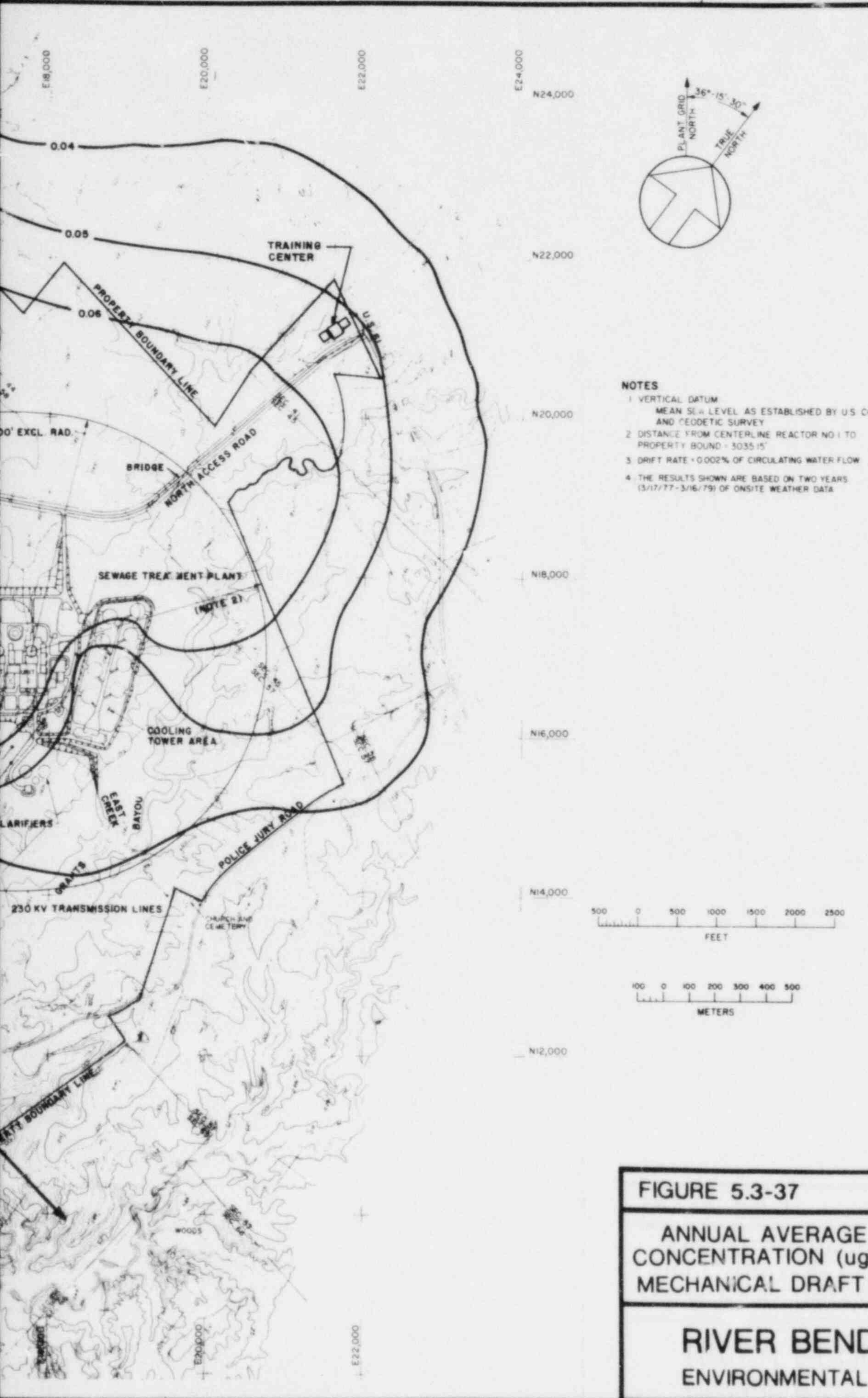
100 0 100 200 300 400 500
METERS

FIGURE 5.3-36

ANNUAL WATER DEPOSITION RATE (lb/acre/yr) FROM ROUND MECHANICAL DRAFT COOLING TOWERS

RIVER BEND STATION
ENVIRONMENTAL REPORT ~~- OLS~~


E6,000
E8,000
E10,000
E12,000
E14,000
E16,000
N24,000
N22,000
N20,000
N18,000
N16,000
N14,000
N12,000
N10,000
MISSISSIPPI RIVER
PROPERTY BOUNDARY LINE
EXISTING 69 KV TRANSMISSION LINE
MICROWAVE TOWER
METEOROLOGICAL STATION
HWY 965
BRIDGE
CEMETERY
CREEK
WEST
WOODS
RIVER ROAD
ALLIGATOR BAYOU
PRIMARY SPOIL AREA
TEMP SECT RIVER ACCESS ROAD
GRANT SUBSTATION
GSU MICROWAVE TOWER
230 KV & 500 KV SWITCHYARD
PLANT ACCESS RAILROAD
POLICE JURY ROAD
WILDLIFE MANAGEMENT LAKE
INTAKE STRUCTURE
BARGE SLIP
DISCHARGE OUTFALL
ALLIGATOR BAYOU CROSSING
RIVER ACCESS ROAD
500 KV TRANSMISSION LINE
230 KV TRANSMISSION LINES
PROPERTY BOUNDARY LINE
ILLINOIS CENTRAL GULF



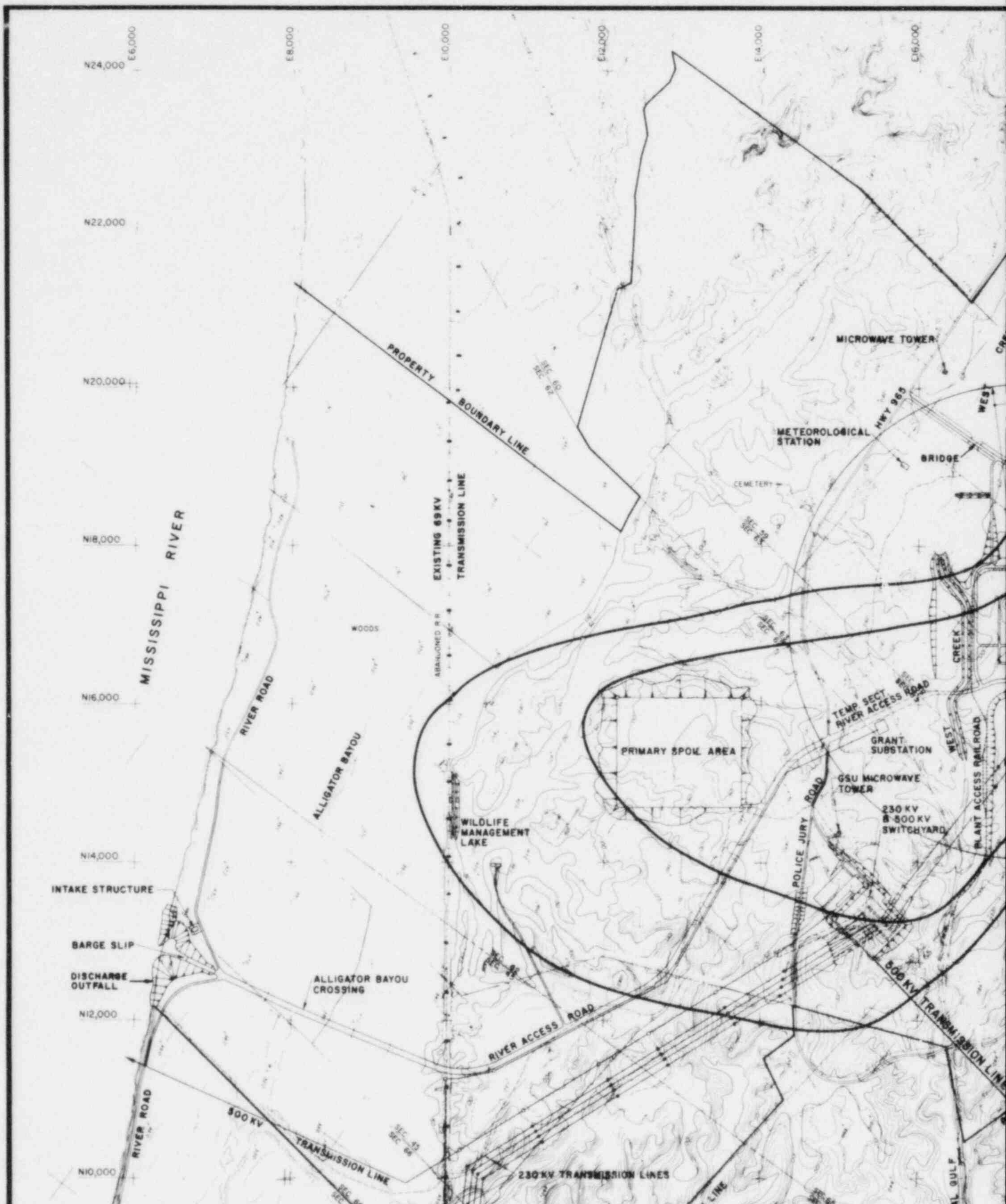
NOTES

1. VERTICAL DATUM
   MEAN SEA LEVEL AS ESTABLISHED BY U.S. COAST AND GEODETIC SURVEY
2. DISTANCE FROM CENTERLINE REACTOR NO. 1 TO PROPERTY BOUND = 3035.15'
3. DRIFT RATE = 0.002% OF CIRCULATING WATER FLOW
4. THE RESULTS SHOWN ARE BASED ON TWO YEARS (3/17/77 - 3/16/79) OF ONSITE WEATHER DATA

FIGURE 5.3-37

ANNUAL AVERAGE AIRBORNE SALT CONCENTRATION (ug/m^3) FROM ROUND MECHANICAL DRAFT COOLING TOWERS

RIVER BEND STATION
ENVIRONMENTAL REPORT – OLS



MISSISSIPPI RIVER
PROPERTY BOUNDARY LINE
EXISTING 69 KV TRANSMISSION LINE
ABANDONED R.R.
WOODS
RIVER ROAD
ALLIGATOR BAYOU
INTAKE STRUCTURE
BARGE SLIP
DISCHARGE OUTFALL
ALLIGATOR BAYOU CROSSING
WILDLIFE MANAGEMENT LAKE
PRIMARY SPOIL AREA
RIVER ACCESS ROAD
500 KV TRANSMISSION LINE
230 KV TRANSMISSION LINES
MICROWAVE TOWER
METEOROLOGICAL STATION
HWY 965
BRIDGE
CEMETERY
WEST CREEK
TEMP. SECT. RIVER ACCESS ROAD
GRANT SUBSTATION
GSU MICROWAVE TOWER
230 KV & 500 KV SWITCHYARD
PLANT ACCESS RAILROAD
POLICE JURY ROAD
ILLINOIS CENTRAL GULF
N24,000
N22,000
N20,000
N18,000
N16,000
N14,000
N12,000
N10,000
N8,000
E6,000
E8,000
E10,000
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E14,000
E16,000

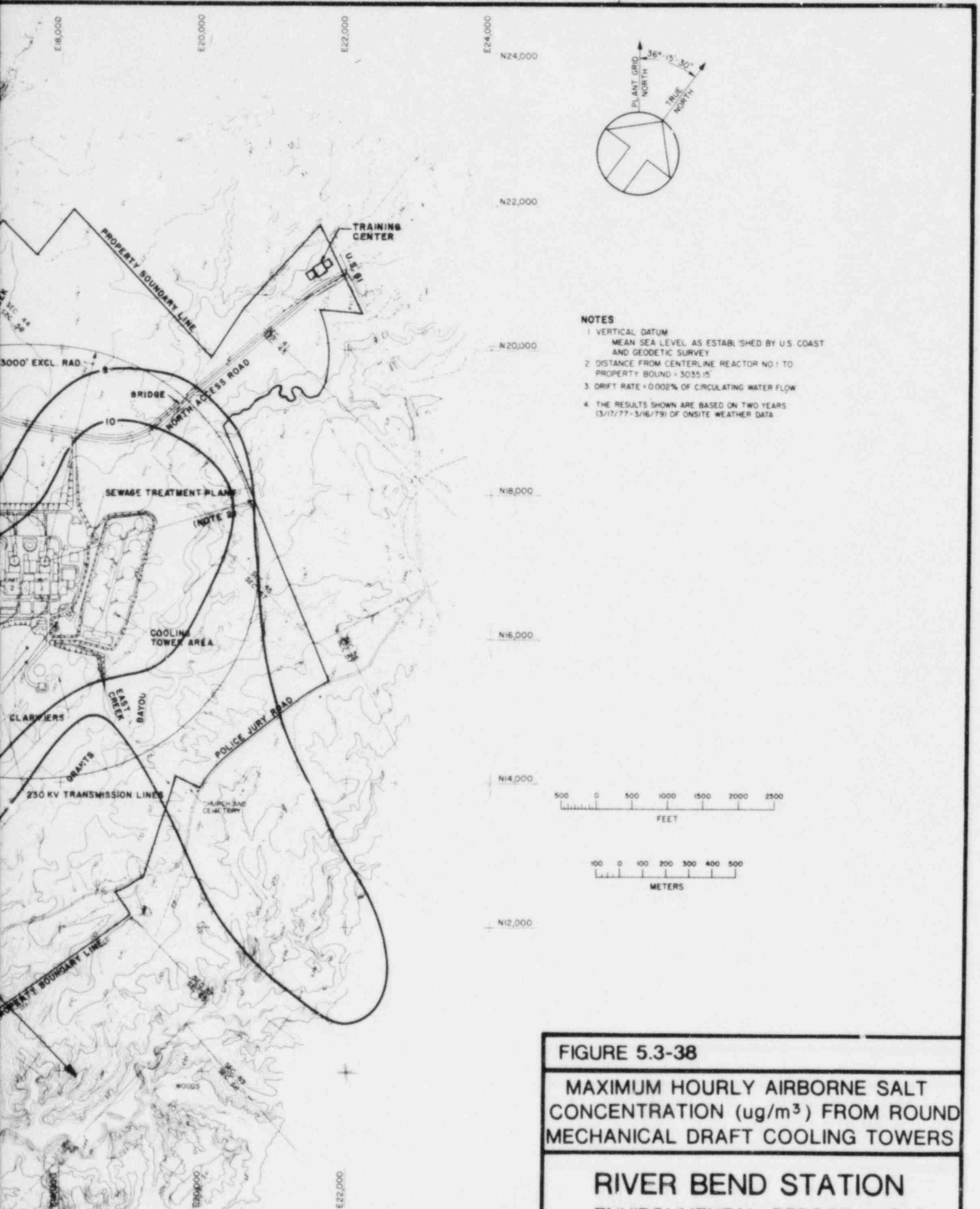


FIGURE 5.3-38

MAXIMUM HOURLY AIRBORNE SALT CONCENTRATION (ug/m³) FROM ROUND MECHANICAL DRAFT COOLING TOWERS

RIVER BEND STATION
ENVIRONMENTAL REPORT – OLS

TABLE OF CONTENTS

Chapter	Section	Title	Volume
1		INTRODUCTION	1
	1.1	The Proposed Project	1
	1.2	Status of Reviews and Approvals	1
	1.3	Substantive Informational Changes from Construction Permit Stage	1
2		ENVIRONMENTAL DESCRIPTIONS	1
	2.1	Description of the Station Location	1
	2.2	Land	1
	2.3	Water	1
	2.4	Ecology	1
	2.5	Socioeconomics	2
	2.6	Geology	2
	2.7	Meteorology	2
	2.8	Ambient Air Quality	2
	2.9	Ambient Noise	2
	2.10	Related Federal Project Activities	2
	APPENDICES 2A, 2B, and 2C		3
3		PLANT DESCRIPTION	3
	3.1	External Appearance and Plant Layout	3
	3.2	Reactor Steam - Electric System	3
	3.3	Plant Water Use	3
	3.4	Cooling System	3
	3.5	Radioactive Waste Management Systems	3
	3.6	Nonradioactive Waste Systems	3
	3.7	Power Transmission Systems	3
	3.8	Transportation of Radioactive Materials	3
4		ENVIRONMENTAL IMPACTS OF CONSTRUCTION	3
	4.1	Land Use Impacts	3
	4.2	Hydrological Alterations and Water Use Impacts	3
	4.3	Ecological Impacts	3
	4.4	Socioeconomic Impacts	3
	4.5	Radiation Exposure to Construction Workers	3
	4.6	Measures and Controls to Limit Adverse Impacts During Construction	3

4

TABLE OF CONTENTS

Chapter	Section	Title	Volume
5		ENVIRONMENTAL IMPACTS OF STATION OPERATION	3 3
	5.1	Land Use Impacts	3
	5.2	Hydrological Alterations, Plant Water Supply, and Water Use Impacts	3
	5.3	Cooling System Impacts	3
	5.4	Radiological Impacts of Normal Operation	4
	5.5	Nonradioactive Waste System Impacts	4
	5.6	Transmission System Impacts	4
	5.7	Uranium Fuel Cycle Impacts	4
	5.8	Socioeconomic Impacts	4
	5.9	Decommissioning	4
	5.10	Measures and Controls to Limit Adverse Impacts During Operation	4
	APPENDIX 5A		4
6		ENVIRONMENTAL MEASUREMENTS AND MONITORING PROGRAMS	4
	6.1	Thermal	4
	6.2	Radiological	4
	6.3	Hydrological	4
	6.4	Meteorological	4
	6.5	Biological	4
	6.6	Chemical	4
	6.7	Other Monitoring Programs	4
7		ENVIRONMENTAL IMPACTS OF POSTULATED ACCIDENTS INVOLVING RADIOACTIVE MATERIALS	4
	7.1	Plant Accidents	4
	7.2	Transportation Accidents	4
8		THE NEED FOR THE PLANT	4
9		ALTERNATIVES TO THE PROJECT	4

4

Concentrations of radionuclides accumulate in vegetation growing year round in the vicinity of the site. The model used for estimating the transfer of radionuclides from the atmosphere to vegetation considers deposition on foliage and uptake from soil for all radioiodines and particulates, except tritium and carbon-14. The concentration of carbon-14 in vegetation is estimated by assuming that its ratio to the natural carbon in the vegetation is the same as the ratio of carbon-14 to natural carbon in the atmosphere surrounding the vegetation. The concentration of tritium in vegetation is calculated from its concentration in water vapor surrounding the vegetation. Vegetation is assumed to be exposed to station effluents for 60 days before being picked during the growing season and has an agricultural productivity yield of 2 kg/sq m. Table 5.4-5 lists the calculated concentration of radionuclides in vegetation grown at the location of the maximum individual resident's garden, 1,260 m northwest of the site. Foliage retention factors of 0.2 for particulates and 1.0 for elemental radioiodines from airborne deposition are used, as recommended in Regulatory Guide 1.109. The annual average absolute humidity for this area is estimated to be 12.9 g/cu m.

5.4.3 Dose Rate Estimates for Man

Calculated doses to the maximum offsite individual and the 50-mi radius year 2010 population are based on the gaseous and liquid releases shown in Section 3.5. The mathematical models and assumptions used to calculate these doses are given in Appendix 5A. | 4

5.4.3.1 Liquid Pathways

Tables 5.4-6 through 5.4-9 present the calculated doses to the maximum individual from liquid pathways. The tables present the calculated total body and organ doses for the four age groups - adult, teen, child, and infant.

Table 5.4-10 presents a comparison of the maximum individual calculated doses from liquid effluents to the design objectives of Appendix I limits[1].

5.4.3.2 Gaseous Pathways

Tables 5.4-11 through 5.4-21 present the calculated doses to maximum individuals from gaseous pathways. These tables present the calculated total body and organ doses for the four age groups - adult, teen, child, and infant. The analysis was performed for locations where an existing

resident, milk cow, and beef animal was identified[6]. Each analysis considers pathways for the specified location. For example, if a garden and a beef animal existed at the same farm, the maximum individuals residing at that farm are analyzed for submersion, inhalation, ground deposition, ingestion of vegetation, and consumption of beef meat pathways. It was assumed that a vegetable garden could exist at each location. The consumption of deer and grey squirrel was also considered.

Tables 5.4-11 through 5.4-14 present the doses to the maximum individuals living at the estimated maximum residence location. This location was assumed to be the site of the maximum beef animal. Tables 5.4-15 through 5.4-18 present the estimated doses to the maximum individuals living at the maximum milk cow location. Table 5.4-19 presents estimated doses to individuals from the consumption of cow milk from a hypothetical cow grazing at the site boundary. Tables 5.4-20 and 5.4-21 present doses to individuals from consumption of deer meat and squirrel meat, respectively.

Table 5.4-10 presents the comparison of the maximum individual calculated doses from gaseous effluents to the design objectives of Appendix I limits[1].

Annual calculated gamma air dose and beta air dose values were determined and are compared to the 10CFR50 design objective limit values in Table 5.4-10[1].

5.4.3.3 Direct Radiation from Facility

The station is designed so that neither solid nor liquid radioactive wastes are stored outside shielded buildings, thus limiting the maximum dose rate at the property boundary to 1 mrem/yr.

5.4.3.4 Annual Population Doses

4 | 5.4.3.4.1 50-mi Radius Population Doses

Table 5.4-22 presents the calculated annual total body and thyroid doses from gaseous and liquid pathways to the population projected for the year 2010 which reside within
4 | an 50-mi radius of the site.

5.4.3.4.2 Contiguous U.S. Population Doses

Population dose commitments are calculated for all individuals living within 50 mi of the facility employing 4
the same models used for individual doses (Regulatory Guide 1.109). In addition, population doses associated with
the export of food crops produced within the 50-mi region 4
and the atmospheric and hydrospheric transport of the more mobile effluent species, such as noble gases, tritium, and carbon-14, have been considered. Equations from the NRC Computer Code GASPAR and LADTAP were used to calculate the doses to contiguous U.S. population, shown in Table 5.4-22.

5.4.3.4.2.1 Noble Gas Effluents

Beyond 50 mi, and until the effluent reaches the 4
northeastern corner of the United States, it is assumed that all the noble gases are dispersed uniformly in the lowest 1,000 m of the atmosphere. Decay in transit was also considered. Beyond this point, noble gases having a half-life greater than 1 yr (e.g., Kr-85) were assumed to mix completely in the troposphere of the world with no removal mechanisms operating. Transfer of tropospheric air between the northern and southern hemispheres, although inhibited by wind patterns in the equatorial region, is considered to yield a hemisphere average tropospheric residence time of about 2 yr with respect to hemispheric mixing. Since this time constant is quite short with respect to the expected midpoint of plant life (20 yr), mixing in both hemispheres can be assumed for evaluations over the life of the nuclear facility. This additional population dose commitment to the U.S. population was evaluated.

5.4.3.4.2.2 Iodines and Particulates Released to the Atmosphere

Effluent nuclides in this category deposit onto the ground as the effluent moves downwind, which continuously reduces
the concentration remaining in the plume. Within 50 mi of 4
the facility, the deposition model in Regulatory Guide 1.111 was used in conjunction with the dose models in Regulatory Guide 1.109. Site-specific data concerning production,
transport, and consumption of foods within 50 mi of the 4
reactor were used. Excess food not consumed within the
50-mi distance was accounted for, and additional food 4
production and consumption representative of the southern part of the country was assumed. Doses obtained in this manner were then assumed to be received by the number of individuals living within the direction sector and distance previously described. The population density in this sector

is taken to be representative of the eastern United States, which is about 160 people/sq mi.

5.4.3.4.2.3 Carbon-14 and Tritium Released to the Atmosphere

Carbon-14 and tritium were assumed to disperse without deposition in the same manner as Kr-85 over land. However, they do interact with the oceans. This causes the carbon-14 to be removed with an atmospheric residence time of 4 to 6 yr with the oceans being the major sink. From this, the equilibrium ratio of the carbon-14 to natural carbon in the atmosphere was determined. This same ratio was then assumed to exist in man so that the dose received by the entire population of the U.S. could be estimated. Tritium was assumed to mix uniformly in the world's hydrosphere, which was assumed to include all the water in the atmosphere and in the upper 70 m of the oceans. With this model, the equilibrium ratio of tritium to hydrogen in the environment can be calculated. The same ratio was assumed to exist in man, and was used to calculate the population dose, in the same manner as with carbon-14.

5.4.3.4.2.4 Liquid Effluents

4 Beyond 50 mi, it was assumed that all liquid effluent nuclides except tritium have deposited on the sediments so they make no further contribution to the population exposures. The tritium was assumed to mix uniformly in the world's hydrosphere and to result in an exposure to the U.S. population in the same manner as discussed for tritium in gaseous effluents.

Using the preceding approaches, the calculated U.S.
4 population doses were 45 manrem to the whole body and 48 manrem to the thyroid.

5.4.4 Impacts to Man

5.4.4.1 Maximum Individual Doses

The calculated annual radiation doses to the maximum individual from liquid and gaseous pathways are presented in Tables 5.4-6 through 5.4-9 and Tables 5.4-11 through 5.4-21. As can be seen from these tables and Table 5.4-10, the calculated annual radiation doses are below the 10CFR50, Appendix I design objectives[1].

For the liquid releases, it was assumed that the maximum individual obtains drinking water from the downstream public

water supply. The maximum individual was assumed to consume fish and invertebrates caught at the edge of the initial mixing zone. This location was also used in calculating the dose from swimming. Boating was assumed to occur in the outfall area. Shoreline recreation was analyzed at the closest shore of the Mississippi River.

5.4.4.1.1 Liquid Pathways

The calculated maximum organ dose to the maximum individual from liquid pathways was 0.8 mrem/yr to a child's thyroid. This dose was primarily a result of the consumption of fish. It is assumed that the child consumes 6.9 kg of fish per year which was caught at the edge of the initial mixing zone.

The maximum annual dose resulting from the consumption of duck obtained from the edge of the initial mixing zone was 0.0017 mrem to the adult bone.

5.4.4.1.2 Radioiodine and Particulate Pathways

For the gaseous releases, a separate analysis was performed for each location of the maximum residence, milk cow, and beef animal. Each location was analyzed for submersion, inhalation, ground deposition, and ingestion of vegetation. The consumption of deer and grey squirrel was also considered.

The calculated dose to the maximum individual from gaseous pathways was 4.5 mrem/yr to an infant's thyroid. It represents a hypothetical infant who lived at the residence corresponding to the maximum cow location 1.3 km north-northwest. A majority of this dose is due to the consumption of cow milk. The thyroid dose from the ground deposition is conservatively assumed to be equivalent to the calculated total body dose as directed by Regulatory Guide 1.109.

5.4.1.1.3 Immersion Doses from Noble Gases

The doses from immersion in noble gas effluents are presented in Table 5.4-10.

5.4.4.2 Population Dose

The calculated annual doses for the population residing within a 50-mi radius of the site are presented in Table 5.4-22. For the liquid effluents, the calculated whole body and thyroid doses are 0.44 and 0.068 manrem per 4

year, respectively. The calculated doses from gaseous
4 pathways are 1.8 manrem/yr whole body and 4.1 manrem/yr
thyroid. These doses were calculated for a projected
population in the year 2010 of 1,163,282 people within 50 mi
of the site. The milk, meat, and vegetation 50-mi radius
4 crop yield, as well as the 50-mi radius sport fish harvest,
are presented in Appendix 5A.

Annual population doses to the contiguous U.S. from liquid
and gaseous pathways are given in Table 5.4-22. The
4 calculated doses to the U.S. population are 45 manrem to the
whole body and 48 manrem to the thyroid.

5.4.5 Impacts to Biota Other than Man

The exposure pathways and the concentrations of radionuclides in the environment are discussed in previous sections. The doses to terrestrial and aquatic organisms other than man resulting from these radionuclides are presented in the following sections and tables. Calculated internal and external dose rates to biota are based on the model and assumptions presented in Appendix 5A.

5.4.5.1 Doses through Gaseous Pathways

Tables 5.4-23 and 5.4-24 present the calculated external and internal doses, respectively, to biota other than man from gaseous pathways. These doses are calculated for a terrestrial animal residing at the restricted area boundary. The external dose rates for terrestrial animals are based on methodology used to calculate external dose rates for man.

5.4.5.2 Doses through Liquid Pathways

Table 5.4-23 shows the maximum calculated external doses from submersion in water at the edge of the initial mixing zone and exposure to sediments at the closest accessible shoreline from the point of discharge. Table 5.4-24 shows the maximum calculated internal doses due to the bioaccumulation process.

5.4.5.3 Direct Radiation Doses

The station is designed so that neither solid nor liquid radioactive wastes are stored outside shielded buildings, thus limiting the maximum dose rate to 1 mrad/yr. The dose rates to biota other than man are expressed in units of millirads per year rather than millirems per year, since millirem is the unit used specifically to express the effect of radiation on human tissue. This external exposure rate

TABLE 5.4-2

ESTIMATED RADIONUCLIDE CONCENTRATIONS
(PCI/L) IN EFFLUENT(1) AND RECEIVING WATER
UNITS 1 AND 2

Isotope	Discharge Concentration	Closest Accessible Shoreline(2)	Edge of Initial Mixing Zone(2)	Peoples Water Service Company Donaldsonville(3)
H-3	1.03+04	9.09+02	9.09+02	4.16-01
NA-24	1.68+00	1.48-01	1.48-01	1.02-05
P-32	1.23-01	1.09-02	1.09-02	4.58-06
CR-51	3.93+00	3.46-01	3.46-01	1.52-04
MN-54	4.71-02	4.15-03	4.15-03	1.89-06
MN-56	1.23+00	1.09-01	1.09-01	7.45-10
FE-55	6.73-01	5.93-02	5.93-02	2.71-05
FE-59	2.02-02	1.78-03	1.78-03	7.93-07
CO-58	1.35-01	1.19-02	1.19-02	5.34-06
CO-60	2.69-01	2.37-02	2.37-02	1.09-05
NI-63	6.73-04	5.93-05	5.93-05	2.72-08
NI-65	7.41-03	6.52-04	6.52-04	3.95-12
CU-64	4.38+00	3.85-01	3.85-01	1.90-05
ZN-65	1.35-01	1.19-02	1.19-02	5.41-06
ZN-69M	3.14-01	2.77-02	2.77-02	1.61-06
BR-83	1.80-01	1.58-02	1.58-02	4.75-11
BR-84	1.35-02	1.19-03	1.19-03	1.15-30
BR-85	2.02-05	1.78-06	1.78-06	0.0
RB-89	5.05-02	4.45-03	4.45-03	1.46-55
SR-89	6.62-02	5.83-03	5.83-03	2.61-06
SR-90	4.71-03	4.15-04	4.15-04	1.90-07
SR-91	4.38-01	3.85-02	3.85-02	8.62-07
SR-92	2.69-01	2.37-02	2.37-02	2.78-10
Y-91	3.14-02	2.77-03	2.77-03	1.24-06
Y-92	5.39-01	4.74-02	4.74-02	6.63-09
Y-93	4.71-01	4.15-02	4.15-02	1.15-06
ZR-95	5.28-03	4.64-04	4.64-04	2.09-07
ZR-97	1.10-03	9.68-05	9.68-05	8.02-09
NB-95	5.16-03	4.55-04	4.55-04	2.01-07
MO-99	8.64-01	7.61-02	7.61-02	2.26-05
TC-99M	1.35+00	1.19-01	1.19-01	4.70-07
TC-101	2.58-02	2.27-03	2.27-03	2.91-59
RU-103	1.35-02	1.19-03	1.19-03	5.27-07
RU-105	9.54-02	8.40-03	8.40-03	6.12-09
RU-106	2.02-03	1.78-04	1.78-04	8.12-08
AG-110M	6.73-04	5.93-05	5.93-05	2.70-08
TE-129M	2.58-02	2.27-03	2.27-03	1.00-06
TE-131M	2.92-02	2.57-03	2.57-03	4.53-07
TE-132	4.71-03	4.15-04	4.15-04	1.32-07
I-131	2.81+00	2.47-01	2.47-01	9.76-05

TABLE 5.4-6

ANNUAL DOSES TO MAXIMUM INDIVIDUAL IN THE ADULT GROUP FROM LIQUID EFFLUENTS

Pathway	Maximum Individual Liquid Pathways Annual Dose (m rem/yr) Total Body	Skin	Bone	Liver	Thyroid	Kidney	Lung	GI-Tract	
Potable water	4.2-05	0.0	1.1-05	4.6-05	2.1-04	3.8-05	3.3-05	3.5-05	4
Fish consumption	1.5-02	0.0	5.7-02	2.2-02	7.2-01	1.2-02	3.5-03	2.4-02	
Invrt. consumption	5.5-03	0.0	1.4-02	1.5-02	4.3-02	4.6-03	1.9-03	4.1-02	
Shoreline recreation	1.3-03	1.5-03	1.3-03	1.3-03	1.3-03	1.3-03	1.3-03	1.3-03	
Fresh vegetation	8.0-06	0.0	5.6-06	9.9-06	2.9-05	5.3-06	3.6-06	3.0-06	4
Stored vegetation	6.3-05	0.0	4.1-05	7.8-05	2.4-05	4.1-05	2.9-05	2.6-05	
Duck consumption	7.7-05	0.0	1.7-03	1.3-04	2.5-06	1.2-05	1.5-06	2.0-04	
Swimming exposure	5.3-05	7.2-05	5.3-05	5.3-05	5.3-05	5.3-05	5.3-05	5.3-05	
Boating exposure	1.7-04	2.3-04	1.7-04	1.7-04	1.7-04	1.7-04	1.7-04	1.7-04	
TOTAL DOSE	2.2-02	1.8-03	7.4-02	3.9-02	7.6-01	1.8-02	7.0-03	7.6-01	4

NOTE: 2.6-05 = 2.6 x 10^{-5}

TABLE 5.4-7

ANNUAL DOSES TO MAXIMUM INDIVIDUAL IN THE TEEN GROUP
FROM LIQUID EFFLUENTS

	Maximum Individual Liquid Pathways Annual Dose (mrem/yr)								
Pathway	Total Body	Skin	Bone	Liver	Thyroid	Kidney	Lung	GI-Tract	
Potable water	2.8-05	0.0	1.0-05	3.6-05	1.8-04	3.4-05	2.4-05	2.5-05	
Fish consumption	1.1-02	0.0	6.1-02	2.2-02	6.8-01	1.5-02	3.4-03	1.9-02	4
Invrt. consumption	4.5-03	0.0	1.5-02	1.5-02	4.1-02	5.7-03	2.1-03	3.0-02	
Shoreline recreation	7.2-03	8.4-03	7.2-03	7.2-03	7.2-03	7.2-03	7.2-03	7.2-03	
Fresh vegetation	4.5-06	0.0	5.0-06	8.2-05	2.3-05	8.5-06	2.7-06	2.3-06	
Stored vegetation	6.4-05	0.0	6.8-05	1.2-04	3.0-05	9.3-05	4.0-05	3.2-05	4
Duck consumption	6.2-05	0.0	1.4-03	1.0-04	1.9-06	8.4-05	1.4-06	1.4-04	
Swimming exposure	3.0-04	4.1-04	3.0-04	3.0-04	3.0-04	3.0-04	3.0-04	3.0-04	
Boating exposure	1.7-04	2.3-04	1.7-04	1.7-04	1.7-04	1.7-04	1.7-04	1.7-04	
TOTAL DOSE	2.3-02	9.0-03	8.5-02	4.5-02	7.3-01	2.9-02	1.3-02	5.7-02	4

NOTE: 1.7-05 = 1.7×10^{-5}

TABLE 5.4-8

ANNUAL DOSES TO MAXIMUM INDIVIDUAL IN THE CHILD GROUP
FROM LIQUID EFFLUENTS

Pathway	Maximum Individual Liquid Pathways Annual Dose (mrem/yr)							
	Total Body	Skin	Bone	Liver	Thyroid	Kidney	Lung	GI-Tract
Potable water	4.9-05	0.0	2.9-05	7.0-05	4.3-04	5.4-05	4.6-05	4.6-05
Fish consumption	7.9-03	0.0	7.8-02	2.0-02	7.5-01	1.1-02	2.8-03	9.1-03
Invrt. consumption	4.2-03	0.0	2.0-02	1.3-02	4.7-02	3.7-03	1.9-03	1.6-02
Shoreline recreation	1.5-03	1.8-03	1.5-03	1.5-03	1.5-03	1.5-03	1.5-03	1.5-03
Fresh vegetation	3.8-06	0.0	8.7-06	1.0-05	3.4-05	5.0-06	3.1-06	2.5-06
Stored vegetation	7.3-05	0.0	1.6-04	2.0-04	4.8-05	9.3-05	6.2-05	4.7-05
Duck consumption	5.8-05	0.0	1.4-03	7.6-05	1.5-06	5.4-06	8.5-07	4.1-05
Swimming exposure	1.9-04	2.5-04	1.9-04	1.9-04	1.9-04	1.9-04	1.9-04	1.9-04
Boating exposure	9.7-05	1.3-04	9.7-05	9.7-05	9.7-05	9.7-05	9.7-05	9.7-05
TOTAL DOSE	1.4-02	2.2-03	1.0-01	3.5-02	8.0-01	1.7-02	6.6-03	2.7-02

NOTE: 2.8-05 = 2.8 x 10^{-5}

TABLE 5.4-9

ANNUAL DOSES TO MAXIMUM INDIVIDUAL IN THE INFANT GROUP
FROM LIQUID EFFLUENTS

	Maximum Individual Liquid Pathways Annual Dose (mrem/yr)							
Pathway	Total Body	Skin	Bone	Liver	Thyroid	Kidney	Lung	GI-Tract
Potable water	4.7-05	0.0	8.1-05	7.6-05	6.5-04	5.4-05	4.6-05	4.4-05
TOTAL DOSE	4.7-05	0.0	8.1-05	7.6-05	6.5-04	5.4-05	4.6-05	4.4-05

NOTE: 2.6-05 = 2.6×10^{-5}

TABLE 5.4-22

CALCULATED POPULATION DOSE COMMITMENT

50 mi POPULATION DOSE

	Annual Dose per Reactor Unit	
	Total Body (manrem)	Thyroid (manrem)
Natural radiation background[1]	1.2+05	
Liquid effluents[2]	4.4-01	6.8-02
Noble gas effluents	8.0-01	8.0-01
Radioiodines and particulates[3]	1.0+00	3.3+00

CONTIGUOUS U.S. POPULATION DOSE

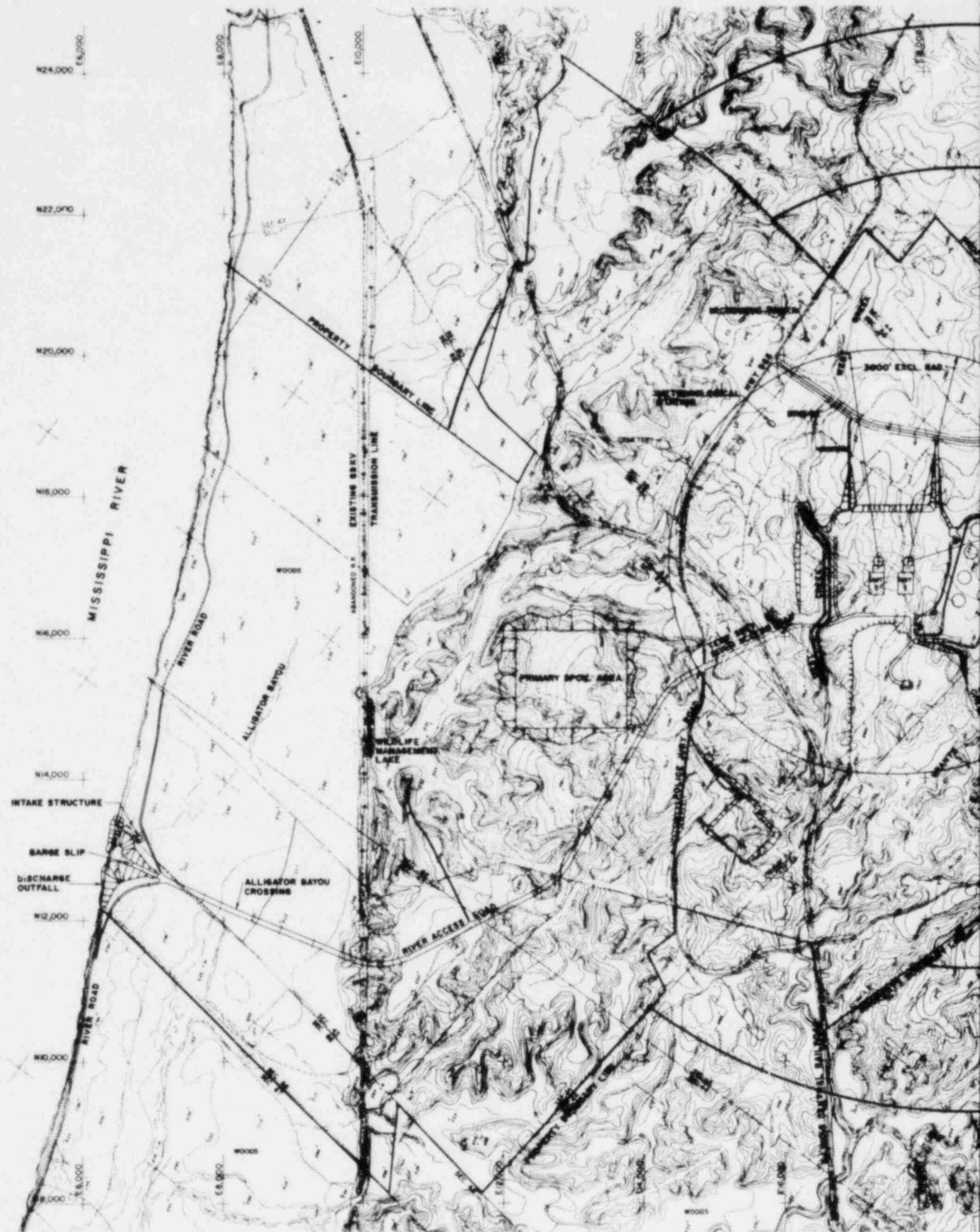
	Annual Dose per Reactor Unit	
	Total Body (manrem)	Thyroid (manrem)
Liquid effluents[2]	4.4-01	6.9-02
Noble gas effluents	1.3+00	1.8+00
Radioiodines and particulates[3]	4.3+01	4.6+01

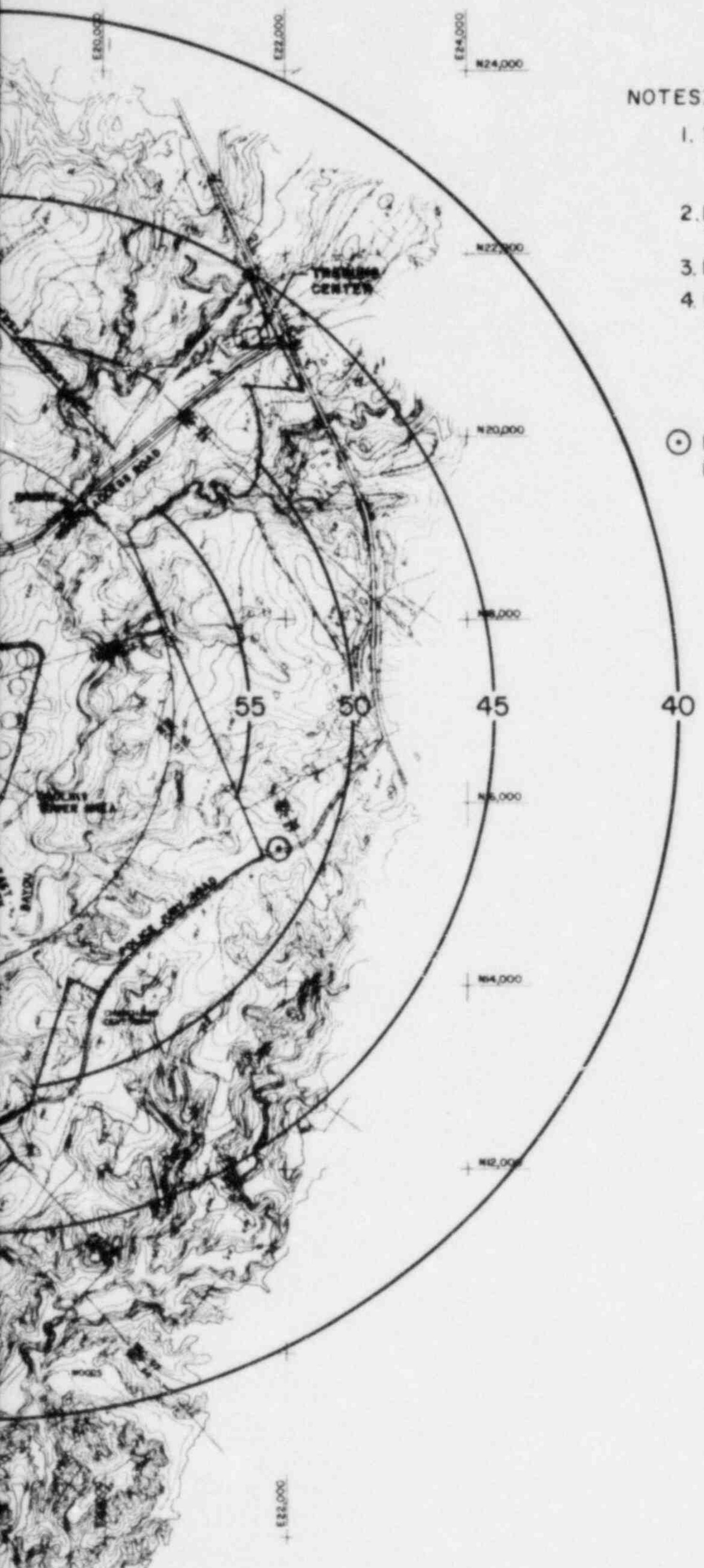
NOTE: 8.8+04 = 8.8×10^4

[1] Natural Radiation Exposure in the United States. U. S. Environmental Protection Agency, ORP-SID-72-1 (June 1972); using the average state background dose (100 mrem/yr) and year 2010 projected population of 1,163,282.

[2] The radiological doses presented in this table for the liquid effluents are based on two-unit operation. (Refer to Table 5.4-10, Note 1, for further clarification). The per reactor unit values would be approximately one-half the two-unit operation values.

[3] Carbon-14 and tritium have been added to this category.

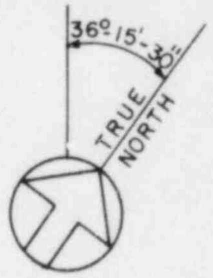

N24,000
N22,000
N20,000
N18,000
N16,000
N14,000
N12,000
N10,000
MISSISSIPPI RIVER
RIVER ROAD
PROPERTY BOUNDARY LINE
EXISTING 69KV TRANSMISSION LINE
WOODS
ALLIGATOR BAYOU
INTAKE STRUCTURE
BARGE SLIP
DISCHARGE OUTFALL
ALLIGATOR BAYOU CROSSING
RIVER ACCESS ROAD
WILDLIFE MANAGEMENT LAKE
PRIMARY SPOIL AREA
3400' EXCL. RAD.



NOTES:

1. VERTICAL DATUM:
   MEAN SEA LEVEL AS ESTABLISHED BY U.S. COAST AND GEODETIC SURVEY
2. DISTANCE FROM CENTERLINE REACTOR NO. 1 TO PROPERTY BOUND = 3035.15'
3. LDN VALUES = LEQ VALUES + 6 dB
4. FOR CALCULATED LEVELS WITH TREE ATTENUATION SEE TABLE 5.8-1

⊙ NEAREST RESIDENCE AFFECTED BY STATION NOISE



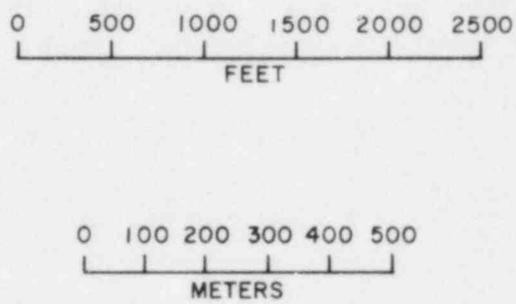


FIGURE 5.8-1

STATION SOUND LEVEL CONTOURS
(dBA Leq VALUES)

RIVER BEND STATION
ENVIRONMENTAL REPORT - OLS

APPENDIX 5A

DOSE CALCULATION MODELS AND ASSUMPTIONS

Calculation of dose rates to biota other than man was performed by means of the computer programs ARRRG and CRITER[1], developed at the Pacific Northwest Laboratory of Battelle Memorial Institute under contract to the Atomic Energy Commission (AEC) - currently the U.S. Nuclear Regulatory Commission (USNRC). The calculation of the dose rate to white tailed deer and grey squirrel and the resultant dose to the maximum individual from the consumption of these animals was performed using SWEC's computer code BAMBIE which employs the methodology of CRITER and Regulatory Guide 1.109, Revision 1[1,2]. Except where noted, the calculation of doses to man was performed using the methodology described in Regulatory Guide 1.109, Revision 1. Bioaccumulation factors used in ARRRG and CRITER have been updated to correspond to the latest published values in Regulatory Guide 1.109, Revision 0 (plants), and Regulatory Guide 1.109, Revision 1 (all others)[3]. See Section 5.4.2.3.1 for additional information on bioaccumulation factor usage.

A summary of the dose models and a list of assumptions used for the site are contained in this appendix and Tables 5A-1 through 5A-4.

Internal Doses to Aquatic Organisms

Aquatic organisms were considered to receive an internal dose rate from uptake and concentration of radiochemicals in the water and from exposure through the food chain. Dose rates to primary organisms were calculated directly from radioisotopic concentrations in the discharge water. The dose rate through the food chain was estimated for secondary organisms such as muskrats and raccoons feeding on primary organisms whose radionuclide content was estimated in the first calculation.

Equations used by CRITER for these calculations are as follows:

$$(DR)_i = AE_i b_i \qquad (5A\text{-}1)$$

where:

$(DR)_i$ = Dose rate for radionuclide i (mrad/yr)

E_i = Effective absorbed energy, MeV/dis in organ of interest

b_i = Specific body burden of nuclide i (pCi/kg)

A = Conversion factor = 0.0187 $\left(\frac{\text{dis-kg-mrad}}{\text{pCi-yr-MeV}}\right)$

and

$$b_i = C_{iw} B_i$$

where:

C_{iw} = Concentration of nuclide i in water (pCi/l)

B_i = Bioaccumulation factor for nuclide i (pCi/kg per pCi/l)

The concentration in water C_{iw} is calculated from:

$$C_{iw} = 1{,}119 \frac{Q_i R_i M_\rho}{F} \exp(-\lambda_i t_\rho) \qquad \text{(5A-2)}$$

where:

Q_i = Release rate of nuclide i (Ci/yr)

R_i = Reconcentration factor to estimate recycling of effluent dimensionless

M_ρ = Mixing ratio at point of exposure (1/dilution factor)

F = Flow rate of the liquid effluent (cu ft/sec)

λ_i = Radiological decay constant of nuclide i (hr^{-1})

t_ρ = Transit time for nuclides to reach point of exposure (hr)

1,119 = Constant to convert Ci/yr per cu ft/sec to pCi/l

The total body dose rate to a secondary organism was calculated as[1]:

$$DR'_i = 0.365\ b_i P' D'_i \tag{5A-3}$$

where:

DR'_i = Total body dose rate to secondary organisms due to nuclide i (mrad/yr)

0.365 = Kg-day/g-yr

b_i = Specific body burden of nuclide i (pCi/kg)

P' = Consumption rate of primary organisms by the secondary organism (g/day)

$$D'_i = \frac{70{,}000\ D_i\ (\text{man})\ E'_i}{E_i\ (\text{man})\ m'}$$

and

$D_{i(man)}$ = Total body dose conversion factor for man for radionuclide i (mrem/pCi)

$E_{i(man)}$ = Effective absorbed energy for man for radionuclide i (Mev/dis)

E'_i = Effective absorbed energy for secondary organism for radionuclide i (Mev/dis)

m' = Mass of secondary organism

70,000 = Total body mass of adult (grams)

The actual equation used by CRITER was of the form:

$$DR' = 2.86 \times 10^7 \frac{M_\rho P'}{Fm'} \sum_{i=1}^{n} Q_i R_i B_i E'_i \exp\ (-\lambda_i t_\rho) \left[D_i/E_i\right] (\text{man}) \tag{5A-4}$$

where:

DR' = Total body dose rate to secondary organisms (mrad/yr)

n = 136, the number of radionuclides

$2.86 \times 10^7 = (0.365)\ (1{,}119)\ (70{,}000)$

All other parameters are as previously defined.

Exposure to Shoreline Deposits

$$DR' = U_\rho \sum_{i=1}^{n} S_i D_{i\rho r} \qquad (5A\text{-}5)$$

$$DR' = 111{,}900\ \frac{U_\rho M_\rho W_f}{F} \sum_{i=1}^{n} Q_i R_i T_i \exp\left(-\lambda_i t_\rho\right) \left[1-\exp(\lambda_i t)\right] D_{i\rho r} \qquad (5A\text{-}6)$$

where:

U_ρ = Duration of exposure to external radiation sources (hr/yr)

W_f = Shore width factor = 0.2 (river shoreline)

T_i = Radiological half-life of isotope i in days

S_i = Effective surface contamination (pCi/cu m)

n = 136 = Number of isotopes

111,900 = Factor to convert from (Ci/yr)/(cu ft/sec) to pCi/l and to account for the proportionality constant used in the sediment radioactivity model

t = Total time the sediment is exposed to the contaminated water normally taken to be the operating lifetime of the facility (hr)

$D_{i\rho r}$ = Dose conversion factor for radionuclides deposited in river sediments (mrad/hr per pCi/m²)

All other parameters are as previously defined.

Dose for Swimming and Water Surface Exposure

$$(DR)_{\rho r} = 1119 \frac{U_\rho M_\rho}{F K_\rho} \sum_{i=1}^{n} Q_i R_i D_{jo} \text{[illegible]} {}_i t_\rho) \qquad (5A\text{-}7)$$

where:

$(DR)_{\rho r}$ = Total body dos[illegible] primary and secondary orga[illegible] rad/yr)

K_ρ = Hemispherical correction constant = 1 for swimming and 2 for boating

n = 136 = Number of isotopes

All other parameters are as previously defined.

Dose from Immersion in Gaseous Effluents

These doses were calculated in the same manner as doses to humans with appropriate changes in the assumptions and values used as shown in Table 5A-4.

Dose to Humans

Dose rates to humans were calculated using the equations recommended in Regulatory Guide 1.109, Revision 1.

Doses from Liquid Pathways

The generalized equation for calculating radiation doses to humans via liquid pathways is:

$$R_{aipj} = (C_{ip})\ (U_{ap})\ (D_{aipj}) \qquad (5A\text{-}8)$$

where:

R_{aipj} = Annual dose to organ j of an individual of age group a from nuclide i via pathway p, in mrem/yr

C_{ip} = Concentration of nuclide i in the media of pathway p, in pCi/l, pCi/kg, or pCi/m²

U_{ap} = Exposure time or intake rate (usage) associated with pathway p for age group a, in hr/yr, l/yr, or kg/yr (as appropriate)

D_{aipj} = Dose factor, specific to age group a, radionuclide i, pathway p and organ j, in mrem/pCi ingested or mrem per hr/pCi per sq m from exposure to deposited activity in sediment or on the ground.

1. Potable Water

$$R_{apj} = 1{,}100 \frac{M_p U_{ap}}{F} \sum_i Q_i D_{aipj} \exp(-\lambda_i t_p) \qquad (5A\text{-}9)$$

where:

R_{apj} = Total annual dose to organ j of individuals of age group a from all of the nuclides i in pathway p, mRem/yr

M_p = Mixing ratio (reciprocal of the dilution factor) at the point of exposure (or the point of withdrawal of drinking water or point of harvest of aquatic food), dimensionless

F = Flow rate of the liquid effluent in cu ft/sec

Q_i = Release rate of nuclide i, Ci/yr

λ_i = Radioactive decay constant of nuclide i, in hr^{-1}

t_p = Average transit time required for nuclides to reach the point of exposure. For internal dose, t_p is the total time elapsed between release of the nuclides and ingestion of food or water, in hours

1,100 = Factor to convert from (Ci/yr)/(cu ft/sec) to pCi/l

All the other symbols are as previously defined.

2. Aquatic Foods

$$R_{apj} = 1{,}100 \frac{U_{ap}M_p}{F} \sum_i Q_i B_{ip} D_{aipj} \exp(-\lambda_i t_p) \quad (5A\text{-}10)$$

where:

B_{ip} = Equilibrium bioaccumulation factor for nuclide i in pathway p, expressed as the ratio of the concentration in biota (in pCi/kg) to the radionuclide concentration in water (in pCi/l), in l/kg

All the other symbols are as previously defined.

3. Doses from Shoreline Deposits

$$R_{apj} = 110{,}000 \frac{U_{ap}M_p W}{F} \sum_i Q_i T_i D_{aipj} \left[\exp(-\lambda_i t_p)\right] \left[1-\exp(-\lambda_i t_b)\right] \quad (5A\text{-}11)$$

where:

W = Shore-width factor that describes the geometry of the exposure, dimensionless

T_i = Radiological half-life of nuclide i, days

t_b = Period of time for which sediment or soil is exposed to the contaminated water, in hours

110,000 = Factor to convert from (Ci/yr)/(cu ft/sec) to pCi/l and to account for the proportionality constant used in the sediment radioactivity model

All the other symbols are as previously defined.

4. Doses from Foods Grown on Land with Contaminated Water

$$R_{apj} = U_{ap} \sum_{i}^{veg} C_{iV} D_{aipj} + U_{ap} \sum_{i}^{animal} C_{iA} D_{aipj}$$

(5A-12)

where:

C_{iV} = Concentration of radionuclide i in the edible portion of crop species V in pCi/kg

C_{iA} = Concentration of radionuclide i in the animal product (meat or milk) in pCi/Kg or pCi/l

All other terms are as previously defined.

5. Dose from Ingestion of Wild Duck

Although this pathway is not specified in Regulatory Guide 1.109, Revision 1, it has been calculated for the maximum individual using the following equation:

From Equation 5A-8: $R_{aipj} = (C_{ip}) (U_{ap}) (D_{aipj})$

where:

R_{aipj} = Annual dose to organ j of an individual of age group a from nuclide i via pathway p (ingestion of duck)

C_{ip} = Concentration of nuclide i in the duck in pCi/kg

U_{ap} = Intake rate of duck for age group a in kg/year

D_{aipj} = Dose factor for radionuclide i, age group a, and organ j in mrem/pCi ingested

where:

(5A-13)

$$C_{ip} = C_{iw} \left[(B_i\ f)_{fish} + (B_i\ f)_{invertebrates} + (B_i\ f)_{aquatic\ plants} \right] \left(Q_f\right) \left(S_{i_{meat}}\right) \left(\exp{-\lambda_i t_d}\right)$$

where:

C_{ip} = Annual average of concentration in the water of radionuclide i at the point of the duck's consumption of fish, invertebrates and/or aquatic plants in pCi/l

B_i = Bioaccumulation factor for radionuclide i in pCi/kg per pCi/l

f = Fraction of total diet, dimensionless

Q_f = daily feed (kg/day)

$S_{i_{meat}}$ = Stable element transfer coefficient for meat, dimensionless

λ_i = Decay constant for radionuclide i in hr^{-1}

t_d = Distribution time, the time elapsed between catching the duck and consumption of the duck

where:

$$C_{iw} = 1{,}100 \frac{Q_i M_p}{F} \exp{-\lambda_i t_n} \qquad (5A-14)$$

t_n = Transit time between the point of release and the point where the duck consumes its food

All other symbols are as previously defined.

The internal dose from consumption of duck is estimated for a hunter postulated to consume approximately 5.0 lb of duck during a year.

The food intake of the duck is assumed to be composed of 100 percent aquatic plants having a bioaccumulation of 0.1 that of algae[2]. This assumed diet is conservative, since a substantial portion of the duck diet during the hunting season will be waste grains from fields and would not contribute to the duck body burden from liquid effluents[4,5,6]. The entire diet is assumed to come from the mixing zone. This assumption is conservative, since ducks eating outside the mixing zone will have a lower radionuclide intake.

6. Doses from Swimming and Boating

The doses from swimming and boating were calculated using the methodology described in WASH 1258[7].

The equation for calculation of external dose to skin and total-body from swimming (water immersion) or boating (water surface) is:

$$(DR)_{pr} = 1{,}119 \sum_i \frac{Q_i R_i}{FK_p} M_p U_p D_{ipr} \exp(-\lambda_i t_p) \qquad (5A\text{-}15)$$

where:

$(DR)_{pr}$ = Annual dose to organ r (skin or total-body) from all radionuclides in pathway p (swimming or boating), in mrem/yr

Q_i = Release rate of nuclide i, Ci/yr

R_i = Reconcentration factor to estimate recycling of effluent, dimensionless

M_p = Mixing ratio at the point of exposure (reciprocal of dilution factor), dimensionless

U_p = Usage (exposure time), in hr/yr

D_{ipr} = Dose factor: a number specific to a given nuclide i, pathway p (swimming or boating) and organ r (skin or total-body) which is used to calculate radiation doses from exposure to a given radionuclide concentration, in mrem/hr per pCi/l

λ_i = Radiological decay constant of nuclide i, in hr^{-1}

t_p = Transit time for nuclides to reach point of exposure, in hr

F = Flow rate of the liquid effluent, in cu/ft sec

K_p = Geometry correction factor equal to 1 for swimming and 2 for boating, dimensionless (no credit is taken for the shielding provided by the boat)

1,119 = Constant which converts from (Ci/yr)/(cu ft/sec) to pCi/l

Doses from Air Pathways

A. Gamma and Beta Doses from Noble Gases Discharged to the Atmosphere

1. Annual Gamma and Beta Air Doses from Noble Gas Releases

$$D^{\gamma}(r,\theta) \text{ or } D^{\beta}(r,\theta) = 3.17\times10^{4} \sum_i Q_i[\chi/Q](r,\theta)\left(DF_i^{\gamma} \text{ or } DF_i^{\beta}\right)$$

(5A-16)

where:

$D^{\gamma}(r,\theta), D^{\beta}(r,\theta)$ = Annual gamma and beta air doses at distance r in the sector at angle θ from the discharge point in mrad/yr

Q_i = Release rate of the radionuclide i, in Ci/yr

$[\chi/Q](r,\theta)$ = Annual average gaseous dispersion factor at distance r in sector in sec/cu m

$DF_i^{\gamma}, DF_i^{\beta}$ = Gamma and beta air dose factors for a uniform semi-infinite cloud of radionuclide i, in mrad-cu m/pCi-yr

3.17×10^4 = Number of pCi per Ci divided by the number of sec per yr

2. Annual Total Body Dose from Noble Gas Releases

$$D_{\infty}^{T}(r,\theta) = S_F \sum_i \chi_i(r,\theta) DF\beta_i \qquad (5A\text{-}17)$$

where:

$D_{\infty}^{T}(r,\theta)$ = Total body dose due to immersion
4 a semi-infinite cloud at distance r in sector θ, in mrem/yr

S_F = Attenuation factor that accounts for dose reduction due to shielding provided by residential structures, dimensionless

$\chi_i(r,\theta)$ = Annual average ground-level concentration of radionuclide i at distance in sector θ, in pCi/cu m

$DF_{\beta i}$ = Total body dose factor for a semi-infinite cloud of radionuclide i which includes the attenuation of 5 g/sq m of tissue, in mrem-cu m/pCi-yr

3. Annual Skin Dose from Noble Gas Release~

$$D_{\infty}^{S}(r,\theta) = 1.11\ S_F \sum_i \chi_i(r,\theta) DF_i^{\gamma} + \sum_i \chi_i(r,\theta) DFS_i \qquad (5A\text{-}18)$$

where

$D_{\infty}^{S}(r,\theta)$ = Annual skin dose due to immersion in a semi-infinite cloud at the distance r in sector θ, in mrem/yr

DFS_i = Beta skin dose factor for a semi-infinite cloud of radionuclide i, which includes the attenuation by the outer dead layer of skin, in mrem-cu m/pCi-yr

1.11 = Average ratio of tissue to air energy absorption coefficients

All other parameters are as previously defined.

B. Doses from Radioiodines and Other Radionuclides (Not Including Noble Gases) Released to the Atmosphere

1. Annual Organ Dose from External Irradiation from Radionuclides Deposited onto the Ground Surface

$$D_j^{G}(r,\theta) = 8760\ S_F \sum_i C_i^{G}(r,\theta) DFG_{ij} \qquad (5A\text{-}19)$$

where:

$D_j^{G}(r,\theta)$ = Annual dose to the organ j at location (r,θ), in mrem/yr

S_F = Shielding factor that accounts for the dose reduction due to shielding provided by residential structures during occupancy, dimensionless

$C_i^G(r,\theta)$ = Ground plane concentration of radionuclide i at distance r in sector θ, in pCi/sq m

DFG_{ij} = Open field ground plane dose conversion factor for organ j from radionuclide i, in mrem-sq m/pCi-hr

8,760 = Number of hours in a year

2. Annual Organ Dose from Inhalation of Radionuclides in Air

$$D_{ja}^A(r,\theta) = R_a \sum_i \chi_i(r,\theta) DFA_{ija} \qquad (5A\text{-}20)$$

where:

$D_{ja}^A(r,\theta)$ = Annual dose to organ j of an individual in the age group a at location (r,θ) due to inhalation, in mrem/yr

R_a = Annual air intake for individuals in the age group a, in cu m/yr

$\chi_i(r,\theta)$ = Annual average concentration of radionuclide i in air at location (r,θ), in pCi/cu m

DFA_{ija} = Inhalation dose factor for radionuclide i, organ j, and age group a, in mrem/pCi

3. Annual Organ Dose from Ingestion of Atmospherically Released Radionuclides in Food (Vegetation, Milk, Meat - i.e., beef and game animals such as deer and grey squirrel)

$$D^{D}_{j_a}(r,\theta) = \sum_{i} DFI_{ija} \left[U^{V}_{a} f_g C^{V}_{i}(r,\theta) + U^{m}_{a} C^{m}_{i}(r,\theta) + U^{F}_{a} C^{F}_{i}(r,\theta) + U^{L}_{a} f_1 C^{L}_{i}(r,\theta) \right] \quad (5A\text{-}21)$$

where:

$C^{V}_{i}(r,\theta), C^{m}_{i}(r,\theta),$ = Concentrations of radionuclide i in produce (nonleafy vegetables, fruits and grains) milk, leafy vetgetables, and meat respectively, at location (r,θ) in pCi/kg or pCi/l

$C^{L}_{i}(r,\theta), C^{F}_{i}(r,\theta)$ = Annual dose to organ i of an individual in age group a from ingestion of produce, milk, leafy vegetables, and meat at location (r,θ) in mrem/yr

DFI_{ija} = Ingestion dose factor for radionuclide i, organ j, and age group a in mrem/pCi

f_g, f_1 = Respective fractions of the ingestion rates of produce and leafy vegetables that are produced in the garden of interest

$D^{D}_{j_a}(r,\theta)$ = Annual dose to the organ i of an individual in age group a from ingestion of produce, milk, leafy vegetables, and meat at location (r,θ), in mrem/yr

$U^{V}_{a}, U^{m}_{a}, U^{F}_{a}, U^{L}_{a}$ = Annual intake (usage) of produce, milk, meat, and leafy vetgetables, respectively, for individuals in age group a, in kg/yr or l/yr

General Expression for Population Doses

The general expression for calculating the annual population-integrated dose is:

$$D_j^P = 0.001 \sum_d P_d \sum_a D_{jda} f_{da} \qquad (5A\text{-}22)$$

where:

D_j^P = Annual population-integrated dose to organ j (total body or thyroid), in manrems or thyroid manrems

P_d = Population associated with subregion d

D_{jda} = Annual population-integrated dose to organ j (total body or thyroid) of an average individual of age group a in subregion d, in mrem/yr

f_{da} = Fraction of the population in subregion d that is in the age group a

0.001 = Conversion factor from mrem to rem

The Equation 5A-22 used in conjunction with the preceding equations and average adult usage factors was used to calculate the population doses.

For further refinements on the preceding equation used to calculate the doses to man see Regulatory Guide 1.109, Revision 1.

In addition to the site-specific data listed in Tables 5A-1 through 5A-4, the following is a list of information and ER Section references that was used in the analysis.

Information	ER Section
1. Meteorology and radial distance for the 16 cardinal compass directions to the nearest:	
a. Property Boundary	2.7.5
b. Residence, milk cow, meat animal, and garden	2.7.5
2. Population distribution for the year 2010	2.5.1
3. Present meat production distribution	2.2.3
4. Present milk production distribution	2.2.3
5. Present vegetable production distribution	2.2.3

5A References

1. Soldat, S.K., Robinson, N.M., and Baker, D.A. Models and Computer Codes for Evaluating Environmental Radiation Doses. Battelle Pacific Northwest Laboratories, Richland, WA, February 1974. BNWL-1754.

2. Regulatory Guide 1.109 Revision 1, October 1977. Calculation of Annual Doses to Man From Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10CFR50, Appendix I.

3. Regulatory Guide 1.109, March 1976. Calculation of Annual Doses to Man From Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10CFR50, Appendix I, March 1976.

4. Kortright, F.H. The Ducks, Geese, and Swans of North America. The Stackpole Company. Harrisburg, PA, 1942.

5. Martin, A.C., Zim, H.S., and Nelson, A.L. American Wildlife and Plants - A Guide to Wildlife Food Habits. Dover Publications Incorporated, New York, NY, 1951.

6. Waterfowl Tomorrow. U.S. Dept. of Interior, Bureau of Sports Fisheries and Wildlife of the Fish and Wildlife Service, Washington, DC, 1964.

7. Atomic Energy Commission. Final Environmental Statement Concerning Proposed Rule Making Action; Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion ("as low as practicable") for Radioactive Material in Light Water Cooled Nuclear Power Reactor Effluents. Washington, DC, July 1973.

TABLE 5A-1

PARAMETERS AND ASSUMPTIONS USED IN EQUATIONS FOR ESTIMATING DOSES TO HUMANS

F = Effluent flow rate = 9.8 ft^3/sec
Tp = Transit time (Tables 5A-2 and 5A-3)
Dp = Dilution factors (Tables 5A-2 and 5A-3)
I = Irrigation rate = 0.104(l/m^2/hr)
fi = Fraction of year crops are irrigated = 1.0 (12 months)
p = Fraction equilibrium ratio of C^{14} = 1 (continuous release); = 0.073 (intermittent release)
Qf = Cow feed consumption rate = 24 kg/day [wet weight]
fp = Fraction of year cows graze on pasture = 1.0(100%)
fs = Fraction of daily feed which is pasture grass = 0.62
H = Absolute humidity = 12.9 g/m^3
Uap = Recreational usage factor (hr/yr of exposure):

Maximum individual	Child	Teen	Adult
Shoreline	14.0	67.0	12.0
Swimming	28.0	45.0	8.0
Boating	29.0	52.0	52.0

Uap: Population	Child	Teen	Adult	
Shoreline	9.5	47.0	8.3	
Swimming	12.0	19.0	3.5	2
Boating	17.0	29.0	29.0	

Vp = Total commercial U.S. fish harvest = 2.33×10^9 kg/yr
Vdp = 50 mi commercial fish harvest = 3.4×10^6 kg/yr
Vdp' = 50 mi sports fish harvest = 3.4×10^6 kg/yr
Vdp'' = 50 mi milk production = 1.1×10^8 l/yr 4
Vdp''' = 50 mi meat production = 5.20×10^7 kg/yr
Vdp''' = 50 mi vegetation production = 4.4×10^8 kg/yr

NOTE: Input parameters and assumptions used in dose equations will be taken from Regulatory Guide 1.109, Revision 1. Site-specific information will be used for the above parameters.

TABLE 5A-4

ASSUMPTIONS USED IN ESTIMATING DOSES TO BIOTA

Parameter	Values Assigned							
	Primary Organisms	Secondary Organisms						
	(Fish, Crustaceans, Mollusks, Algae)	Muskrat	Heron	Duck	Deer	Squirrel	Raccoon	Alligator
R Recirculation factor	0	0	0	0	-		0	0
F Flow rate (cfs)	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8
M Mixing ratio-1/dilution factor	0.088	0.088	0.088	0.088			0.088	0.088
W Shore width factor	0.2	0.2	0.2	0.2	-	-	0.2	0.2
K Water immersion	1	1	-	-	-	-	-	1
Water surface	-	-	2	2	-	-	-	-
Effective radius (cm)	2	6	11	5	45.0	2.5	14.0	17.8
M Mass (kg)	-	1	4.6	0.91	58.97	0.41	12.0	38.56
P Food consumption (gpd)								
Aquatic plants	-	100	-	54.0	-	-	-	-
Fish	-	-	600	-	-	-	-	275
Invertebrate	-	-	-	-	-	-	200	-
U Usage (hr/yr)								
Shoreline	8,766	2,922	2,922	4,383	-	-	2,191	1,972
Water immersion	8,766	2,922	-	-	-	-	-	6,974
Water surface	8,766	-	2,922	4,383	-	-	-	-
t Holdup time (hr)	0	0	0	0	-	-	0	0
Residence time (mo)	12	12	12	12	12	12	12	12

CHAPTER 6

LIST OF TABLES

Table Number	Title
6.2-1	PREOPERATIONAL AND OPERATIONAL RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
6.2-2	SPECIAL INTEREST THERMOLUMINESCENT DOSIMETER LOCATIONS
6.2-3	RADIOCHEMICAL ANALYTICAL SENSITIVITIES
6.4-1	PERTINENT SENSOR CHARACTERISTICS
6.4-2	COMPARISON OF HOURLY WEATHER PARAMETERS RECORDED BY DATA LOGGER AND STRIP CHART RECORDERS FOR JANUARY 20, 1979
6.4-3	DATA RECOVERY PERCENTAGES BY PARAMETER FOR THE PERIOD MARCH 17, 1977 THROUGH MARCH 16, 1979
6.5-1	WATER QUALITY PARAMETERS SAMPLED IN THE MISSISSIPPI RIVER DURING INTERIM STUDIES
6.6-1	METHODS OF ANALYSES OF GROUNDWATER SAMPLES
6.6-2	CHEMICAL AND THERMAL MONITORING

CHAPTER 6

LIST OF FIGURES

Figure Number	Title
6.2-1	RADIOLOGICAL ENVIRONMENTAL MONITOR LOCATIONS
6.2-2	RADIOLOGICAL ENVIRONMENTAL MONITOR LOCATIONS 10 KM RADIUS
6.5-1	AQUATIC BIOLOGY SAMPLING STATIONS ESTABLISHED DURING BASELINE STUDY
6.5-2	AQUATIC SAMPLING STATIONS - INTERIM MONITORING, 1974-1981
6.5-3	AQUATIC SAMPLING STATIONS - PREOPERATIONAL AND OPERATIONAL MONITORING, 1981-1985
6.7-1	DATA ACQUISITION SYSTEM

4

6.2 RADIOLOGICAL

Parts 20 and 50 of 10CFR require that radiological environmental monitoring programs be established to provide data on measurable levels of radiation and radioactive materials in the site area. In addition, Appendix I to 10CFR50 requires the evaluation of the relationship between the quantities of radioactive material released in effluents during normal operation, including anticipated operational occurrences, and the resultant radiation doses to individuals from principal pathways of exposure. The River Bend Station environmental monitoring program will be conducted to determine the effectiveness of in-plant measures used for controlling the release of radioactive materials. Surveillance will be established to identify changes in the use of unrestricted areas (e.g., for agricultural purposes), to provide a basis for modifications in the monitoring programs for evaluating doses to individuals from principal pathways of exposure (identified in Section 5.4), and to better ensure that resulting radiation doses to the public will be minimal.

The results of the environmental radiological monitoring program are intended to confirm that the measured concentrations of radioactive materials and levels of radiation are not greater than federal limitations. The program provides measurements of radiation and radioactive materials in those pathways which lead to the highest potential radiation exposures of individuals, resulting from station operation.

The radiological monitoring program for the station will be conducted in two phases: the preoperational phase and the operational phase. The preoperational phase will be conducted during the 2-yr period prior to commercial operation. This phase is designed to determine background levels of radioactivity and to identify important pathways of exposure to man and biota. Following this period, modifications to the preoperational phase, resulting from experiences with procedures and equipment, will be incorporated into the operational phase to establish a more efficient monitoring program.

Guidelines for the radiological monitoring program are outlined in: 1) Regulatory Guide 4.1, 2) A Branch Technical Position on Radiological Environmental Monitoring Program Requirements, and 3) Radiological Effluent Technical Specification (RETS) for conformance to the provisions of 10CFR50, Appendix I. The radiological surveillance program

the River Bend site will be based on these recommended programs[1,2,3].

6.2.1 Preoperational Monitoring

The preoperational environmental monitoring program will be instituted 2 yr prior to commercial operation. The purposes of this program are: 1) to measure background radiation levels and their variations along the anticipated critical pathways near the station; 2) to train personnel, and 3) to evaluate procedures, equipment, and techniques. The elements (sampling medium and type of analysis) of both the preoperational and operational programs will be essentially the same. The duration of the preoperational program and specific mediums sampled are as follows:

6 months	1 yr	2 yr
Airborne iodine	Airborne particulates	Direct radiation
Iodine in milk (while animals are on pasture)	Milk	Fish and invertebrates
	Surface water	Food products
	Drinking water	Shoreline sediment

The preoperational radiological monitoring program is summarized in Table 6.2-1. A map showing tentative locations of monitoring stations and nearest receptors is provided in Fig. 6.2-1.

6.2.1.1 Sampling Locations, Techniques, and Frequencies

6.2.1.1.1 Atmospheric Discharges

Particulates

Tentative locations for five indicator and one control continuous air monitoring stations have been selected.
4 Three samples will be collected in different sectors with the highest calculated annual average ground-level D/Q, i.e., north-northeast, north, north-northwest directions. One additional sample will be taken from the vicinity of a community having the highest calculated annual average ground-level D/Q (i.e., St. Francisville, 5.0 km, west-northwest). One additional sample will be taken from a control location 15 to 30 km from the plant in a southwest (least prevalent) wind direction. A sample will be taken near the embayment on GSU property to monitor the impact on site air quality from Big Cajun No. 2 operation.

Airborne particulate samples will be collected by drawing air at 3 x 10^{-2} cu m/min through a filter. After passing through the filter, the air passes through an iodine cartridge. The dust filters will be changed weekly or as required by dust loading, whichever is more frequent. After standing for 3 or 4 days to allow the daughter isotopes of radon and thoron to decay, the filters will be assayed weekly for gross beta activity and examined quarterly for gamma isotopes.

Airborne Iodine

The indicator and control sampling stations will utilize iodine cartridges, which will be replaced and assayed weekly for radioactive iodine-131.

6.2.1.1.2 Direct Radiation

Forty-two thermoluminescent dosimeter (TLD) stations will be established to measure offsite exposure due to direct radiation. An indicator station will be located in each of 16 compass directions surrounding the plant near the property/restricted area boundary. Another set of indicator stations will be located within a 6- to 10-km range of the site in each of the 16 compass directions. Seven stations will be located in areas of special interest, such as local population centers, schools, or milk animal pastures. These special locations are listed in Table 6.2-2. Three other stations will be maintained as control stations located at a distance of 15 to 30 km in the southwest, east, and north directions.

The indicator stations will contain two TLDs. One TLD will be replaced and read monthly, the other quarterly. The background stations will contain four TLDs. Two will be replaced and read monthly, the other two quarterly.

6.2.1.1.3 Ingestion

Milk

Milk appears to be the most direct and the most sensitive means for monitoring iodine-131 (the limiting isotope) in terrestrial pathways. The known locations of milk animals within a 5-km radius of the plant in 1980 are listed in Table 2.7-115 for dose assessment purposes. These locations, specifically 1,600 m NW, 1,400 m N, and 1,300 m N-NW, were identified in the Livestock Survey for Radiation Exposure Pathways within a 3 1/10 mi (5-km) Radius of GSU's River Bend Nuclear Power Plant, as prepared by Gulf

South Research Institute (GSRI), March 1980. In a subsequent effort to establish milk sampling stations for the monitoring program at these locations, it was determined that the milking animals no longer existed. According to the referenced Branch Technical Position on Radiological Environmental Monitoring Program Requirements, the maximum organ dose to the individual at the 5-km distance in the highest dose potential areas (W, WNW, NW, and NNW) was determined and found to be 0.30 (from cow milk) and 0.75 mrem (from goat milk) in the WNW location. Although this value is significantly less than 1 mrem/year, a milk surveillance program will be implemented. The number of sampling sites selected and their respective locations, and the location of the control sample site differs from those recommended in the referenced Branch Technical Position. Justification for these alternates is provided.

Samples from the McKowen Dairy, located 6 km ESE from the
4 station, will be obtained for gamma isotropic and iodine-131 analysis semimonthly when animals are on pasture, and monthly at other times. This sampling site is the only known location within the 5- to 8-km distance from which milk samples can be readily obtained.

A control sample from milking animals at the Louisiana State Penitentiary, located approximately 35 km NW of the station, also will be analyzed at the same frequency. This site, 35-km distant, is the most practical location from which to obtain control samples.

The milking animal locations used in the Appendix I analysis to evaluate the radiation dose to individuals from the cow-milk-man pathway (Section 5.4) differs from that used in this sampling program. The Appendix I analysis is based on the milking animal locations identified in the GSRI survey. The analysis remains applicable however, since these milking animals were present at the time the analysis was being performed and are the most conservative (highest dose potential) from the cow-milk-man pathway.

Food Products

Three samples of broadleaf vegetation grown in the offsite locations of the highest calculated annual average ground-level D/Q will be taken for gamma isotopic analysis on the edible portion of the plant, if milk samples are not available. This analysis will be done monthly when crops are available. Samples of broadleaf vegetation will be
4 2 obtained from a 40-sq m onsite garden in the sector with the highest calculated annual average ground-level D/Q, if

offsite samples are not obtainable. A control sample of similar vegetation will be obtained from the Louisiana State Penitentiary at Angola. 2 4

The potential radiological impact of station operation on nearby vegetable crops, including the sweet potato, was reviewed. No waterborne pathway to man exists via the sweet potato. Irrigation and surface and ground waters in the station vicinity do not reach the vegetable croplands, since there is no use of Mississippi River water for sweet potato or other vegetable crop. Impact to vegetables near the station from normal gaseous releases will be insignificant, as discussed in Section 5.4. The milk pathway provides a greater potential impact to man, and vegetable sampling will be conducted only if milk samples are not available.

6.2.1.1.4 Liquid Discharges

Surface Water

River water will be collected at the control station located approximately 4.2 km upriver from the plant liquid discharge outfalls, at the St. Francisville ferry crossing. River water will also be collected at a point approximately 3.9 km 1 downstream from the plant liquid discharge outfalls, near Crown-Zellerbach paper mill, where the plant effluent is completely mixed with river water. Weekly samples for gamma isotopic analysis will be composited and analyzed monthly; 4 weekly samples for tritium analysis will be composited and analyzed quarterly.

Drinking Water

A monthly composite sample of the raw intake at the first downriver water supply (Peoples Water Service Company - Bayou Lafourche, River Mile 175.5) will be collected and analyzed on the same schedule as that of surface water. Analysis of gross beta and isotopic gamma activity will be performed. Since the calculated dose for the consumption of

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water is less than 1 mrem per year, composite analysis of iodine-131 will not be performed (Section 5.4). A composite analysis for tritium will be performed quarterly. Similar analyses of a sample from the upstream control station at 4
the St. Francisville ferry crossing, located 4.2 km upstream, will be performed.

Groundwater

Preoperational groundwater radioactivity data will be col- 1
lected on a quarterly basis beginning 1 yr prior to opera-
tion. Samples will be obtained from a downgradient well and 4
an upgradient control well located on the site property.

Shoreline Sediment

One sample of shoreline sediment will be selected for semiannual gamma analysis from the east bank of the Mississippi River near the Crown-Zellerbach papermill. This is upstream of shoreline areas with existing or potential recreational value and public access.

Fish and Invertebrates

One sample of each commercially and recreationally important species will be taken seasonally or semiannually from the vicinity of the plant liquid discharge points for gamma
isotopic analysis on edible portions. One sample of the 1
same species in an area upstream of the discharge will also be monitored. These samples will be collected and provided by commercial fisherman at the preceding location.

6.2.1.2 Radiological Sample Analyses

The radiological monitoring program will adhere to the standards outlined in Regulatory Guide 4.15, Revision 1, February 1979, for quality assurance of the surveillance methods used. Results will be confirmed through participation in the Environmental Protection Agency's Environmental Radioactivity Laboratory Intercomparisons Studies Program.

Typical detection capabilities for the environmental sample analyses are provided in Table 6.2-3.

6.2.2 Operational Monitoring

The purpose of the operational monitoring program is to monitor for radiological releases along pathways identified in the preoperational program. The operational program will

begin when commercial operation begins and will continue throughout the life of the plant. Following the

TABLE 6.2-1

PREOPERATIONAL AND OPERATIONAL RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Number of Samples and Locations[1]	Sampling and Collection Frequency[1]	Type, Frequency, and Analysis
AIRBORNE			
Radioiodine and Particulates	Samples from 6 locations: 3 samples in different sectors of the highest calculated annual average ground-level D/Q (NNE, N, NNW). 1 sample from the vicinity of a community having the highest calculated annual average ground-level D/Q (St. Francisville, 5 km WNW). 1 sample onsite between the station and the river (near embayment). 1 sample from a control location 15-30 km (10-20 mi) distant and in the least prevalent (SW) wind direction[4]	Continuous sampler operation with sample collection weekly or as required by dust loading, whichever is more frequent	Radioiodine cannister: analyze weekly for I-131 Particulate sampler: Gross beta radioactivity following filter change[2], composite (by location) for gamma isotopic[3] quarterly
DIRECT RADIATION	42 stations with two or more dosimeters to be placed as follows: 1) an inner ring of stations in the general area of the property/restricted area boundary and an outer ring in the 6- to 10-km range from the site, with a station in each sector of each ring (16 sectors x 2 rings = 32 stations) 2) the balance of the stations, 10, are to be placed in the special interest areas designated in Table 6.2-2, and in 3 areas to serve as control stations (SW, E, and N, between 15 and 30 km).	Monthly or quarterly	Gamma dose monthly or quarterly

TABLE 6.2-1 (Cont)

Exposure Pathway and/or Sample	Number of Samples and Locations(1)	Sampling and Collection Frequency(1)	Type, Frequency, and Analysis	
WATERBORNE				
Surface(5)	1 sample, 4.2 km upstream from the plant liquid discharge outfalls, at St. Francisville ferry crossing 1 sample 3.9 km downstream from the plant liquid discharge outfalls, near Crown-Zellerbach paper mill	Composite sample over 1-month period	Gamma isotopic analysis monthly. Composite for tritium analyses quarterly	1
Drinking	1 sample from the nearest downstream water supply (Bayou Lafourche, River Mile 175.5) 1 sample 4.2 km upstream	Composite sample monthly	Composite for Gross beta and gamma isotopic analyses monthly. Composite for tritium analysis quarterly	4
Ground	1 sample from downgradient source 1 sample from upgradient source	Quarterly	Gamma isotopic and tritium analysis quarterly	4
Sediment from Shoreline	1 sample from downstream area near Crown-Zellerbach papermill	Semiannually	Gamma isotopic analyses semiannually	
INGESTION				
Milk	1 sample from milking animals at the McKowen dairy (6 km ESE) 1 sample from milking animals at a control location (Louisiana State Penitentiary) 35 km NW	Semimonthly when animals are on pasture, monthly at other times	Gamma isotopic and I-131 analysis semimonthly when animals are on pasture; monthly at other times	4
Fish and Invertebrates	1 sample of each commercially and recreationally important species in vicinity of discharge plant 1 sample of same species in areas not influenced by plant disch rge	Sample in season, or semiannually if they are not seasonal (provided by commercial fisherman)	Gamma isotopic analysis on edible portions	4

TABLE 6.2-1 (Cont)

Exposure Pathway and/or Sample	Number of Samples and Locations(1)	Sampling and Collection Frequency(1)	Type, Frequency, and Analysis
Food Products	3 samples of broadleaf vegetation grown nearest offsite locations of highest calculated annual average ground-level D/Q (NNE, N, NNW) if milk sampling is not performed. If offsite samples are not obtainable, an onsite garden will provide broadleaf vegetation samples.	Monthly when available	Gamma isotopic analysis on edible portion
	1 sample of each of the similar vegetation grown 35 km NW at Angola from the Louisiana State Penitentiary	Monthly when available	

(1)The number, medium, frequency, and location of sampling may vary. At times, it may not be possible or practical to obtain samples of the medium of choice at the most desired location or time. In these instances, suitable alternative mediums and locations will be chosen for the particular pathway in question.

(2)Particulate sample filters will be analyzed for gross beta 24 hr or more after sampling to allow for radon and thoron daughter decay. If gross beta activity in air or water is greater than 10 times the yearly mean of control samples for any medium, gamma isotopic analysis will be performed on the individual samples.

(3)Gamma isotopic analysis means the identification and quantification of gamma-emitting radionuclides that may be attributable to the effluents from the facility or from weapons testing fallout.

(4)The purpose of this sample is to obtain background information. If it is not practical to establish control locations in accordance with the distance and wind direction criteria, other sites which provide valid background data may be substituted.

(5)The upstream sample will be taken at a distance beyond influence of the discharge. The downstream sample will be taken in an area beyond but near the mixing zone.

TABLE 6.2-2

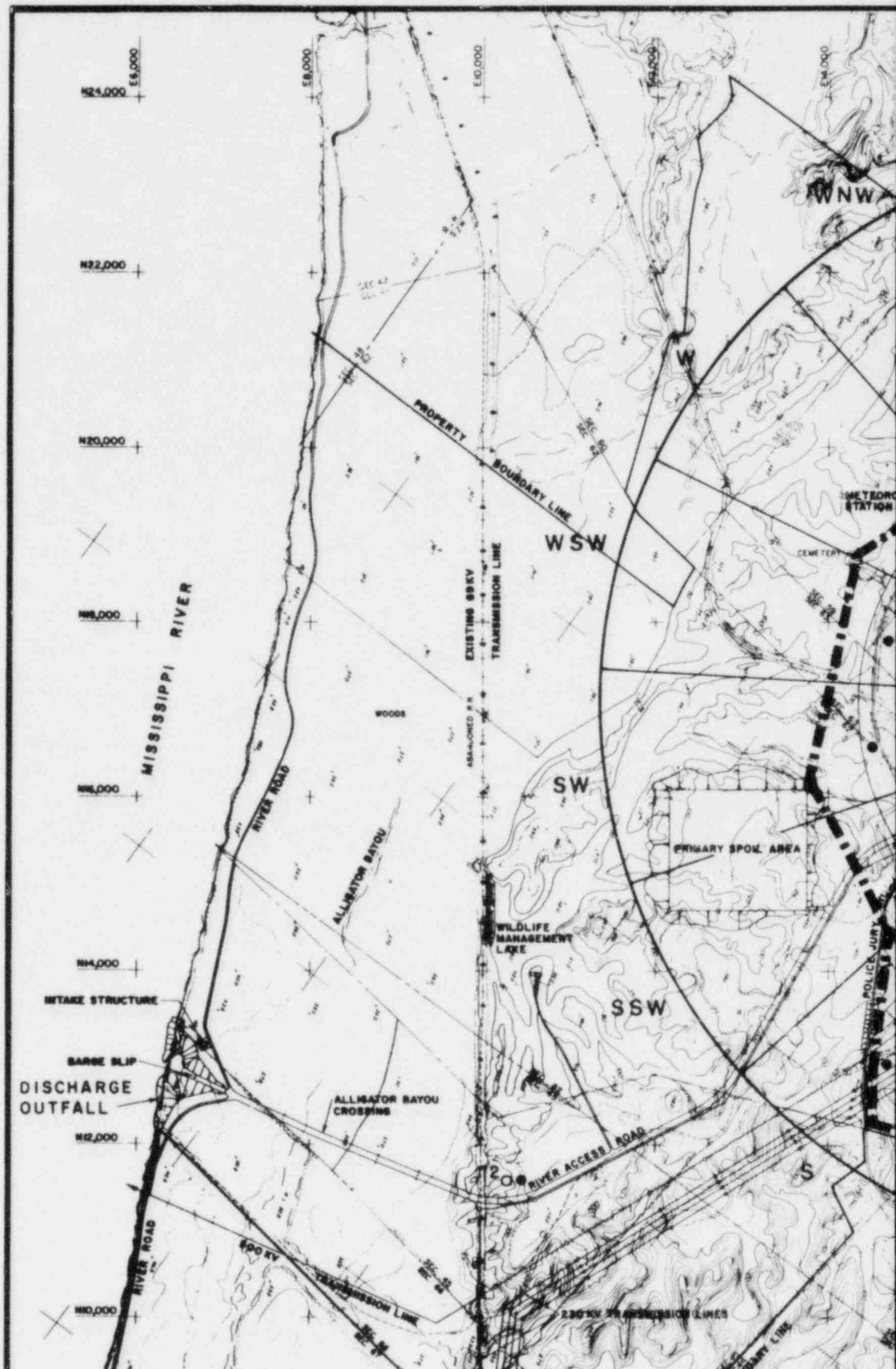
SPECIAL INTEREST THERMOLUMINESCENT DOSIMETER LOCATIONS

Map ID No.*	Location	Distance (km)	Direction
1	Edge of New Roads Population Center	10.0	SW
2	Air Sampling Station on River Access Road	2.8	SSW
3	West Feliciana Parish Hospital	4.0	NW
4	Bains School Complex	9.5	NNW
5	Edge of Jackson Population Center	12.0	NE
6	Edge of St. Francisville	6.0	NW
7	East Louisiana State Hospital	12.0	NE

4

4

*See Fig. 6.2-1.



N24,000
E6,000
E8,000
E10,000
E14,000
WNW
N22,000
W
PROPERTY BOUNDARY LINE
N20,000
WSW
CEMETERY
MISSISSIPPI RIVER
N18,000
TRANSMISSION LINE
WOODS
RIVER ROAD
N16,000
SW
ALLIGATOR BAYOU
PRIMARY SPOIL AREA
WILDLIFE MANAGEMENT LAKE
N14,000
INTAKE STRUCTURE
SSW
BARGE SLIP
DISCHARGE OUTFALL
ALLIGATOR BAYOU CROSSING
N12,000
RIVER ACCESS ROAD
S
RIVER ROAD
500 KV TRANSMISSION LINE
N10,000
230 KV TRANSMISSION LINES
PROPERTY BOUNDARY LINE
WOODS
POLICE JURY

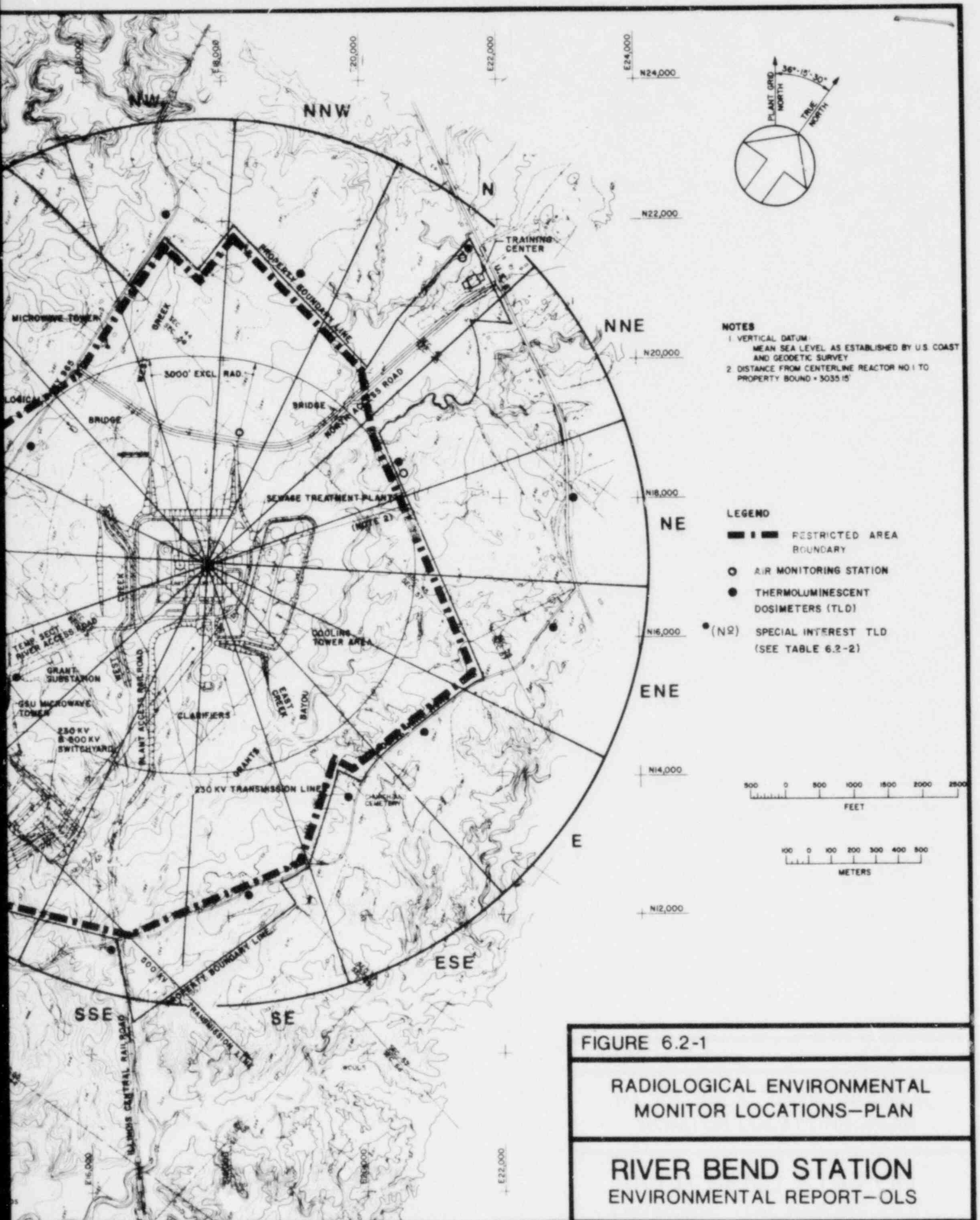
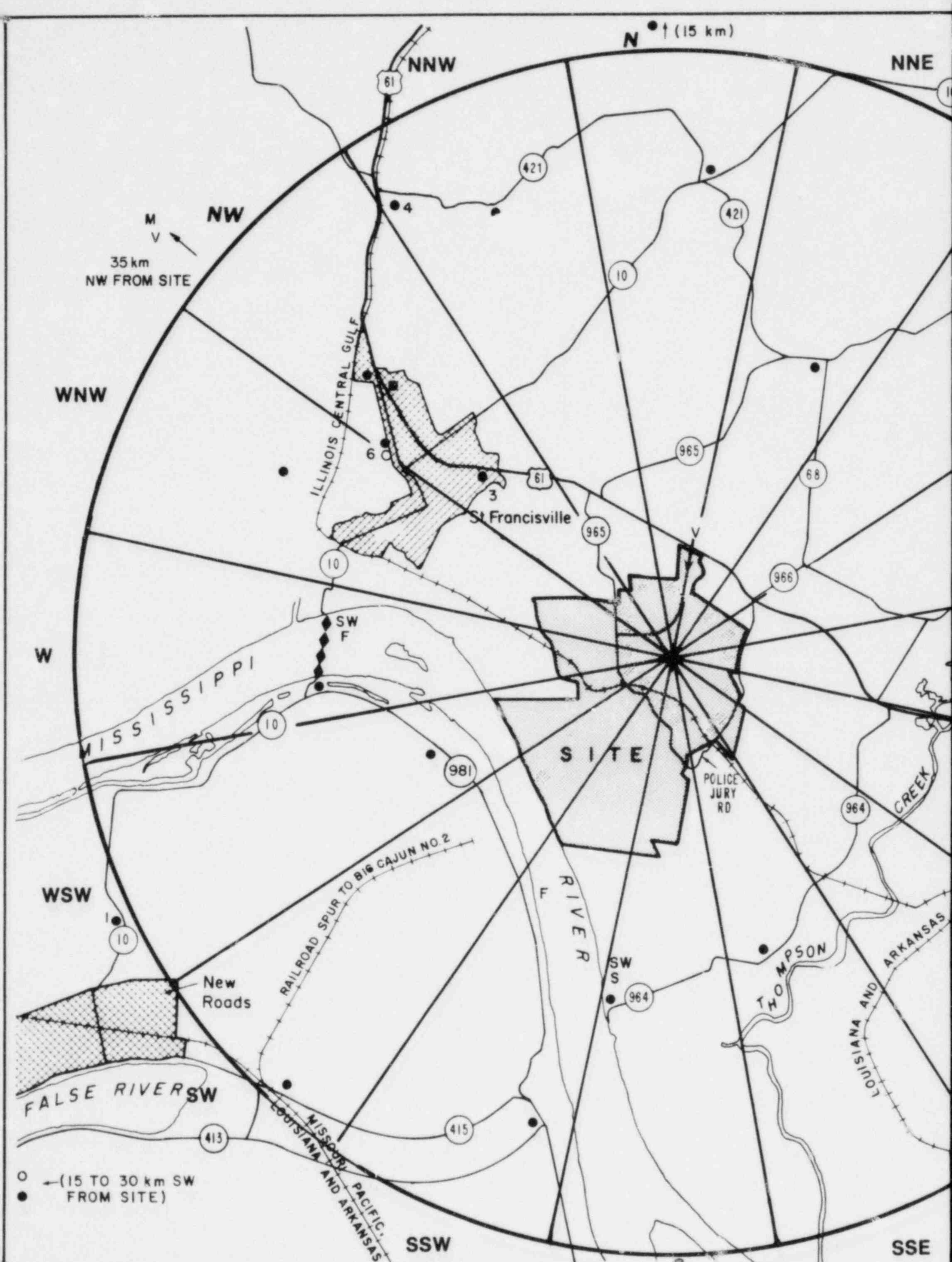


FIGURE 6.2-1

RADIOLOGICAL ENVIRONMENTAL MONITOR LOCATIONS—PLAN

RIVER BEND STATION
ENVIRONMENTAL REPORT—OLS



N
(15 km)
NNW
NNE
NW
M
V
35 km
NW FROM SITE
WNW
W
WSW
SW
SSW
S
SSE
61
421
10
965
68
966
981
964
415
413
4
6
3
1
St Francisville
ILLINOIS CENTRAL GULF
MISSISSIPPI
RIVER
SW
F
SITE
POLICE
JURY
RD
CREEK
THOMPSON
LOUISIANA AND ARKANSAS
RAILROAD SPUR TO BIG CAJUN NO. 2
New
Roads
FALSE RIVER
MISSOURI PACIFIC
LOUISIANA AND ARKANSAS
SW
S
(15 TO 30 km SW
FROM SITE)

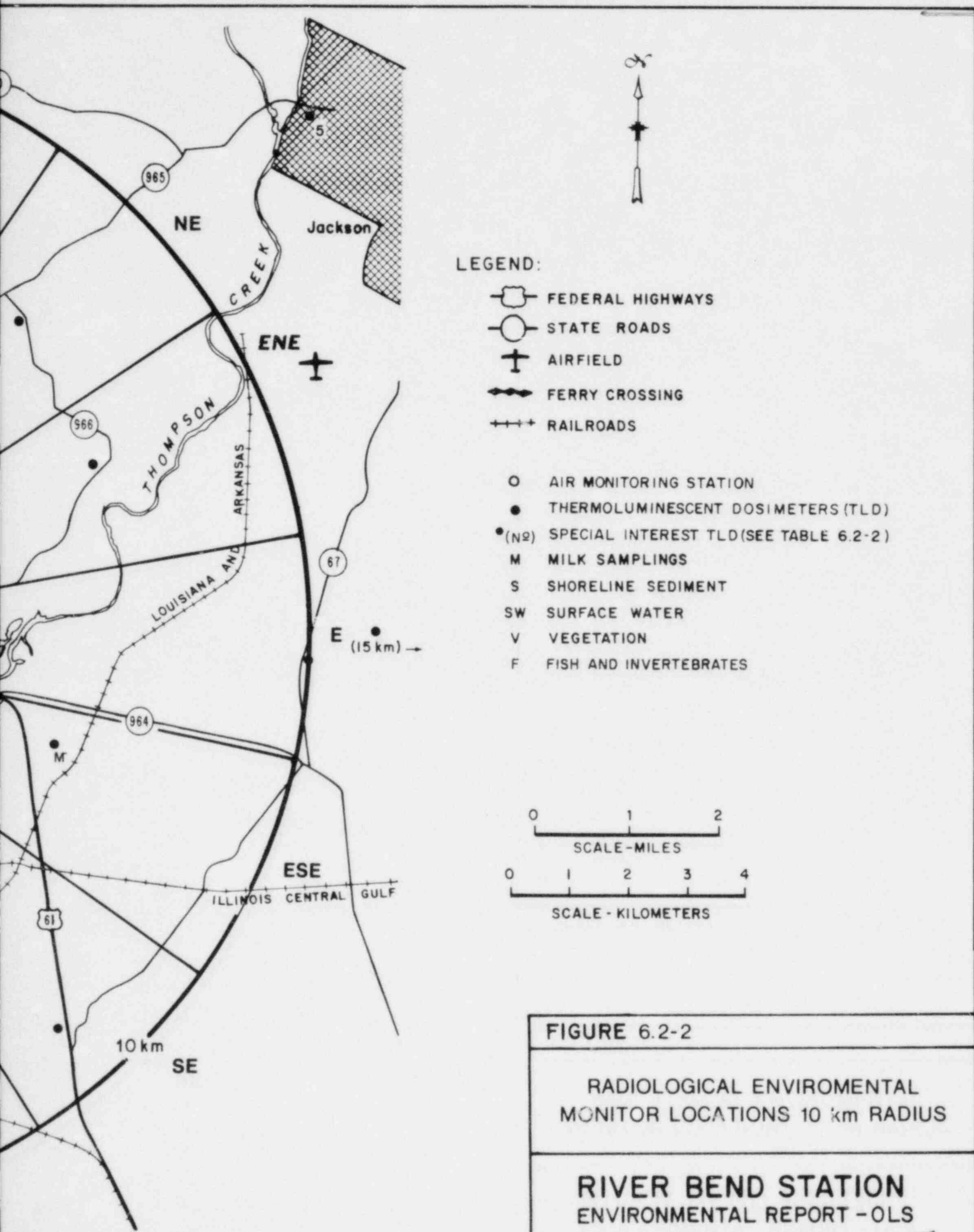


FIGURE 6.2-2

RADIOLOGICAL ENVIROMENTAL MONITOR LOCATIONS 10 km RADIUS

RIVER BEND STATION
ENVIRONMENTAL REPORT - OLS

CHAPTER 7

ENVIRONMENTAL IMPACTS OF POSTULATED ACCIDENTS INVOLVING RADIOACTIVE MATERIALS

7.1 PLANT ACCIDENTS

This section discusses the radiological environmental impact of River Bend Station as required by 10CFR51, and as based on the accident assumptions provided in Environmental Standard Review Plan, Section 7.1 [1,2]. For each accident the following is provided:

1. A description of a representative type of accident appropriate for each accident class together with its basic assumptions

2. A determination of the radiological doses for each classification accident as it applies to River Bend Station.

Table 7.1-1 identifies the accidents considered.

Table 7.1-2 gives a summary of the radiological doses of each accident to a hypothetical maximum exposed individual at the exclusion area boundary, as defined in 10CFR100[3].

Table 7.1-3 summarizes the population doses for each accident at an 80-km radius utilizing the projected demography for the year 2000.

The demographic data and CHI/Q values at the 50 percent probability level that were used in these analyses can be found in Sections 2.5.1 and 2.7, respectively. Both the demographic data and CHI/Q values were based on the most recently available information at the time of analyses performance, thus providing more representative individual and population doses. 4

Calculations of doses to individuals and population are performed in accordance with the methods of NRC Regulatory Guide 1.3 and Regulatory Guide 1.145[4,5]. Population doses result from adjusting the individual dose by a factor incorporating population density and CHI/Q values for each specific sector.

7.1.1 Design Basis Accidents

7.1.1.1 Trivial Incidents Class

These incidents are included and evaluated under routine release in accordance with Appendix I to 10CFR50 in Section 5.4.

7.1.1.2 Small Releases Outside Containment Class

These releases include releases from small spills or leaks of radioactive materials outside the containment. These releases are included and evaluated under routine releases in accordance with Appendix I to 10CFR50 in Section 5.4.

7.1.1.3 Radwaste System Failures Class

7.1.1.3.1 Equipment Leakage or Malfunction

The source for this event is the largest radioactive storage tank which would be a rupture of an off gas system charcoal delay bed. This would cause the release of 25 percent of the average inventory on the bed. The source of activity for a bed is based upon the expected reactor coolant steam activities. The effective charcoal delay bed holdup time for krypton is 9.2 hr and for xenon is 211 hr. The duration of the accident is assumed to be 2 hr.

The calculated dose at the exclusion area boundary is given in Table 7.1-2. The integrated dose to the population is given in Table 7.1-3.

7.1.1.3.2 Release of Waste Gas Storage Tank Contents

This event is similar to the previous accident with the exception that 100 percent of the bed inventory is released to the atmosphere.

The calculated dose at the exclusion area boundary is given in Table 7.1-2. The integrated dose to the population is given in Table 7.1-3.

CHAPTER 8

THE NEED FOR THE PLANT

On March 26, 1982 the Nuclear Regulatory Commission (NRC) amended its regulations in 10CFR Part 51 to provide that, for National Environmental Policy Act (NEPA) purposes, need for power issues need not be addressed by applicants for operating licenses for nuclear power plants in environment reports to the NRC. 4

10.4 BENEFIT-COST BALANCE

10.4.1 Benefits

10.4.1.1 Direct Benefits

The primary benefit of River Bend Station is the generation of electric power to meet the growing demand in the Gulf States system. This project will produce approximately 12.88 billion kWh/yr which will go to residential, industrial, and commercial customers throughout the service area. 4

10.4.1.2 Indirect Benefits

Benefits incident to the construction and operation of the project are mainly economic in nature, such as payment of taxes, increased employment, and money spent in Louisiana and other parts of the country for engineering, materials, and fuel processing. All of these benefits are presented in Sections 4.4.2 and 5.8.2.

Other benefits incident to the construction and operation of the project include the following.

The extensive biological studies which have been completed or are under way are adding to the present knowledge of the biota of the Lower Mississippi River. These studies which are being conducted by Louisiana State University are discussed in detail in several sections of this report.

Similar extensive studies of the geology, hydrology, archaeology, and meteorology of the area have already contributed significantly to man's knowledge of the environment.

The facility will contribute to tourism. The operation of the visitors center will attract visitors. This will have the positive effect of increasing the exposure of the already existing tourist attractions discussed in Section 2.5.3. Positive steps will be taken to acquaint visitors to the site with these other tourist attractions.

Gulf States proposes to construct an outdoor classroom and a nature trail which, along with the Wildlife Management Lake, will be used for educational purposes.

10.4.2 Costs

10.4.2.1 Direct Costs

The cost to construct River Bend Station - Unit 1 and common facilities is estimated to be $2.3 billion. The estimated annual cost to operate Unit 1 for the first 5 yr, including interest on investment, overhead, taxes, depreciation and other operating maintenance, insurance and full costs are as follows:

<u>Annual Cost of Operation</u>

1984 (8 mo.)	321,200,000
1985	471,768,000
1986	463,277,000
1987	458,092,000
1988	455,454,000
1989 (4 mo.)	151,490,000

For the first full year (1985) of commercial operation, a breakdown of the total estimated operational costs is as follows:

1

	$	mils/kWh
Fixed Costs	377,829,000	68.0
Nuclear Fuel	58,910,000	10.6
Operations and Maintenance	35,029,000	6.3
Total	471,768,000	85 mils/kWh

Decommissioning costs for Unit 1 are estimated to be approximately $47 million, as described in Section 5.9.2.

10.4.2.2 Indirect Costs

The indirect costs due to environmental impacts summarized in previous sections of this chapter, while difficult to quantify, have been investigated and are believed not to be significant when compared to the benefits derived from the project.