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FPL

Lauderdale Repowering Project

Site Certification Application

Volume 1

Chapters 1-9

Submitted By:

FPL

an FPL Group Company

State of Florida
DEPARTMENT OF ENVIRONMENTAL REGULATION

For Routing To Other Than The Addressee	
To:	Location:
To:	Location:
To:	Location:
From:	Date:

Interoffice Memorandum

TO: Power Plant Siting Review Committee

FROM: Buck Oven

DATE: November 6, 1989

SUBJECT: FPL Ft. Lauderdale - Power Plant Siting Application PA 89-26, Module No. 8182

Attached please find a copy of the above referenced application for the Ft. Lauderdale repowering application as submitted by FPL on November 29. Please review the application for completeness by December 12, 1989, and sumit any requests for additional data to me. For those of you in Tallahassee, please attend a brief meeting with me on this project on December 12th at 9:00 a.m. in room 338 D. FPL is planning to visit the Department on December 14th at 10:30 p.m. in 330D to discuss this project with us. Please submit any requests for curing insufficient information for this project to me by January 31, 1990.

Attachment

FPL

P. O. Box 078768, West Palm Beach, FL 33407-0768
6001 Village Blvd.

November 27, 1989

Hamilton S. Oven, Jr., P.E., Administrator
Bureau of Air Resources Management
Department of Environmental Regulation
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Re: Lauderdale Repowering Project
Application for Site Certification

Dear Mr. Oven:

Florida Power & Light Company (FPL) herewith submits to the Department forty-five (45) copies of its Application for Site Certification (SCA) for the Lauderdale Repowering Project, pursuant to the Florida Electrical Power Plant Siting Act and Florida Administrative Code Rule 17-17.051(1)(d). Also enclosed is FPL Check No. 80746, made payable to the Department in the amount of $30,000.00 and provided as the application fee pursuant to Florida Administrative Code Rule 17-17.051(2).

The SCA addresses the environmental and socioeconomic aspects of the Lauderdale Repowering Project by presenting information in accordance with the Department's "Instruction Guide for Certification Application", DER Form 17-1.211(1). The scope, quantity and specificity of information supplied in the SCA conforms to the binding written agreement entered into between FPL and the Department on May 25, 1989, following review of FPL's proposed Plan of Study by state, regional and local agencies. Consistent with the Plan of Study, the primary focus of the SCA is upon changes to the Lauderdale Plant site and concomitant changes in environmental impacts resulting from the Repowering Project.

FPL looks forward to working with the Department and other interested agencies in the certification process.

Sincerely,

C. D. Henderson

Charles D. Henderson
Manager
Environmental Technical Services

CDH:ku

Enclosure

P.O. Box 078768, West Palm Beach, FL 33407-0768
6001 Village Blvd.

FPL

March 20, 1990

Hamilton S. Oven, Jr., P.E., Administrator
Bureau of Air Resources Management
Department of Environmental Regulation
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Re: Lauderdale Repowering Project Site Certification Application (SCA);
Errata 1 for Volumes 1 and 2

Dear Mr. Oven:

Attached is the Errata for the above referenced SCA which was submitted to you November 29, 1989. The errata pages have corrected inadvertent errors and typographical mistakes contained in the original submittal. The errata package includes instruction sheets which detail all corrections as well as replacement pages. To update your copy of the SCA, substitute the replacement pages from the errata package and destroy the original pages.

FPL is distributing the errata package to all recipients of the SCA. For tracking purposes, it is recommended that you file this letter at the beginning of Volume 1 (following the original transmittal letter dated November 27, 1989).

Sincerely,

Sheppard N. Moore

Sheppard N. Moore
Senior Coordinator
Environmental Affairs

SNM:ds

Enclosure

cc: All recipients of SCA (enclosure)

APPLICANT INFORMATION

Applicant's Official Name: Florida Power & Light Company

Address: P.O. Box 078768 West Palm Beach, FL 33407-0768

Address of Official Headquarters: 9250 West Flagler Street, Miami, FL 33102

Business Entity (corporation, partnership, co-operative): Corporation

Name of Project: Lauderdale Repowering Project

Name and Title of Chief Executive Officer: R.E. Tallon, President, Chief Operating Officer

Name, Address, and Phone Number of Official Representative responsible for obtaining certification: Charles D. Henderson, P.E., P.O. Box 078768, West Palm Beach, Florida 33407-0768 (407) 640-2060
Mr. Sheppard N. Moore (Alternate) (407) 640-2055

Site Location (county): Broward County

Site Address: SW 42nd Street; 2 miles west of Ravenswood Road, Fort Lauderdale, Florida 33314

Nearest Incorporated City: Hollywood

Latitude and Longitude: 26°4'5"N. 80°11'54"W.

UTM's Northerly 2,883,300
Easterly 580,200

Section, Township, Range: Sections 19, 20, and 30 of Township 50 S and Range 42 E Section 25 Township 50 S Range 41 E

Location of any directly associated transmission facilities (counties):
No off-site transmission facilities required

Name Plate Generating Capacity: 960 MW (Gross winter)

Capacity of Proposed Additions and Ultimate Site Capacity (where applicable): Not applicable

LIST OF ORGANIZATIONS THAT PARTICIPATED IN THE PREPARATION OF THE SCA

Florida Power and Light Company

Juno Beach, West Palm Beach, Fort Lauderdale, and Miami, Florida

- Overall SCA Management and Direction

KBN Engineering and Applied Sciences, Inc.

Gainesville and Tampa, Florida

- Overall Environmental Contractor

Applied Technology and Management, Inc.

Gainesville, Florida

- Surface Water Resources Subcontractor

Hunter Environmental Services, Inc.

Gainesville and Tampa, Florida

- Subcontractor for Portions of Surface Water Resources, Ambient Air Monitoring, Geohydrology, and Socioeconomics

Ebasco Services Incorporated

Atlanta, Georgia

- Engineering Contractor

Hopping Boyd Green & Sams

Tallahassee, Florida

- Environmental Attorneys for Florida Power and Light Company

Keith and Schnars, P.A.

Fort Lauderdale, Florida

- Subcontractor Reviewer for Socioeconomic Elements of SCA

Huebner and Murray

Fort Lauderdale, Florida

- Attorneys Coordinating with Local Governments

SITE CERTIFICATION APPLICATION
FOR
LAUDERDALE REPOWERING PROJECT

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TABLE OF CONTENTS

CHAPTER 1.0

CHAPTER 2.0

TABLE OF CONTENTS
(Continued)

TABLE OF CONTENTS
(Continued)

CHAPTER 3.0

TABLE OF CONTENTS
(Continued)

TABLE OF CONTENTS
(Continued)

TABLE OF CONTENTS
(Continued)

CHAPTER 4.0

TABLE OF CONTENTS
(Continued)

CHAPTER 5.0

TABLE OF CONTENTS
(Continued)

TABLE OF CONTENTS
(Continued)

CHAPTER 6.0

TABLE OF CONTENTS
(Continued)

CHAPTER 7.0

CHAPTER 8.0

TABLE OF CONTENTS
(Continued)

CHAPTER 9.0

CHAPTER 10.0

LIST OF TABLES

LIST OF TABLES
(Continued)

LIST OF TABLES
(Continued)

LIST OF TABLES
(Continued)

LIST OF TABLES
(Continued)

LIST OF TABLES
(Continued)

LIST OF TABLES
(Continued)

LIST OF TABLES
(Continued)

LIST OF FIGURES

LIST OF FIGURES
(Continued)

LIST OF FIGURES
(Continued)

LIST OF FIGURES
(Continued)

LIST OF FIGURES
(Continued)

LIST OF ACRONYMS AND ABBREVIATIONS

AADT	average annual daily traffic
AAQS	Ambient Air Quality Standards
ANSI	American National Standard Institute
APIS	air pollutant inventory system
AQRV	air quality related value
ASTM	American Society for Testing Materials
BACT	best available control technology
BAQM	Bureau of Air Quality Management
BCC	Broward County Code
BCEQCB	Broward County Environmental Quality Control Board
BDL	below detection limits
BOD_5	five-day biochemical oxygen demand
BOR	Basis of Review for Surface Water Management Permit Applications within the South Florida Water Management District
BPT	best practicable control technology
Btu/hr	British thermal unit per hour
Btu/kW-hr	British thermal unit per kilowatt-hour
Btu/ft^3	British thermal units per cubic foot
$Ca(OH)_2$	calcium hydroxide
CAA	Clean Air Act
$CaCO_3$	calcium carbonate
CARL	conservation and recreation lands
CFR	Code of Federal Regulations
cfs	cubic feet per second
cm/sec	centimeters per second
cm	centimeters
CNEL	community noise equivalent level
CNR	composite noise rating
CO	carbon monoxide
COD	chemical oxygen demand
CT	combustion turbine
CWP	circulating water pump
°C	degrees Celsius
dB	decibel
dBA	A-weighted decibels
DHR	Florida Department of State, Division of Historical Resources
DO	dissolved oxygen
DRI	development of regional impact
EM	electromagnetic conductivity
EP	evaporation pond
EPA	U.S. Environmental Protection Agency
EPP	evaporation percolation pond
F.A.C.	Florida Administrative Code
FAA	Federal Aviation Administration
FDA	Florida Department of Agriculture

LIST OF ACRONYMS AND ABBREVIATIONS
(Continued)

FDER	Florida Department of Environmental Regulation
FDNR	Florida Department of Natural Resources
FDOT	Florida Department of Transportation
FDPR	Florida Department of Professional Regulation
FERC	Federal Energy Regulatory Commission
FGD	flue gas desulfurization
FGFWFC	Florida Game and Fresh Water Fish Commission
FGT	Florida Gas Transmission Company
FLUCFCS	Florida land use, cover, and forms classification system
FNAI	Florida Natural Areas Inventory
FPL	Florida Power & Light
FPSC	Florida Public Service Commission
FR	Federal Register
F.S.	Florida Statutes
ft/min	feet per minute
ft/ft	feet per foot
ft/day	feet per day
ft	feet
ft/yr	feet per year
ft/sec	feet per second
ft^3	cubic feet
ft^3/hour	cubic feet per hour
°F	degrees Fahrenlheit
GEP	good engineering practice
gpd/ft^3	gallons per day per cubic foot
gpd/ft^2	gallons per day per square foot
gpm	gallons per minute
gpm/ft^2	gallons per minute per square foot
GT	gas turbine
H_2NNH	hydrazine
H_2SO_4	sulfuric acid
HBW	home base work
HCM	Highway Capacity Manual
HHV	high heating value
HRSG	heat recovery steam generators
HUD	Housing and Urban Development
HX	heat exchangers
Hz	hertz
I-95	Interstate 95
JTU	Jackson turbidity units
km	kilometers
kV	kilovolt
kWh	kilowatt-hour
lb	pounds
lb/hr	pounds per hour
lb/ft^2/day	pounds per square foot per day
lb/ft^2	pounds per square foot

LIST OF ACRONYMS AND ABBREVIATIONS
(Continued)

L_{dn}	twenty-four-hour average sound pressure level calculated for two daily time periods
L_{eq}	equivalent sound pressure level averaged over measurement period
L_{np}	noise pollution level
LOLP	loss-of-load probability
LOS	level of service
LPIL	lowest practical identification level
LTSA	long-term stability additive
m	meters
m^3	cubic meters
mg/m^3	milligrams per cubic meter
mg/l	milligrams per liter
mgd	million gallons per day
mgd/ft	million gallons per day per foot
mgy	million gallons per year
mL/kg	milliliters per kilogram
mm	millimeters
mph	miles per hour
msl	mean sea level
MW	megawatt
NAAQS	National Ambient Air Quality Standards
NaOH	sodium hydroxide
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NGVD	National Geodetic Vertical Datum--1923
NH_3	ammonia
NO_2	nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NO_x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NSPS	New Source Performance Standard
NTU	Nephelometric turbidity units
NWS	National Weather Service
NYDPS	New York Department of Public Service
O&M	operating and maintenance
O_2	oxygen
OCWP	open cooling water pump
OSHA	Occupational Safety and Health Administration
PCB	polychlorinated biphenol
PM	particulate matter
POD	point of discharge
POS	plan of study
POTW	publicly owned treatment works
ppm	parts per million
ppmvd	parts per million by volume, dry weight
ppmvw	parts per million by volume, wet weight
PPSA	preferred speech interference level
ppt	parts per thousand

LIST OF ACRONYMS AND ABBREVIATIONS
(Continued)

PSD	Prevention of Significant Deterioration
psig	pounds per square inch gauge
PVC	polyvinyl chlorides
QF	qualified facilities
RARE	roadless area review and evaluation
RBW	receiving body of water
RIMS II	Regional Input-Output Modeling System
RO	reverse osmosis
SBCRRP	South Broward County Resource Recovery Project
SCA	Site Certification Application
scf	standard cubic feet
SCR	selective catalytic reduction
SELS	severe local storms
SF	supplementary firing
SFWMD	South Florida Water Management District
SO_2	sulfur dioxide
SPCC	spill prevention, control, and countermeasure
SPL	sound pressure levels
SPT	standard penetration tests
SR	State Road
SRCP	slant rib coalescer pack
SSB	solid settling basins
SSB/EPP	solids settling basin/evaporation percolation pond
SWMM	storm water management model
TDS	total dissolved solids
TETF	totally enclosed treatment facility
TOC	total organic carbon
TON	threshold odor number
TPY	tons per year
TSP	total suspended particulates
TSS	total suspended solids
$\mu g/m^3$	micrograms per cubic meter
$\mu g/L$	micrograms per liter
μm	micrometers
UHC	unburned hydrocarbon
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USGS	United States Geological Survey
VOC	volatile organic compounds
yd^3	cubic yards

Chapter 1

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Lauderdale Repowering Project

Site Certification Application

Chapter 1

Need For Power And The Proposed Facilities

TABLE OF CONTENTS

1.0 NEED FOR POWER AND THE PROPOSED FACILITIES

1.1 INTRODUCTION

Florida Power & Light Company (FPL) proposes to repower two electrical generating units at its Lauderdale Plant site located in Broward County, Florida. Repowering will consist of replacing two existing steam generators with advanced combustion turbines (CTs) and heat recovery steam generators (HRSGs). By repowering these units, FPL will increase the electrical generating capacity of its Lauderdale Plant site by up to 680 MW using economical, fuel-efficient generating units while minimizing environmental impacts to the site and the surrounding area.

FPL is seeking approval for this repowering project under the Florida Electrical Power Plant Siting Act (PPSA), Chapter 403, Part II, Florida Statutes (F.S.). The PPSA provides a centralized review process for new electrical generating facilities in Florida, involving a balancing of "the increasing demand for electrical power plants with the broad interests of the public," including human health, the environment, state waters, and wildlife. Under the PPSA, the Florida Public Service Commission (FPSC) is the sole forum for the determination of need for a proposed facility. The Florida Department of Environmental Regulation (FDER) acts as the coordinator for the remainder of the certification process, with input from various state, regional, and local agencies and ultimate disposition by the governor and cabinet sitting as the Siting Board.

FPL submitted a Petition to Determine Need for Electrical Power Plant--Lauderdale Repowering Project to FPSC on July 25, 1989. A copy of that petition is provided in Appendix 10.6 of this application. The petition, along with supporting documentation, addresses the manner in which the Lauderdale Repowering Project and other new generating facilities proposed by FPL will meet the need for electric system reliability, integrity, and adequacy at a reasonable cost and be the most cost-effective alternatives available. These documents supporting the need petition were prepared prior to completion of detailed engineering of the Lauderdale Repowering Project, and certain information contained therein (e.g., unit capacity, unit heat rates, total inservice costs, capital costs) differs somewhat from the information, based upon more detailed engineering, presented in Chapters 2.0 through 7.0 of this application. The FPSC has scheduled a hearing in the Repowering Project need proceeding for March 21 through 23, 1990.

This Site Certification Application (SCA) is being filed with FDER pursuant to Chapter 17-17, Florida Administrative Code (F.A.C.). It addresses the environmental and socioeconomic aspects of the Lauderdale Repowering Project by presenting information on the existing natural and human environment, on the generating facilities proposed to be constructed and operated, and on the impacts of those facilities on those environments. The SCA fulfills the provisions of a binding written agreement between FPL and FDER, executed on May 25, 1989, which established the scope, quantity, and specificity of information to be supplied by FPL in this application. That agreement was entered into pursuant to Section 403.5063, F.S. and Chapter 17-17.041, F.A.C., following review of FPL's proposed Plan of Study for this SCA by state, regional, and local agencies. In accordance with the Plan of Study, the primary focus of the SCA is upon changes to the Lauderdale Plant site and concomitant increases in environmental impacts resulting from the Lauderdale Repowering Project.

1.2 THE APPLICANT

FPL, the largest electric utility in Florida and the fourth largest investor-owned utility in the nation, has seen significant growth in the number of customers and demand for electricity in the past ten years. FPL's service territory encompasses 35 Florida counties (27,650 square miles) that include 12 generating plants and more than 51,500 miles of transmission and distribution lines. In the coming decade, FPL expects to see the demand for electricity grow steadily, with the number of customers served increasing from the present 2.9 million to 4.1 million by the end of 1998. More than 70 percent of FPL's electrical demand is located in southeast Florida.

1.3 OVERVIEW OF THE LAUDERDALE REPOWERING PROJECT

The Lauderdale Plant has supplied reliable electrical energy to FPL's residential, commercial, and industrial customers in South Florida since the mid-1920s. This facility, which is located about 1 mile west of Interstate 95 and one-half mile north of Griffin Road in the unincorporated area of Broward County, has grown over the years through the addition of new units to meet the increasing electrical demand in the area. As part of FPL's energy management plans to meet the continued demand for electrical energy in southeast Florida counties, an innovative approach called repowering will be undertaken at the Lauderdale site.

The Lauderdale Plant site occupies 392 acres and currently consists of two steam electric units (Units 4 and 5) and 24 gas turbines. Both the steam electric units and the gas turbines use natural gas and oil as fuels. About 185 acres of the plant site comprise a cooling canal/pond system serving the existing steam electric units. Currently, the site has a total net winter generating capability of 1,248 megawatt (MW).

Repowering of Units 4 and 5 consists of replacing the existing steam generators, which produce steam for electrical generation, with CTs and HRSGs. The CTs, similar to but larger and more efficient than traditional jet engines, will produce electrical energy by direct connection to an electric generator. Natural gas and light oil will be used as fuels for the CTs. The exhaust from the CTs, which would otherwise be wasted energy released to the atmosphere, will instead be routed through the HRSGs to produce steam for the existing electric generators, thereby replacing the need for the existing boilers in Units 4 and 5. The repowered units will be the most efficient in the FPL system, producing an additional 570 MW (net summer) to 680 MW (net winter), sufficient to supply the electrical needs of about 380,000 residential customers.

The Lauderdale site was selected for repowering because it is centrally located in relation to the increasing electrical demand occurring in south Florida and to FPL's transmission system. In addition, the size of the existing steam units is compatible with commercially available CT and HRSG equipment and the Lauderdale Plant site has sufficient land area and infrastructure to accommodate the repowered configuration.

By repowering an existing plant site, environmental impacts will be significantly minimized. No new off-site transmission lines or rights-of-way are required to serve the repowered units. No new off-site fuel supply lines or rights-of-way will be required. The current use of heavy oil in Units 4 and 5 will be discontinued once the repowered units are in operation and replaced by natural gas and lighter fuel oil. The existing cooling canal/pond system will continue to be used to cool thermal discharges from the plant. Consumptive use of, and discharge to groundwater will be reduced for plant operation. Only a small portion of the site that is currently undeveloped will be permanently used to accommodate the repowered units. No new roads are required to serve the new facilities. Few additional employees will be required to operate the repowered plant.

1.4 NEED FOR THE PROJECT

FPL has identified a need to construct approximately 2,000 MW of new generating capacity on its system between 1993 and 1997. This capacity is needed to maintain adequate system reliability in the face of increasing demand for electrical energy coupled with declining power purchases from the Southern Companies.

The series of unit additions identified by FPL to meet new demand reflects the need for new generating capacity that remains after implementation of all reasonably available, cost effective alternatives to new construction. These alternatives, which total over 3,000 MW, include:

1. Incremental conservation,
2. Load management and interruptible load,
3. Firm purchases from qualifying facilities, and
4. Power purchases from the Southern Companies.

FPL's determination of these new capacity needs results from its ongoing power supply planning process. FPL experienced an average compound annual growth in summer peak demand of approximately 4.0 percent for the period 1978 through 1988. That demand is projected to continue to grow at a rate of approximately 2.4 percent per year over the next two decades. At the same time, power purchases from the Southern Companies will decline to an annual average of 900 MW in the mid-1990s, down from the current level of 2,000 MW.

FPL's reliability analysis shows that in order to meet its dual reliability target of less than 0.1 day/year assisted loss-of-load probability (LOLP) and generation reserves of 15 percent or greater based on summer peak demand, FPL would require, in the absence of other measures, additional capacity resources beginning in 1992, totaling over 5,000 MW by the year 1997.

In assessing the need for the Lauderdale Repowering Project and other new capacity requirements, FPL analyzed its generating needs by first assuming that all of the incremental demand for electricity would have to be met by new generating units to be constructed by FPL. This analysis resulted in a Reference Plan in which FPL's total capacity need was to be met by the addition of over 4,400 MW of additional generation between 1992 and 1996, in addition to 505 MW of contracted firm qualified facilities (QFs).

FPL then conducted an economic and strategic analysis of demand-side and power purchase alternatives to determine how much of this new construction could be avoided by incremental conservation, load management, interruptible load, potential qualifying facilities, and the recently concluded power purchase agreement with the Southern Companies. This analysis showed that these alternatives to FPL's construction of new generating facilities would defer the first capacity addition from 1992 to 1993 and would reduce the total amount of new capacity needed through 1997 from over 4,400 MW to approximately 2,000 MW.

This analysis resulted in the development of the Base Plan, consisting of the Lauderdale Repowering Project and the separate Martin expansion project. The economics of the Base Plan were then compared to the economics of other combinations of unit additions to verify that it was the optimum plan for filling the capacity requirements to be met by new construction. The various combinations of unit additions were tested under a number of scenarios and sensitivities designed to determine their flexibility under changing conditions, including changes in fuel price and availability, peak demand forecasts, and economy energy availability.

The Base Plan, which includes the Lauderdale Repowering Project, was found to be the optimum power supply expansion plan. The unit additions in this plan provide a flexible, cost-effective approach to meeting the future needs of FPL's customers. In combination with the other demand and supply-side alternatives discussed previously, this plan represents significant savings compared to a plan based on new construction alone to meet the projected increased demand for electricity.

1.5 BENEFITS OF THE REPOWERING PROJECT

The principal benefits of the Lauderdale Repowering Project will be those inherent in the increased capacity and efficiency in the production of electrical energy which the project provides to FPL's customers. In addition to improving the efficiency of existing generating capacity by over 20 percent, the repowered units will retain dual fuel capability, providing fuel supply flexibility into the future.

Along with supplying electricity in an efficient, flexible manner, the Lauderdale Repowering Project will contribute to both the public and private sector economies. The project will generate new direct and indirect jobs during both construction and operation of the units. The local economy will benefit by local purchases of services, supplies, and materials by FPL and its employees. The public sector will benefit by the Project's addition to the local tax base which will generate additional funds to local governments. These additional public sector revenues will exceed the additional public sector costs, thereby making the Lauderdale Repowering Project a net revenue source for local and state governments.

TABLE OF CONTENTS

TABLE OF CONTENTS
(Continued)

TABLE OF CONTENTS
(Continued)

LIST OF TABLES

LIST OF TABLES
(Continued)

LIST OF TABLES
(Continued)

LIST OF TABLES
(Continued)

LIST OF TABLES
(Continued)

LIST OF FIGURES

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(Continued)

LIST OF FIGURES
(Continued)

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Lauderdale Repowering Project

Site Certification Application

Chapter 2

Site And Vicinity Characterization

Chapter 2

2.0 SITE AND VICINITY CHARACTERIZATION

2.1 SITE AND ASSOCIATED FACILITIES DELINEATION

2.1.1 Site Location

The site for the Lauderdale Repowering Project is the existing Lauderdale Plant site, which is currently located in unincorporated eastern Broward County (Figures 2.1-1 and 2.1-2). A portion of the site is in the process of being annexed into the City of Hollywood (see Section 2.2.1.1). The plant site lies about 1 mile east of the Florida Turnpike and 1 mile west of Interstate 95 (I-95). The Fort Lauderdale-Hollywood International Airport is immediately east of I-95. State Road 84 and I-595, which is under construction, are north of the plant site. Griffin Road is about one-half of a mile south of the site.

2.1.2 Existing Site Uses

Electric generating units have been operating at this site since the 1920s. The two original generating units and a third unit placed in service in 1941 have been retired. Currently, the FPL Lauderdale Plant consists of two fossil-fuel-fired steam units and 24 gas turbine (GT) units with a total plant net summer capability of 1,126 MW and a total plant net winter capability of 1,248 MW. The fossil-fuel-fired steam units, Units 4 and 5, have a combined net summer generating capability of 274 MW and a net winter capability of 276 MW. These units are designed to burn natural gas and/or oil. Units 4 and 5 have been operational since 1957 and 1958, respectively.

The Lauderdale Plant site occupies 392 acres south of the South New River Canal and north of the Dania Cut-Off Canal (Figures 2.1-3 and 2.1-4). Approximately one-half of this site is occupied by a cooling canal/pond system which discharges to the South Fork New River near the northeast corner of the site. The existing intakes for the fossil-fuel-fired steam electric generating units are located on the Dania Cut-Off Canal. Transmission linkage is via 69, 138, and 230 kilovolt (kV) connections. Plant access is through Griffin Road and SW 42nd Avenue. Construction access is by Edgewater Road (i.e., SW 42nd Street).

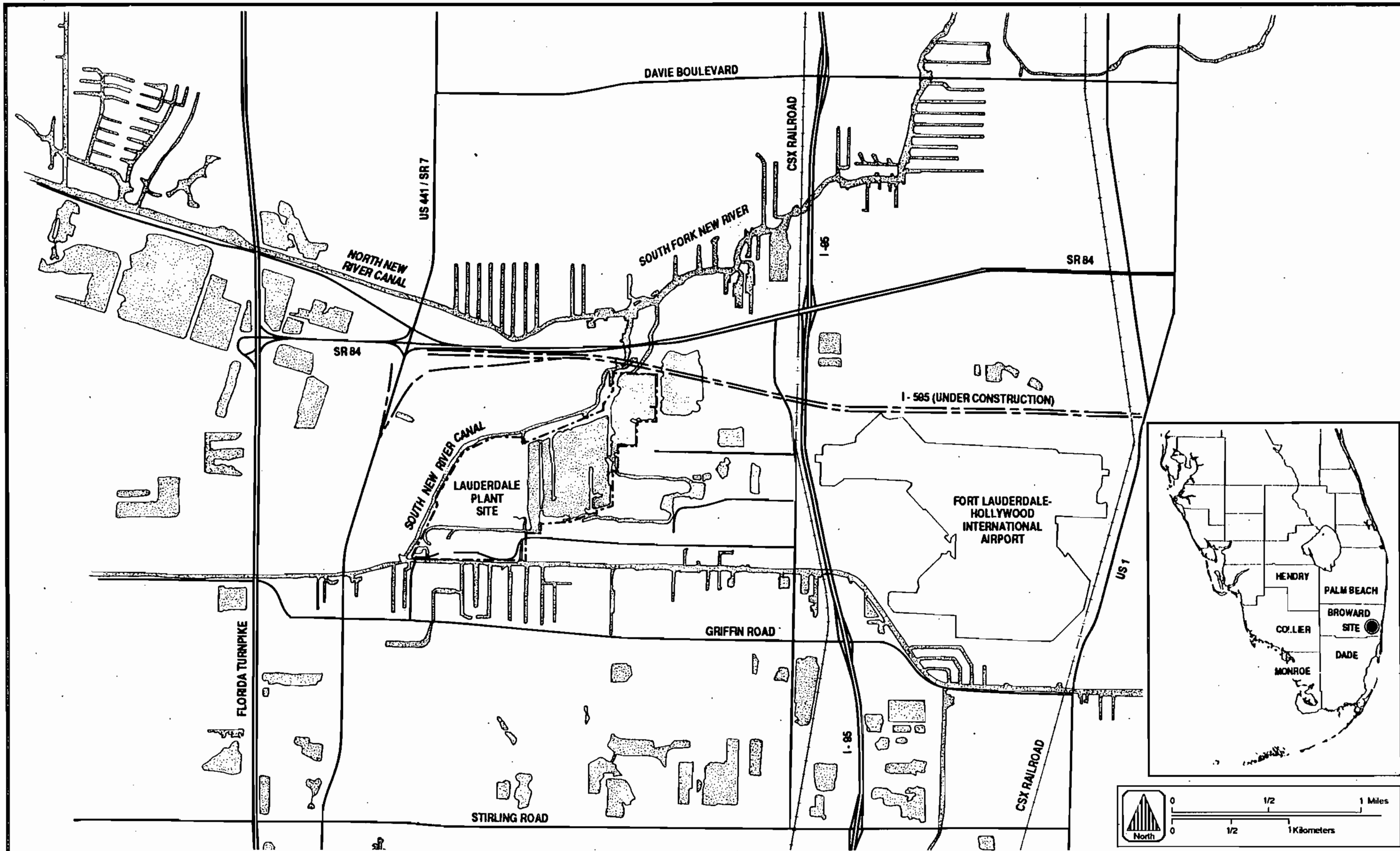

Figure 2.1-1 SITE LOCATION MAP

Lauderdale Repowering Project

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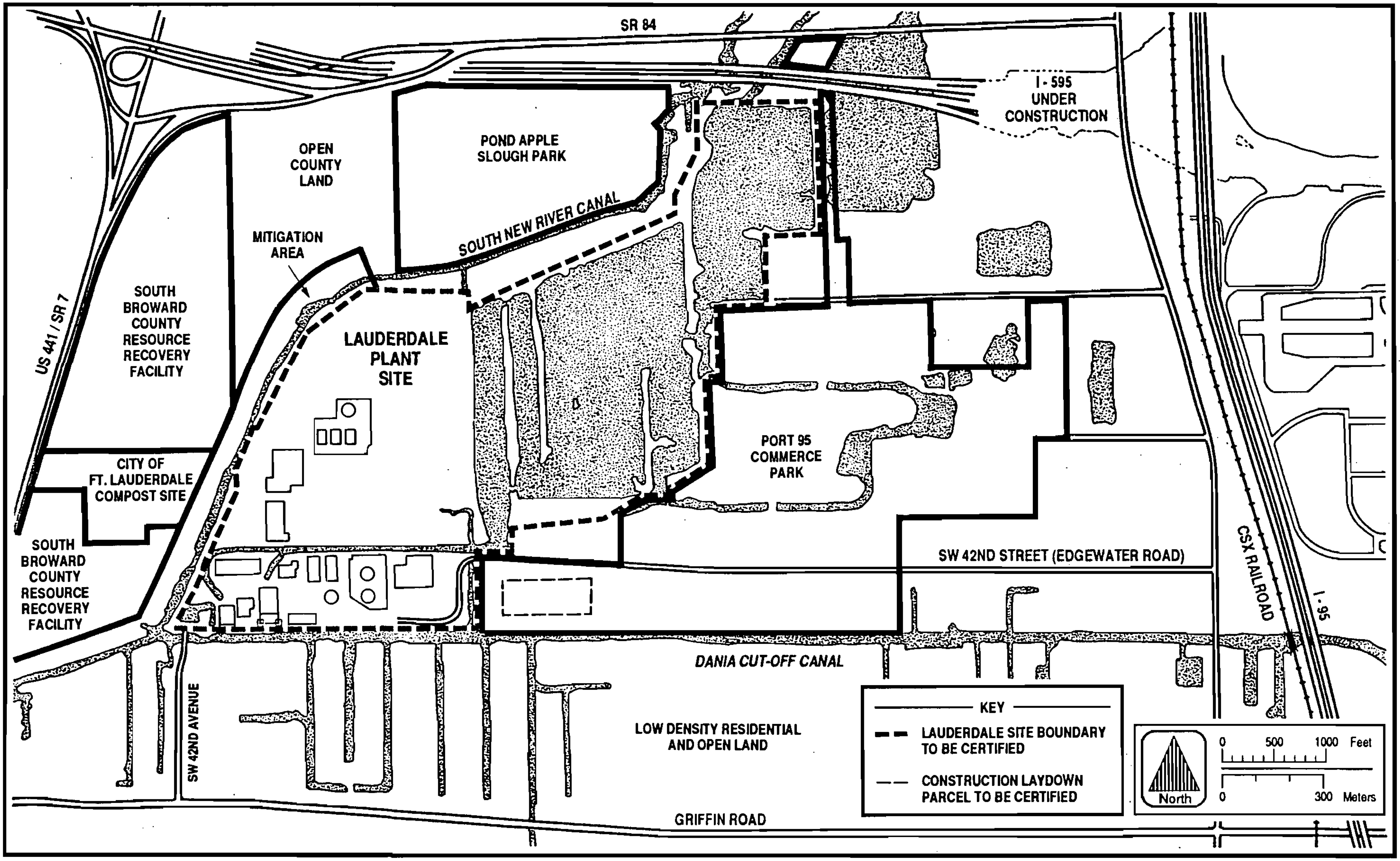

Figure 2.1-2 LAUDERDALE PLANT SITE, VICINITY AND ADJACENT PROPERTIES

Lauderdale Repowering Project

FPL

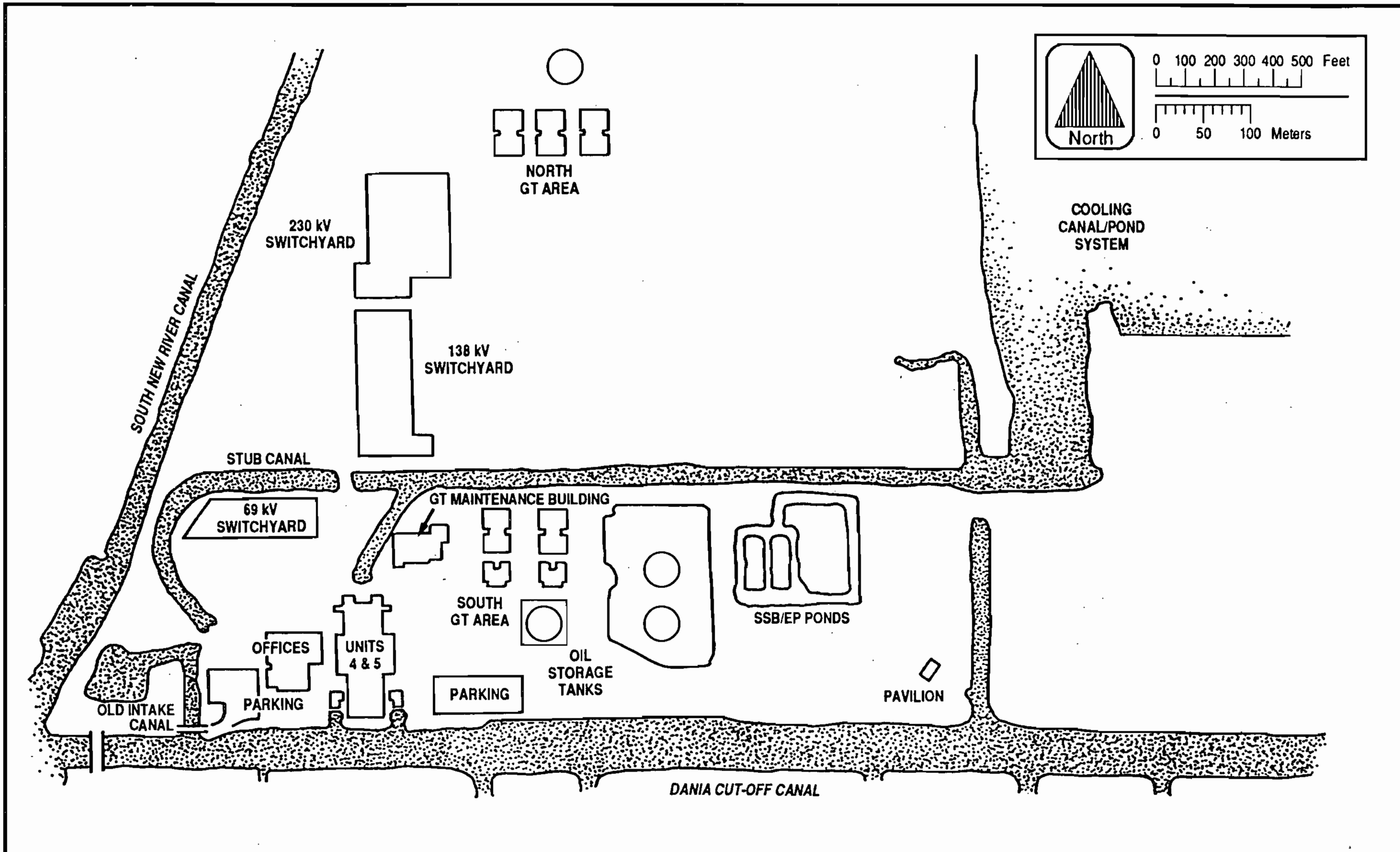

Figure 2.1-3 LAUDERDALE PLANT SITE — MAJOR EXISTING USES

Lauderdale Repowering Project

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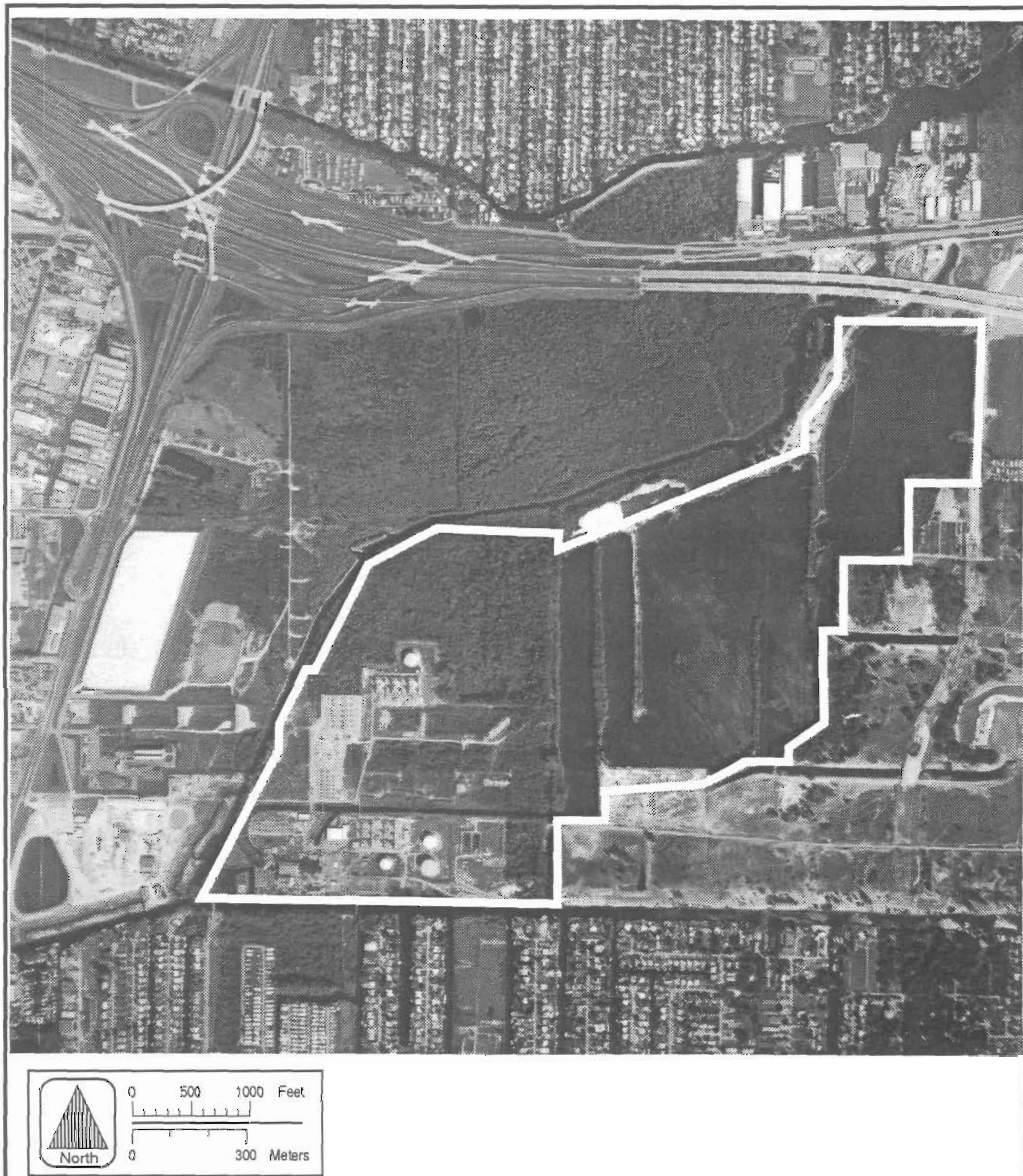

Figure 2.1-4 AERIAL OF LAUDERDALE PLANT SITE AND SURROUNDING VICINITY

Lauderdale Repowering Project

FPL

The site is currently served by an existing natural gas pipeline and a light-oil pipeline from Port Everglades. When required, No. 6 oil is delivered by tank truck.

In addition to the area occupied by the cooling canal/pond system, existing facilities occupy about 25 acres as follows:

Facility	Acres
Units 4 and 5, associated facilities and offices	5.5
South GT area and shops	3.1
North GT area	4.5
69, 138, & 230 kV substation yards	3.2
Tank area	3.6
Parking	1.8
Solid Settling Basins (SSBs)/Evaporation Ponds (EPs)	2.5
Employee Recreation Pavilion/Field	0.7

The remaining portions of the property are open fields or undeveloped; the undeveloped areas are located in the eastern portions of the property and north of the northern GT area.

Operation of the Lauderdale Plant currently is authorized under various environmental permits issued by federal, state, regional, and local regulatory agencies. These permits are identified in Table 2.1-1.

In addition to these permits, the FPL has right-of-way permits granted by the South Florida Water Management District (SFWMD). These permits are listed in Table 2.1-2.

2.1.3 Adjacent Properties

Adjacent properties in the general area are a mixture of residential, commercial, and industrial uses (see Figure 2.1-2). Property located west and northwest of the site is owned by the City of Fort Lauderdale and Broward County. The City of Fort Lauderdale operates a compost facility, and the South Broward County Resource Recovery Project (SBCRRP) and its

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2 NORTHSIDE 75
SUITE 235
ATLANTA, GEORGIA 30318
(404) 355-7800

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Table 2.1-1. Existing Environmental Permits for the Lauderdale Plant

Facility	Permit Number	Issuing Agency	Type of Permit	Effective Date	Expiration Date
Plant	FL0001503	EPA	NPDES	05/01/87	04/30/92
Unit 4	AO-06-146594	FDER	Air Operating	05/31/88	05/15/93
Unit 5	AO-06-143213	FDER	Air Operating	05/09/88	02/15/93
Units GT 1-12	AO-06-148760	FDER	Air Operating	08/05/89	06/30/93
Units GT 13-24	AO-06-148761	FDER	Air Operating	08/05/89	06/30/93
Plant	IO-06-158722	FDER	Industrial Wastewater	01/30/89	01/30/94
Plant	06-00503-W	SFWMD	Consumptive use--off-site wells	09/07/83	12/15/93
Unit 4	AO-42503R-1	BCEQCB	Air operating	12/04/87	12/31/89
Unit 5	AO-42503R-2	BCEQCB	Air operating	12/04/87	12/31/89
Units GT 1-12	AO-42503R-3 thru 15	BCEQCB	Air operating	12/04/87	12/31/89
Units GT 13-24	AO-42503R-16 thru 28	BCEQCB	Air operating	12/04/87	12/31/89
Plant	IWH-102-89	BCEQCB	Industrial wastewater, hazardous materials	02/25/89	03/10/90
Plant	0534	FDNR	Terminal facility	01/02/88	12/31/89

Note: BCEQCB = Broward County Environmental Quality Control Board
EPA = U.S. Environmental Protection Agency
FDNR = Florida Department of Natural Resources
NPDES = National Pollutant Discharge Elimination System

Table 2.1-2 Existing Right-of-Way Permits Granted by the SFWMD

Permit Number	Issue Date	Affected District Works	Purpose
1927-5	07/12/27	Dania Cut-Off Canal	Bridge
1939-4	08/15/39	Dania Cut-Off Canal	Tide gate
1941-22	01/31/41	South Fork New River	Supplementary intake canal, bridge and trash screen
482	12/20/55	Dania Cut-Off Canal	Construction of docks and portion of road
502	02/15/56	Dania Cut-Off Canal	Tide gate-move 1,600 ft from previous structures
532	06/08/56	Dania Cut-Off Canal	Intake canal
6564	07/22/76	Dania Cut-Off Canal	Seawall around tide gates
6720	07/18/77	South Fork New River	Replace bridge with culvert
7055	07/12/79	Dania Cut-Off Canal	Aerial messenger and control cable

Source: SFWMD, 1989.

associated landfill are being constructed. The proposed Pond Apple Slough Park (formerly referred to as the Ann Kolb Park) will be developed north of the Lauderdale Plant site.

A multi-use development, Port 95 Commerce Park, has been approved by the Broward County Commission Ordinance No. 88-82. This development is located directly east of the site and is currently being developed. Low-density residential and open land lie immediately south of the site.

2.1.4 Proposed Site Uses

The Lauderdale Repowering Project consists of replacing the existing Units 4 and 5 steam generators with CTs and HRSGs. The CTs exhaust through the HRSGs, producing steam in the HRSG to replace the steam-generating function of the existing units. The existing steam turbines, electric generators, and associated condenser cooling system will remain in service as part of the repowered units. The CTs and associated HRSGs will be located directly east of the existing Units 4 and 5. The existing condenser cooling water system, which draws brackish cooling water from the Dania Cut-Off Canal through intake structures, will be used. The water is cooled in a manmade canal/pond system and discharged to the South Fork New River. New stacks will be constructed for the repowered units, and the existing stacks and steam generators will be removed after the commercial operation of the repowered units begins. The areas of the site which will be permanently affected by the repowered facilities encompass about 15.6 acres and include:

Facility	Acres
Power Block	9.3
Water Treatment	1.1
Wastewater Treatment	1.5
Equalization Basin	3.0
Runoff Pond	0.7

Of the 15.6 acres affected by the repowered facilities, only about 2.8 acres currently are not affected by the existing plant. Figure 2.1-5 shows the areas affected by these facilities.

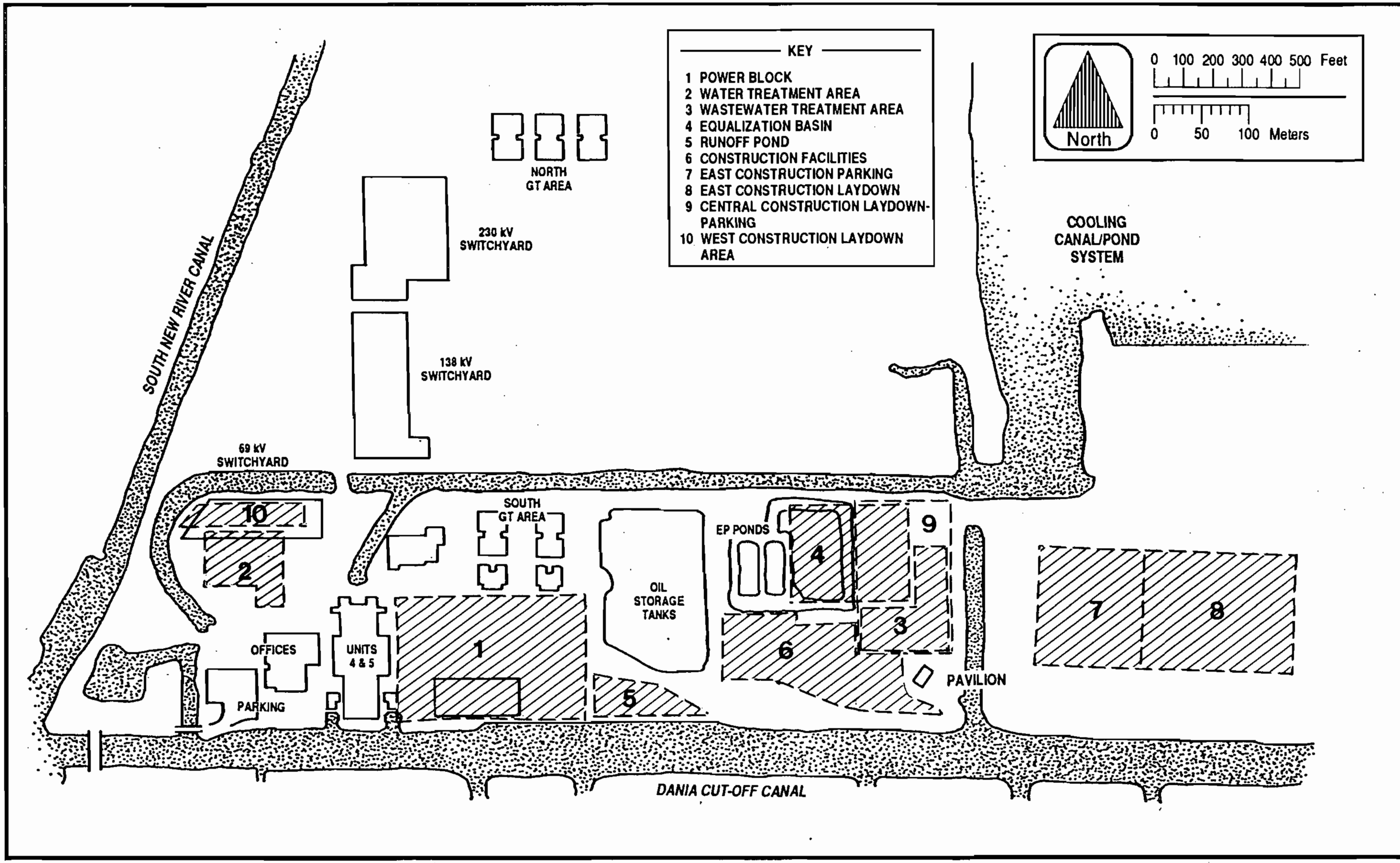


Figure 2.1-5 AREAS AFFECTED BY REPOWERING PROJECT

Lauderdale Repowering Project

FPL

The facilities that will be used exclusively for construction include about 12.6 acres:

Facility	Acres
West Construction Laydown	0.7
Construction Facilities	3.2
Central Construction Laydown and Parking	0.4*
East Construction Laydown	4.6
East Construction Parking	3.7

*Actual acreage will be 3.4 acres but 3 acres ultimately will be used for the wastewater treatment area and equalization basin.

Of this total acreage, only the area designated as the central construction laydown and parking area is not currently affected by existing development.

The repowered units will burn natural gas or No. 2 fuel oil. The use of No. 6 fuel oil will be discontinued.

No new offsite transmission corridors or substations will be required for the repowering project; however, in order to integrate the Lauderdale Repowering Project into the FPL transmission grid, the following on-site transmission improvements will be made:

1. Construct substation facilities (CT switchyards) to accept the output of the repowering CTs, and
2. Construct two transmission line connections from the CT switchyards to the 138 kV and 230 kV substations.

These transmission improvements will not impact any presently unaffected areas of the site.

2.1.5 100-Year Flood Zone

The elevation of the site ranges from 7 feet (ft) above mean sea level (msl) in the existing plant facility areas to less than 2 ft above msl in the undeveloped areas. The site and all adjoining properties within 1 mile of the site are located within the 100-year flood zone (Federal Emergency

Management Agency, 1987 and 1983; U.S. Department of Housing and Urban Development, 1978).

2.1.6 Property Delineation

Figure 2.1-6 presents a survey and legal description of the site. The east construction parking and laydown areas are on property owned by Alandco, the developer of the Port 95 Commerce Park. This land will be leased for the duration of the construction.

0110037

(1)

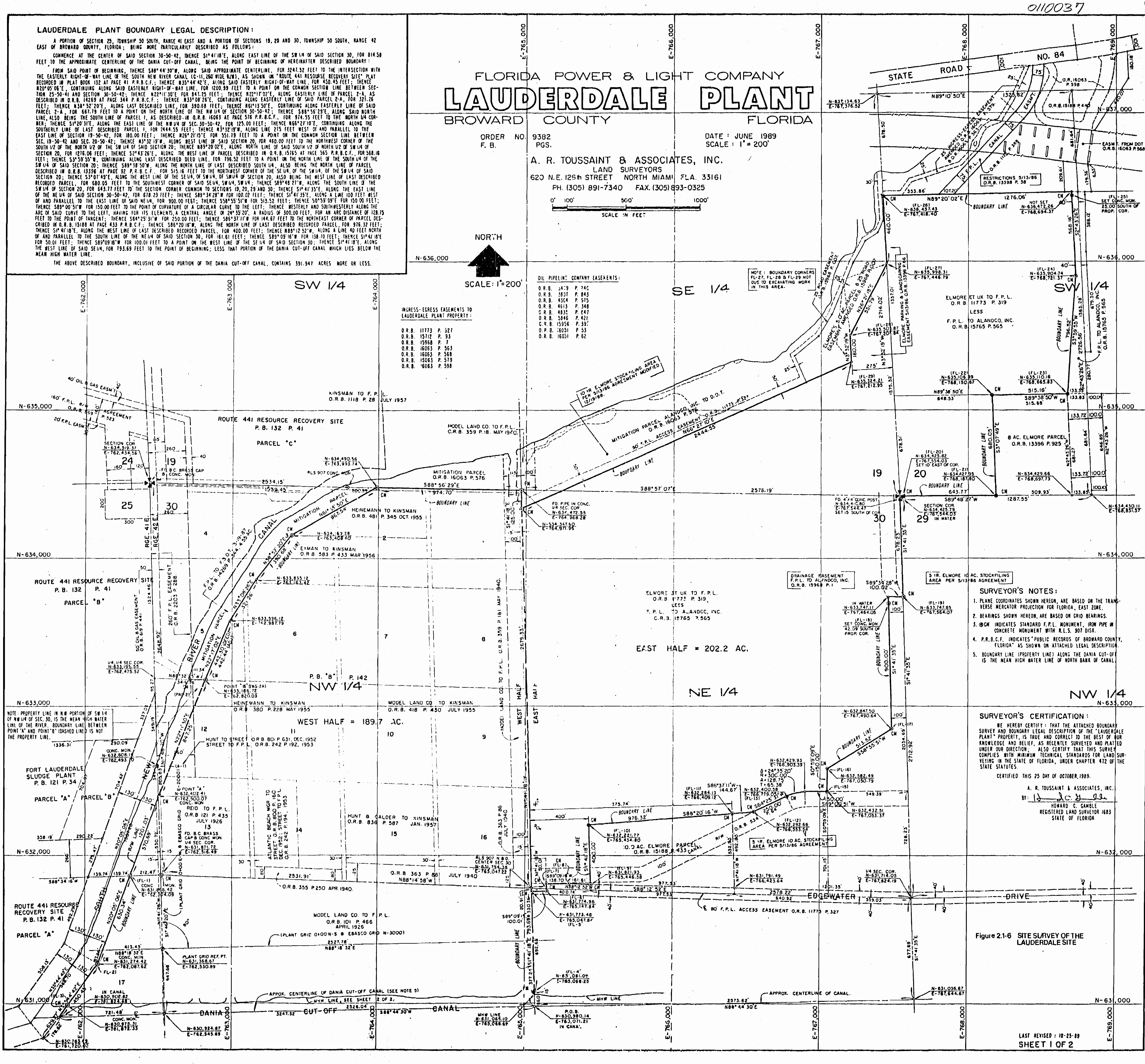
LAUDERDALE PLANT BOUNDARY LEGAL DESCRIPTION:

A PORTION OF SECTION 25, TOWNSHIP 50 SOUTH, RANGE 41 EAST AND A PORTION OF SECTIONS 19, 20 AND 30, TOWNSHIP 50 SOUTH, RANGE 42 EAST OF BROWARD COUNTY, FLORIDA; BEING MORE PARTICULARILY DESCRIBED AS FOLLOWS:

COMMENCE AT THE CENTER OF SAID SECTION 30-50-42, THENCE S1°41'18"E, ALONG EAST LINE OF THE SW 1/4 OF SAID SECTION 30, FOR 814.58 FEET TO THE APPROXIMATE CENTERLINE OF THE DANIA CUT-OFF CANAL, BEING THE POINT OF BEGINNING OF HEREINAFTER DESCRIBED BOUNDARY:

FROM SAID POINT OF BEGINNING, THENCE S88°44'30"W, ALONG SAID APPROXIMATE CENTERLINE, FOR 3247.52 FEET TO THE INTERSECTION WITH THE EASTERLY RIGHT-OF-WAY LINE OF THE SOUTH NEW RIVER CANAL (C-11, 260' WIDE R/W), AS SHOWN ON "ROUTE 441 RESOURSE RECOVERY SITE" PLAT RECORDED IN PLAT BOOK 132 AT PAGE 41 P.R.B.C.F.; THENCE N35°44'42"E, ALONG SAID EASTERLY RIGHT-OF-WAY LINE, FOR 450.45 FEET; THENCE N20°05'06"E, CONTINUING ALONG SAID EASTERLY RIGHT-OF-WAY LINE, FOR 1200.99 FEET TO A POINT ON THE COMMON SECTION LINE BETWEEN SECTION 25-50-41 AND SECTION 30-50-42; THENCE N22°11'30"E FOR 841.25 FEET; THENCE N22°17'02"E, ALONG EASTERLY LINE OF PARCEL 2-A, AS DESCRIBED IN O.R.B. 14269 AT PAGE 344 P.R.B.C.F.; THENCE N33°08'26"E, CONTINUING ALONG EASTERLY LINE OF SAID PARCEL 2-A, FOR 321.26 FEET; THENCE N38°52'20"E, ALONG LAST DESCRIBED LINE, FOR 390.68 FEET; THENCE N61°13'50"E, CONTINUING ALONG EASTERLY LINE OF SAID PARCEL 2-A, FOR 667.79 FEET TO A POINT ON THE NORTH LINE OF THE NW 1/4 OF SECTION 30-50-42; THENCE S88°56'29"E, ALONG SAID NORTH LINE, ALSO BEING THE SOUTH LINE OF PARCEL 1, AS DESCRIBED IN O.R.B. 16063 AT PAGE 576 P.R.B.C.F., FOR 974.55 FEET TO THE NORTH 1/4 CORNER; THENCE S1°20'31"E, ALONG THE EAST LINE OF THE NW 1/4 OF SEC. 30-50-42, FOR 125.00 FEET; THENCE N66°27'10"E, CONTINUING ALONG THE SOUTHERLY LINE OF LAST DESCRIBED PARCEL 1, FOR 2444.55 FEET; THENCE N3°32'19"W, ALONG LINE 275 FEET WEST OF AND PARALLEL TO THE EAST LINE OF SECTION 19-50-42, FOR 180.00 FEET; THENCE N26°21'15"E FOR 551.79 FEET TO A POINT ON THE COMMON SECTION LINE BETWEEN SEC. 19-50-42 AND SEC. 20-50-42; THENCE N3°32'19"W, ALONG WEST LINE OF SAID SECTION 20, FOR 460.00 FEET TO THE NORTHWEST CORNER OF THE SOUTH 1/2 OF THE NORTH 1/2 OF THE SW 1/4 OF SAID SECTION 20; THENCE N89°20'02"E, ALONG NORTH LINE OF SAID SOUTH 1/2 OF NORTH 1/2 OF SW 1/4 OF SECTION 20, FOR 1276.06 FEET; THENCE S2°43'26"E, ALONG THE WEST LINE OF PARCEL DESCRIBED IN O.R.B. 15765 AT PAGE 565 P.R.B.C.F., FOR 568.16 FEET; THENCE S3°59'55"W, CONTINUING ALONG LAST DESCRIBED DEED LINE, FOR 796.52 FEET TO A POINT ON THE NORTH LINE OF THE SOUTH 1/4 OF THE SW 1/4 OF SAID SECTION 20; THENCE S89°38'50"W, ALONG THE NORTH LINE OF LAST DESCRIBED SOUTH 1/4, ALSO BEING THE NORTH LINE OF PARCEL DESCRIBED IN O.R.B. 13396 AT PAGE 92 P.R.B.C.F., FOR 515.16 FEET TO THE NORTHWEST CORNER OF THE SE 1/4, OF THE SW 1/4, OF THE SW 1/4 OF SAID SECTION 20; THENCE S3°07'49"E, ALONG THE WEST LINE OF THE SE 1/4, OF SW 1/4, OF SW 1/4 OF SECTION 20, ALSO BEING THE WEST LINE OF LAST DESCRIBED RECORDED PARCEL, FOR 680.05 FEET TO THE SOUTHWEST CORNER OF SAID SE 1/4, SW 1/4, SW 1/4; THENCE S89°48'27"W, ALONG THE SOUTH LINE OF THE SW 1/4 OF SECTION 20, FOR 643.77 FEET TO THE SECTION CORNER COMMON TO SECTIONS 19, 20, 29 AND 30; THENCE S1°41'35"E, ALONG THE EAST LINE OF THE NE 1/4 OF SAID SECTION 30-50-42, FOR 678.23 FEET; THENCE S89°34'28"W FOR 100.02 FEET; THENCE S1°41'35"E, ALONG A LINE 100 FEET WEST OF AND PARALLEL TO THE EAST LINE OF SAID NE 1/4, FOR 900.00 FEET; THENCE S58°55'51"W FOR 513.52 FEET; THENCE S0°59'09"E FOR 150.00 FEET; THENCE S89°00'51"W FOR 150.00 FEET TO THE POINT OF CURVATURE OF A CIRCULAR CURVE TO THE LEFT; THENCE WESTERLY AND SOUTHWESTERLY ALONG THE ARC OF SAID CURVE TO THE LEFT, HAVING FOR ITS ELEMENTS, A CENTRAL ANGLE OF 24°35'20", A RADIUS OF 300.00 FEET, FOR AN ARC DISTANCE OF 128.75 FEET TO THE POINT OF TANGENT; THENCE S64°25'31"W FOR 250.00 FEET; THENCE S86°37'11"W FOR 144.67 FEET TO THE NORTHEAST CORNER OF PARCEL DESCRIBED IN O.R.B. 15188 AT PAGE 433 P.R.B.C.F.; THENCE S86°20'16"W, ALONG THE NORTH LINE OF LAST DESCRIBED RECORDED PARCEL, FOR 976.32 FEET; THENCE S1°41'18"E, ALONG THE WEST LINE OF LAST DESCRIBED RECORDED PARCEL, FOR 400.00 FEET; THENCE N88°12'52"W, ALONG A LINE 40 FEET NORTH OF AND PARALLEL TO THE SOUTH LINE OF THE NE 1/4 OF SAID SECTION 30, FOR 161.61 FEET; THENCE S89°09'16"W FOR 138.70 FEET; THENCE S1°41'18"E FOR 50.01 FEET; THENCE S89°09'16"W FOR 100.01 FEET TO A POINT ON THE WEST LINE OF THE SE 1/4 OF SAID SECTION 30; THENCE S1°41'18"E, ALONG THE WEST LINE OF SAID SE 1/4, FOR 793.69 FEET TO THE POINT OF BEGINNING; LESS THAT PORTION OF THE DANIA CUT-OFF CANAL WHICH LIES BELOW THE MEAN HIGH WATER LINE.

THE ABOVE DESCRIBED BOUNDARY, INCLUSIVE OF SAID PORTION OF THE DANIA CUT-OFF CANAL, CONTAINS 391.947 ACRES MORE OR LESS.



SURVEYOR'S NOTES:

1. PLANE COORDINATES SHOWN HEREON, ARE BASED ON THE TRANSVERSE MERCATOR PROJECTION FOR FLORIDA, EAST ZONE.
2. BEARINGS SHOWN HEREON, ARE BASED ON GRID BEARINGS.
3. ◉CM INDICATES STANDARD F.P.L. MONUMENT, IRON PIPE IN CONCRETE MONUMENT WITH R.L.S. 907 DISK.
4. P.R.B.C.F. INDICATES "PUBLIC RECORDS OF BROWARD COUNTY, FLORIDA" AS SHOWN ON ATTACHED LEGAL DESCRIPTION.
5. BOUNDARY LINE (PROPERTY LINE) ALONG THE DANIA CUT-OFF IS THE MEAN HIGH WATER LINE OF NORTH BANK OF CANAL.

SURVEYOR'S CERTIFICATION:

WE HEREBY CERTIFY: THAT THE ATTACHED BOUNDARY SURVEY AND BOUNDARY LEGAL DESCRIPTION OF THE "LAUDERDALE PLANT" PROPERTY, IS TRUE AND CORRECT TO THE BEST OF OUR KNOWLEDGE AND BELIEF, AS RECENTLY SURVEYED AND PLATTED UNDER OUR DIRECTION; ALSO CERTIFY THAT THIS SURVEY COMPLIES WITH MINIMUM TECHNICAL STANDARDS FOR LAND SURVEYING IN THE STATE OF FLORIDA, UNDER CHAPTER 472 OF THE STATE STATUTES.

CERTIFIED THIS 25 DAY OF OCTOBER, 1989.

A. R. TOUSSAINT & ASSOCIATES, INC.

BY: [signature]

HOWARD C. GAMBLE
REGISTERED LAND SURVEYOR 1683
STATE OF FLORIDA

Figure 2.1-6 SITE SURVEY OF THE LAUDERDALE SITE

2.2 SOCIOPOLITICAL ENVIRONMENT

2.2.1 Governmental Jurisdictions

2.2.1.1 Local Governments

The Lauderdale Plant site currently occupies 392 acres south of the South New River Canal and north of the Dania Cut-Off Canal approximately 2 miles west of the Fort Lauderdale-Hollywood International Airport. The majority of the site, i.e., about 377 acres, is located in unincorporated Broward County. The remaining 15 acres is being annexed into the City of Hollywood. The municipal boundaries within 1 mile of the site are the Town of Davie and City of Hollywood (Figure 2.2-1). The latter boundary (i.e., City of Hollywood) consists of a recent elective annexation by property owners north of Stirling Road and a proposed area north of Griffin Road. Municipal boundaries of Davie, Dania, Fort Lauderdale, and Hollywood, along with the Hollywood Indian Reservation, are within a 2-mile radius of the Lauderdale Plant site. Boundaries occurring within a 3-mile radius of the site include the City of Plantation along with the jurisdictions previously stated. Cooper City and the City of Pembroke Pines are included within a 4-mile radius of the site, and the Cities of Sunrise and Lauderhill are within 5 miles of the Lauderdale Plant site. Table 2.2-1 lists the municipalities located within 1-, 2-, 3-, 4- and 5-mile radii of the site.

2.2.1.2 Public Preservation and Recreation Lands

None of the following local, regional, state, or federal areas is located within either a 1 or 5 mile radius of the Lauderdale Plant site.

1. National parks, forests, seashores, wildlife refuges, wilderness areas, memorials, monuments, marine sanctuaries, estuarine sanctuaries, wild and scenic rivers;
2. Roadless area review and evaluation (RARE) areas, critical habitat of endangered species, state parks, forests, game management areas, areas of critical state concern, save our rivers lands, archaeological landmarks or landmark zones, aquatic preserves, outstanding Florida Waters and wild and scenic rivers; and
3. Military lands.

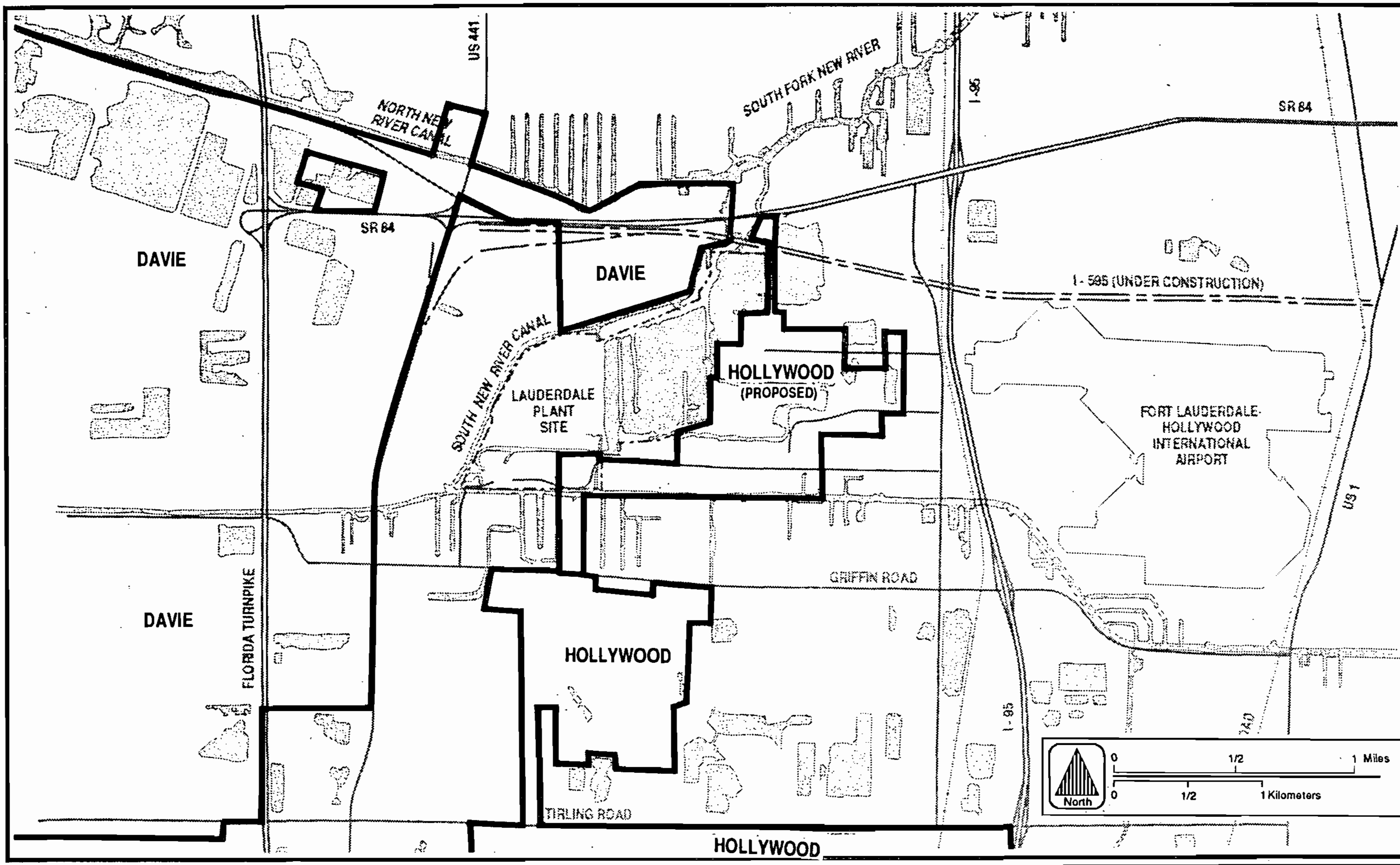


Figure 2.2-1 GOVERNMENTAL JURISDICTIONS WITHIN 1 MILE OF THE LAUDERDALE PLANT SITE

Lauderdale Repowering Project

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Table 2.2-1. Municipalities in the Vicinity of the Lauderdale Plant Site

1-Mile Radius	2-Mile Radius	3-Mile Radius	4-Mile Radius	5-Mile Radius
Davie	Davie	Davie	Davie	Davie
Hollywood	Dania	Dania	Dania	Dania
	Fort Lauderdale	Fort Lauderdale	Fort Lauderdale	Fort Lauderdale
	Hollywood	Hollywood	Hollywood	Hollywood
		Plantation	Plantation	Plantation
			Cooper City	Cooper City
			Pembroke Pines	Pembroke Pines
				Sunrise
				Lauderhill

Under Broward County's urban wilderness inventory program, two areas in the vicinity of the Lauderdale Plant site (North New River Bend and South Fork New River) are designated urban wilderness areas in the Broward County 1989 Comprehensive Plan. The North New River Bend area contains about 20 acres of freshwater wetlands and is located north of the site (see Figure 2.2-2). The South Fork New River area contains approximately 243 acres of wetlands, including cypress and red maple swamps as well as the 102-acre Pond Apple Slough Park that has been set aside as a proposed passive recreation area along the new I-595 corridor. The area is currently owned by Florida Department of Transportation (FDOT) and will be turned over to the county when wetlands mitigation activity in the area is complete in 1992. A portion of the Lauderdale Plant site located north of the northernmost GT area is included in the South Fork New River urban wilderness area (see Figure 2.2-2). This portion of the site will not be affected by the Lauderdale Repowering Project.

Locally designated preservation areas and urban wilderness inventory areas beyond 1 mile but within 5 miles of the Lauderdale Plant site include Port Everglades, FPL discharge canal and mangrove swamp (Port Everglades Plant), West Lake Park, Pine Island Ridge, Secret Woods and Secret Woods buffer, and Pine Ridge Nature Trail. These areas are designated as natural resource or urban wilderness areas.

Although no existing parks occur within 1 mile of the Lauderdale Plant site, Broward County Parks and Recreation Division currently has five regional and eight neighborhood parks in operation within a 5-mile radius (see Figure 2.2-2). A new regional park (Brian Piccolo) is scheduled to open in 1989. Expansions to the county park system beyond 1 mile but within 5 miles of the Lauderdale Plant site include the expansions of the West Lake Park and Tree Tops Regional Park. Both expansions are in the land acquisition stage. The West Lake Park expansion includes most of the land north of the current park up to the Dania Cut-Off Canal plus a 40-acre parcel north of the canal. A 120-acre parcel just north of Tree Tops Park on the Pine Island Ridge (the highest ridge in Broward County) is being

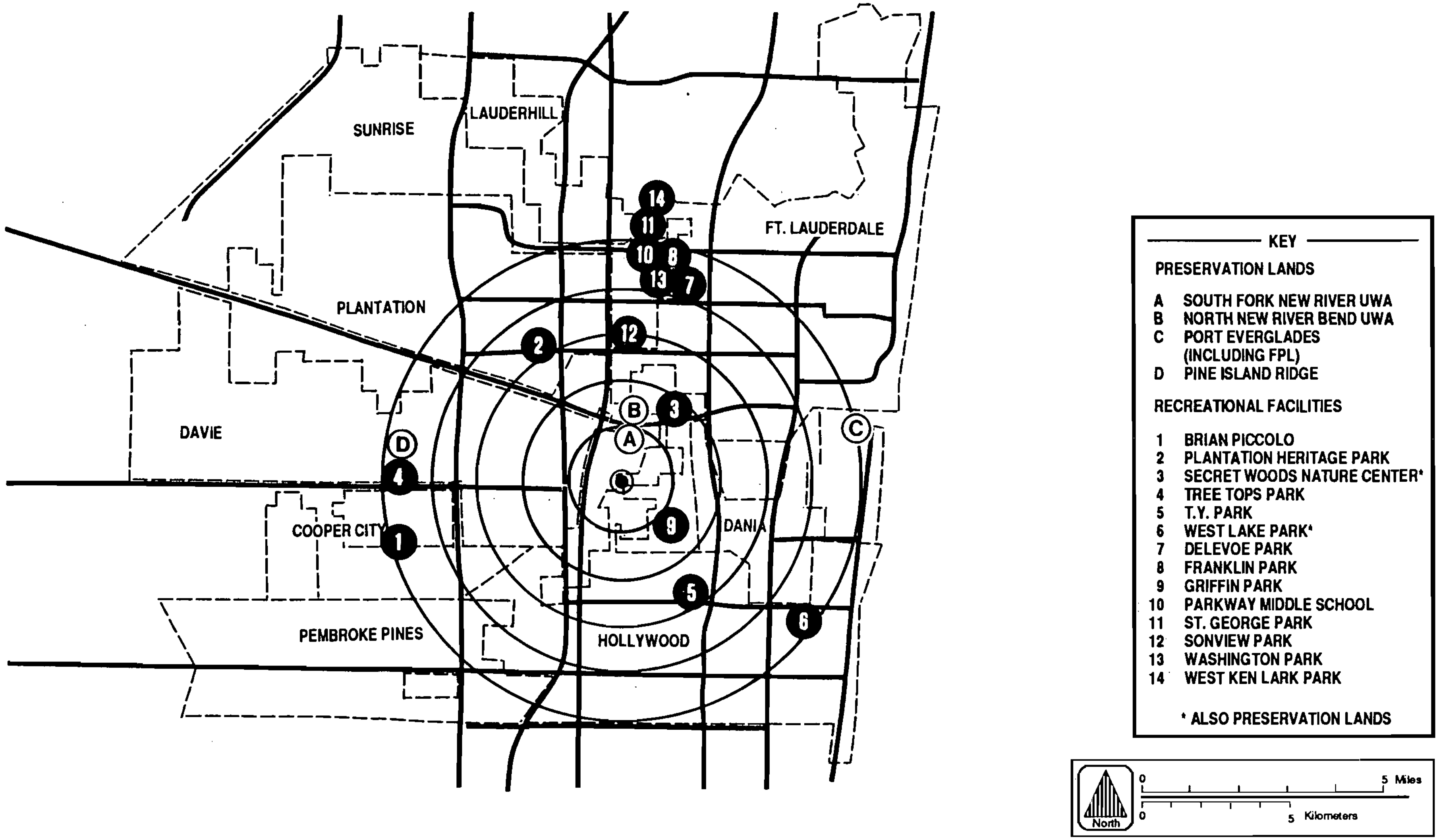

Figure 2.2-2 LOCATION OF PRESERVATION LANDS AND RECREATIONAL FACILITIES WITHIN 5 MILES OF THE PROPOSED PLANT

SOURCE: BROWARD COUNTY, 1989.

Lauderdale Repowering Project

FPL

leased by the county until state funding can become available through the conservation and recreation lands (CARL) fund. According to the Broward County Parks and Recreation Division, passive recreation can be expected to occur there. Table 2.2-2 lists the county-maintained parks within a 5-mile radius of the Lauderdale Plant site.

Besides the public lands, no major landholdings by a conservation group or private individual were identified within the 5-mile radius for which the primary purpose of land ownership is environmental protection.

2.2.2 Zoning and Land Use Plans

The majority of the Lauderdale Plant site is located in unincorporated Broward County. Development is regulated by the Zoning Ordinance of the Code of Broward County, Florida, and the Broward County 1989 Comprehensive Plan adopted March 1, 1989, with associated land use plan maps. The proposed annexation of a portion of the Lauderdale Plant site into the City of Hollywood would not change the site's consistency with zoning or land use plans.

2.2.2.1 Zoning

Most of the Lauderdale Plant site as shown in Figure 2.2-3 is zoned M-3: General Industrial District under Broward County zoning ordinances. A small portion of the site along the northeastern boundary is zoned M-1: Light Industrial District. These districts are two of six industrial categories in the Zoning Ordinance, ranging from M-1A to M-5. In general, the M-1A District (Industrial Park) was developed for research development and the manufacture of small products. Districts M-1, M-2, M-3, M-4, and M-5 allow progressively more intense uses. The purpose of the M-3 and M-1 districts, as well as uses permitted and prohibited, height restrictions, plot size, and other performance criteria are found in the zoning descriptions (contained in Appendix 10.2).

The M-3 General Industrial District is intended primarily for the larger and heavier types of manufacturing uses which normally have no serious

Table 2.2-2. Existing County-Maintained Parks Within 5 Miles of the Lauderdale Plant Site

<u>Regional Parks</u>
Brian Piccolo (scheduled to open in 1989)
Plantation Heritage Park
Secret Woods Nature Center
Tree Tops Park
T.Y. Park
West Lake Park
<u>Neighborhood Parks</u>
Delevoe Park
Franklin Park
Griffin Park
Parkway Middle School
St. George Park
Sunview Park
Washington Park
West Ken Lark Park

Source: Broward County Comprehensive Plan, 1989.

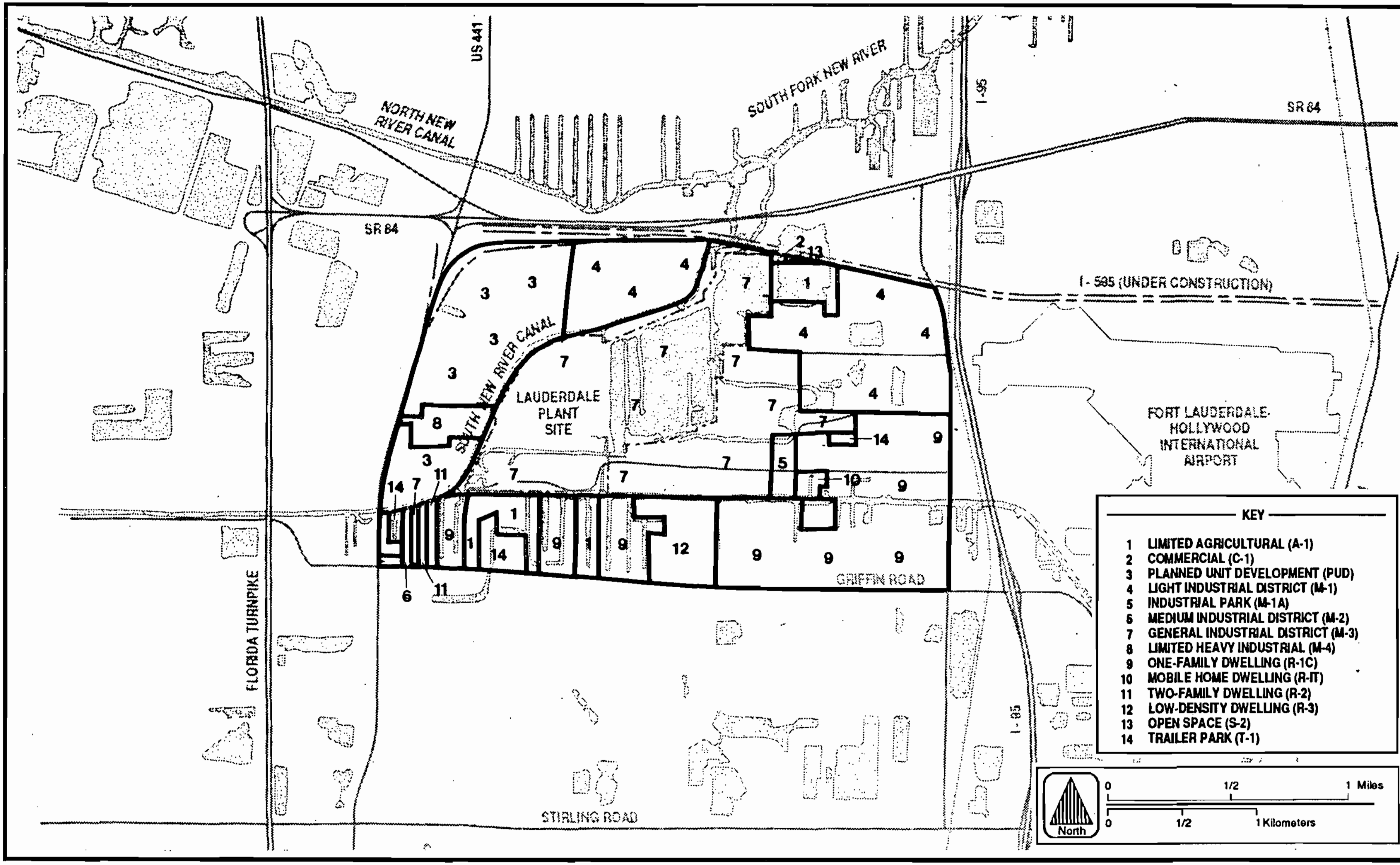

Figure 2.2-3 ZONING MAP OF THE LAUDERDALE PLANT SITE AND ADJACENT PROPERTIES

SOURCE: BROWARD COUNTY, 1989.

Lauderdale Repowering Project

FPL

effects upon contiguous nonresidential areas. In order to minimize conflict and to preserve the general industrial areas for the intended uses, certain uses as listed in the code are not permitted.

The M-1 Light Industrial District is intended primarily for the manufacture of small articles and nonobjectionable products not involving the use of any materials, processes, or machinery likely to cause undesirable effects upon nearby or adjacent residential or business property. The activities permitted in an M-1 district are intended to be compatible with neighboring residential or business districts.

The existing zoning of the Lauderdale Plant site is consistent with the present and proposed uses. Rezoning of the property for the proposed project will not be required.

2.2.2.2 Land Use Plan

The land use plan map for unincorporated Broward County (Sheet 21) designates almost all of the Lauderdale Plant site as Utilities; the northern portion of the cooling canal/pond system is designated as Industrial (Figure 2.2-4). Areas adjacent to the Lauderdale Plant site are also presented in Figure 2.2-4. Land west, north, and east of the Lauderdale Plant site is designated Industrial. Land south of the Lauderdale Plant site is designated Utility, Industrial, or Residential [low density (one to three dwelling units per acre) or medium density (10 to 16 dwelling units per acre)].

Permitted uses in the Utility land use category include electric power plants and substations (see Appendix 10.3, Land Use Descriptions). The existing and proposed uses of the Lauderdale Plant site are consistent with the land use plan. A Land Use Plan amendment of the property for the proposed project will not be required.

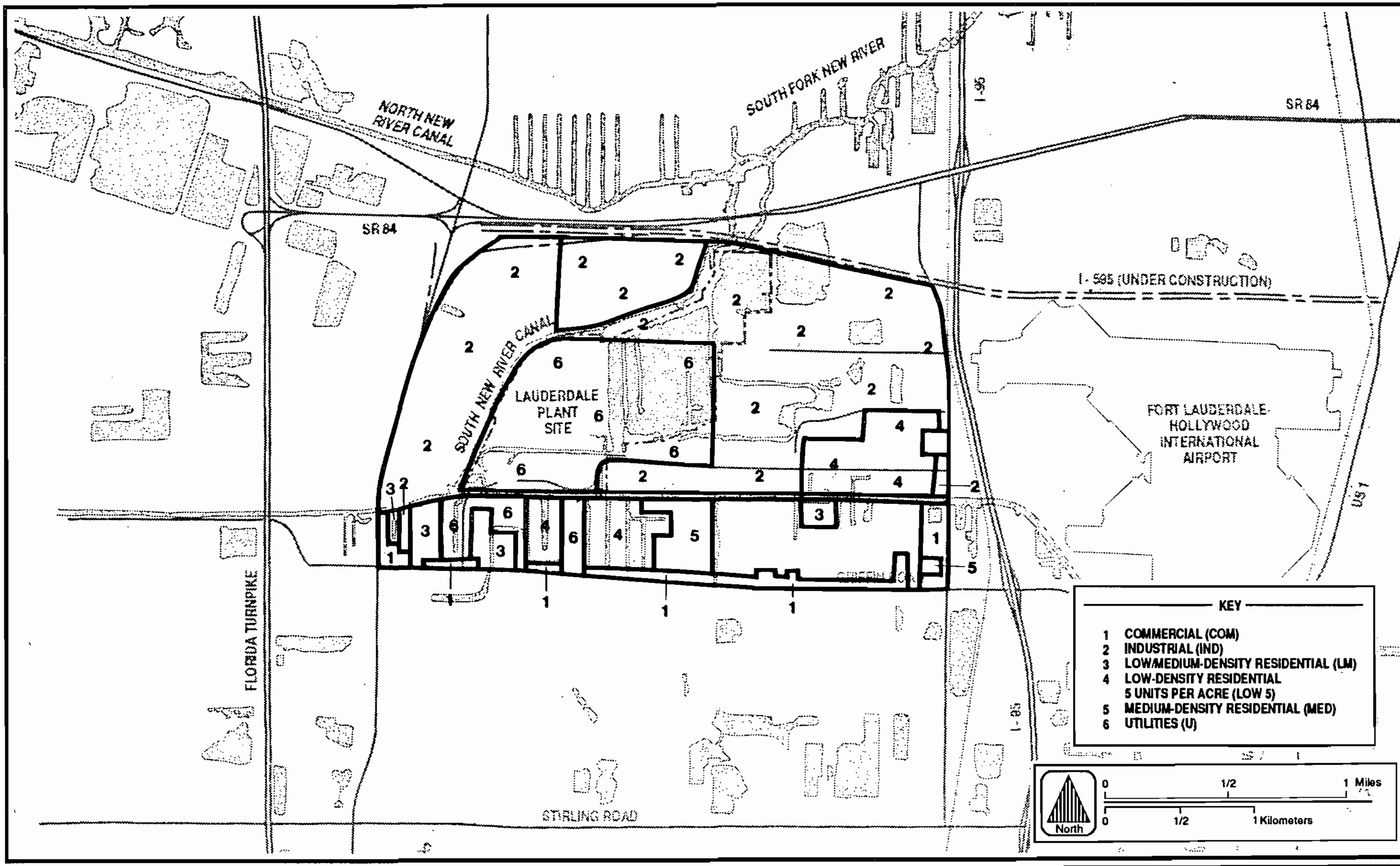

Figure 2.2-4 DESIGNATED LAND USE OF THE LAUDERDALE PLANT SITE AND ADJACENT PROPERTIES

SOURCE: BROWARD COUNTY, 1989.

Lauderdale Repowering Project

FPL

2.2.3 Demography and Existing Land Use

2.2.3.1 Demography

Portions of nine municipalities are within 5-miles of the Lauderdale Plant site. Table 2.2-3 lists these municipalities and their total resident populations for 1980 and 1988. The majority of recent resident population growth has occurred north and west of the Lauderdale Plant site. The cities to the east of the site have much slower recent growth rates, primarily due to lack of undeveloped land. The City of Fort Lauderdale has decreased in population by 1.8 percent between 1980 and 1988. The fastest growing municipality in the study area is Davie, with a 90-percent increase in population between 1980 and 1988.

Figure 2.2-5 shows the 1980 census tracts within 5 miles of the site, and Table 2.2-4 lists the 1980 population, the estimated 1985 population, and the projected 2000 and 2010 resident populations by census tract. This table shows the recent trend of increasing resident population west of the Lauderdale Plant site and predicts the trend to continue through 2000 and 2010.

2.2.3.2 Ongoing Land Use

The Lauderdale Plant site is currently occupied by a power-generating facility. Electrical power-generating units have been operating at the Lauderdale Plant site since the 1920s. The SBCRRP facility is currently under construction adjacent to the western boundary of the site. The City of Fort Lauderdale compost facility is also adjacent to the western edge of the site. In addition, the SBCRRP landfill is northwest of the site. The majority of new industrial development is occurring just west of U.S. 441. This activity is consistent with the county's 1989 land use plan map. The land use categories within 1 mile of the plant are primarily commercial, light industrial, and low-density residential.

Figure 2.2-6 shows the existing land use within 5-miles of the site using Level II of the Florida Land Use, Cover, and Forms Classification System (FLUCFCS). Table 2.2-5 lists the FLUCFCS classifications.

Table 2.2-3. Populations of Municipalities Within 5 Miles of the Lauderdale Plant Site

	1980	1988	Percent Change[a]
Cooper City	10,140	16,523	62.9
Dania	11,796	13,109	11.1
Davie	20,515	38,980	90.0
Fort Lauderdale	153,279	150,553	(1.8)
Hollywood	121,323	125,602	3.5
Lauderhill	37,271	44,341	19.0
Pembroke Pines	35,776	57,339	60.3
Plantation	48,653	63,449	30.4
Sunrise	39,681	56,321	41.9

[a]Parentheses indicate percent decrease in population.

Sources: Florida Statistical Abstract, 1988.
Broward County Comprehensive Plan, 1989.

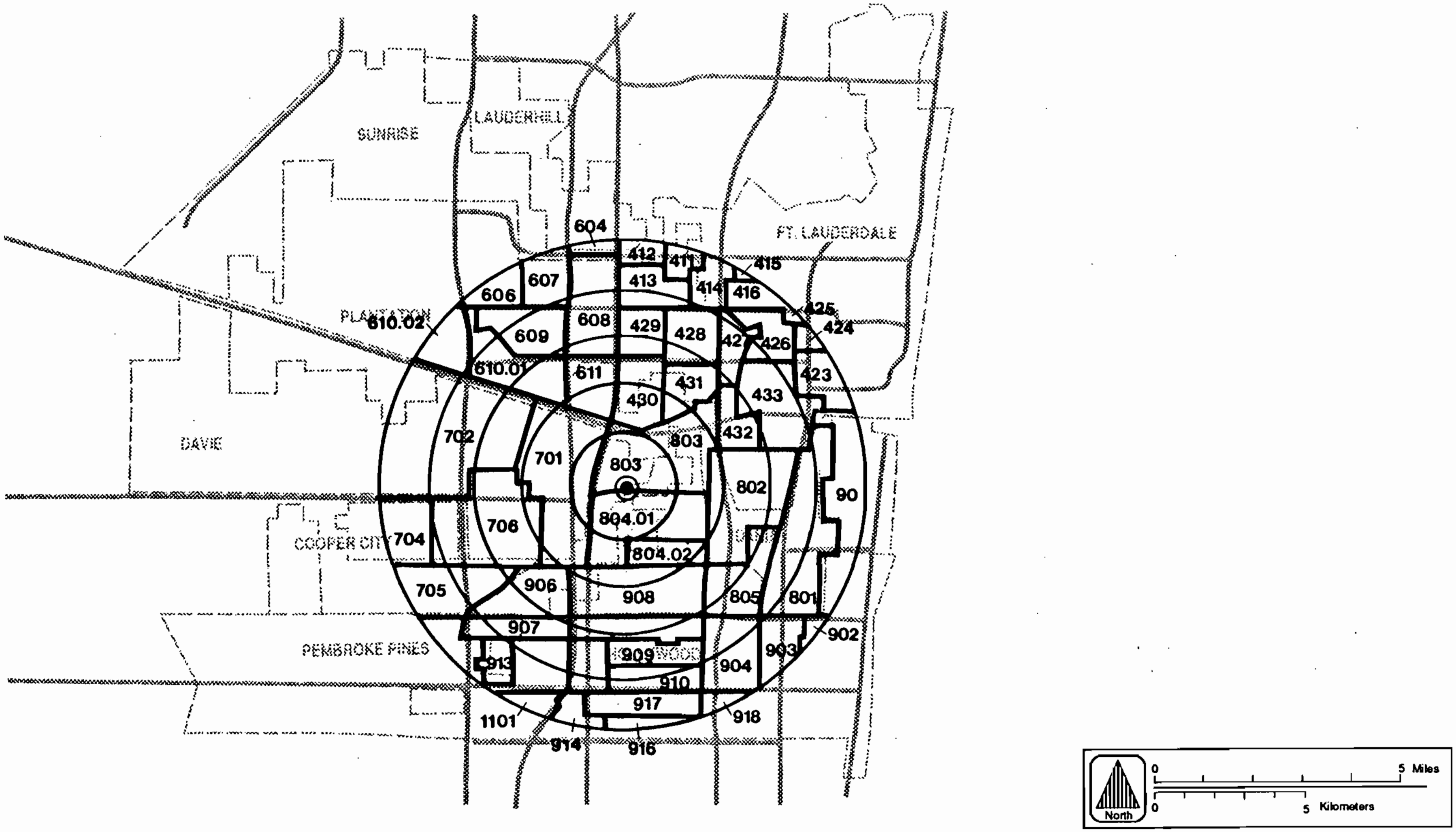

Figure 2.2-5 CENSUS TRACTS WITHIN 5 MILES OF THE LAUDERDALE PLANT SITE

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Table 2.2-4. Resident Population[a] Within 5 Miles of the Lauderdale Plant Site by Census Tract--1980-2010 (Page 1 of 2)

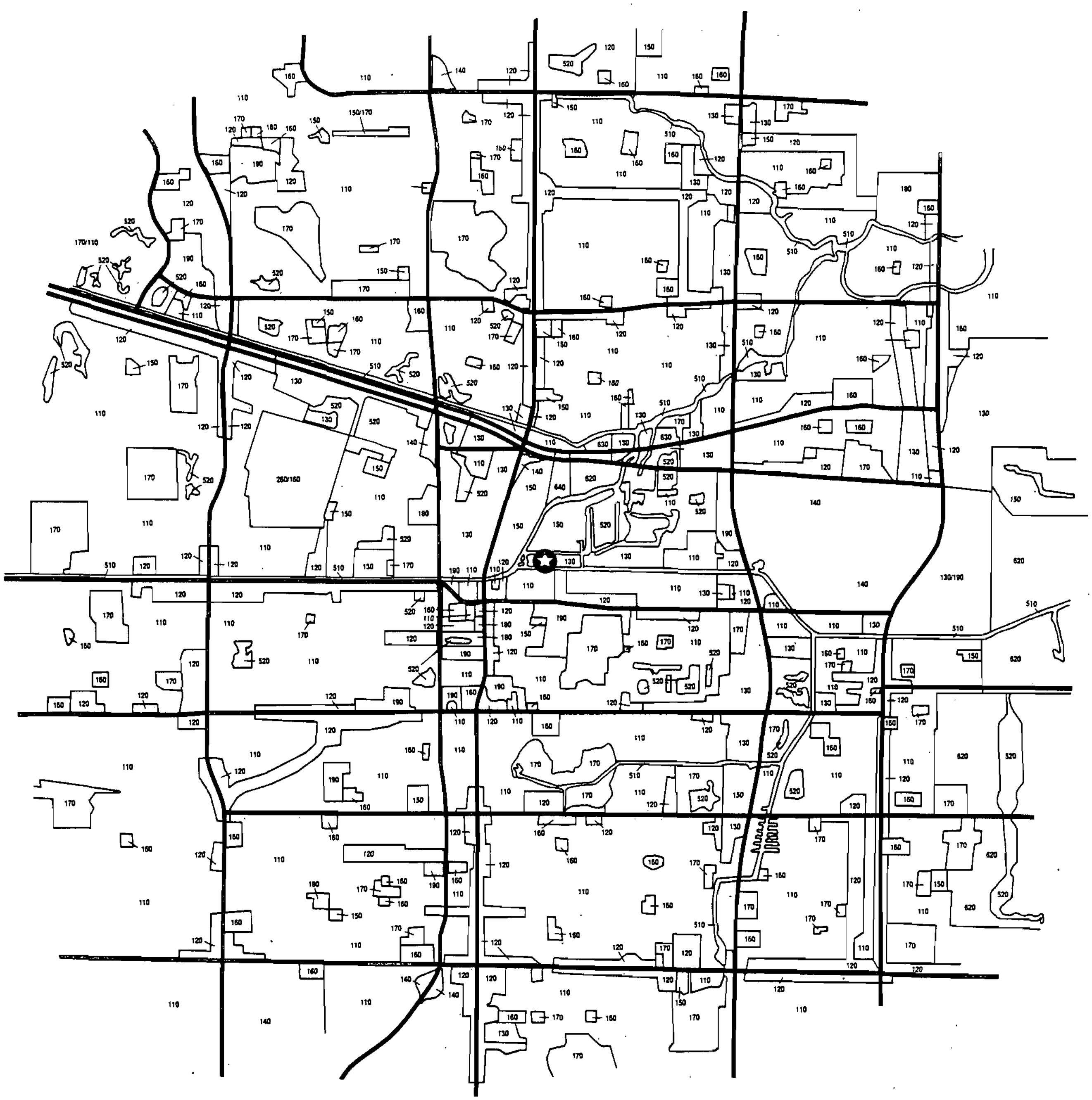
Census Tract	1980 Census Count	1985 Census Count	2000 Forecast[b]	2010 Forecast[b]
411.00	4,845	5,002	5,420	5,640
412.00	5,299	5,314	5,360	5,380
413.00	9,452	9,435	9,407	9,363
414.00	4,860	4,728	4,769	4,789
415.00	4,638	4,551	4,628	4,692
416.00	7,173	6,832	7,010	7,201
423.00	6,148	6,466	6,803	7,108
424.00	2,434	1,898	1,915	2,005
425.00	85	72	74	83
426.00	5,563	5,492	6,057	6,540
427.00	5,713	5,769	5,793	5,874
428.00	7,194	7,297	7,325	7,348
429.00	5,729	5,791	5,684	5,605
430.00	8,502	8,665	8,465	8,326
431.00	4,856	5,224	5,094	5,018
432.00	3,557	3,555	3,551	3,597
433.00	7,403	7,455	7,458	7,588
604.00	14,126	14,676	14,856	15,287
606.01	6,380	7,256	8,806	9,547
606.02	2,111	3,641	22,611	26,749
607.00	3,305	3,377	3,299	3,241
608.00	7,623	7,592	7,463	7,392
609.00	5,226	5,312	5,126	4,951
610.01	6,824	7,206	6,749	6,404
610.02	3,403	5,030	9,633	10,567
611.00	6,212	6,351	6,210	6,117
701.00	9,068	9,948	10,286	10,450
702.00	13,680	19,111	29,243	34,011
704.00	10,973	15,550	22,700	22,807
705.00	4,511	4,806	10,911	14,772
706.00	4,455	4,879	6,186	6,845
801.00	7,225	6,495	6,508	6,673
802.00	1,712	1,747	1,741	1,745
803.00	2,583	2,444	2,418	2,439
804.01	8,992	10,069	11,648	12,447
804.02	2,507	2,972	3,711	4,085
805.00	6,104	6,639	7,966	8,635
901.00	8,877	8,788	9,104	9,654
903.00	6,851	6,956	7,123	7,459
904.00	10,459	10,559	10,679	11,019
905.00	10,584	14,429	15,445	15,746
906.00	9,280	10,367	11,040	11,262
907.00	3,981	4,397	4,829	4,972

Table 2.2-4. Resident Population[a] Within 5-Miles of the Lauderdale Plant Site by Census Tract--1980-2010 (Page 2 of 2)

Census Tract	1980 Census Count	1985 Census Count	2000 Forecast[b]	2010 Forecast[b]
908.00	8,175	8,274	8,434	8,469
909.00	5,659	5,473	5,283	5,141
910.00	4,227	4,245	4,198	4,180
913.00	3,991	4,053	3,906	3,782
914.00	5,290	5,171	5,184	5,224
916.00	4,917	5,000	5,242	5,556
917.00	5,705	6,021	7,033	7,578
918.00	7,183	7,249	7,283	7,401
1,101.00	6,640	6,815	6,689	6,538

[a]Does not include institutional (prison inmate) population.
[b]Population forecasts are based on medium growth rates as defined by the Bureau of Economic and Business Research.

Source: Broward County Office of Planning, Economic Planning and Research Section, January, 1988.



NOTE: SEE TABLE 2.2-5 FOR LEVEL II LAND USE AND COVER CLASSIFICATIONS

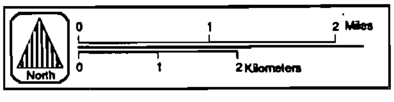


Figure 2.2-6 EXISTING LAND USE WITHIN 5 MILES OF THE LAUDERDALE PLANT SITE

SOURCES: BROWARD COUNTY, 1989; FDOT, 1985; HUNTER SERVICES, INC., 1989.

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Table 2.2-5. Hierarchical Listing of Land Use and Cover Classifications--Level II (Page 1 of 2)

110	Residential, Low Density (less than two dwelling units per acre)
120	Residential, Medium Density (two to five dwelling units per acre)
130	Residential, High Density
140	Commercial and Services
150	Industrial
160	Extractive
170	Institutional
180	Recreational
190	Open Land
210	Cropland and Pastureland
220	Tree Crops
230	Feeding Operations
240	Nurseries and Vineyards
250	Specialty Farms
260	Other Open Lands (Rural)
310	Herbaceous
320	Shrub and Brushland
330	Mixed Rangeland
410	Upland Coniferous Forests
420	Upland Hardwood Forests
430	Upland Hardwood Forests Continued
440	Tree Plantations
510	Streams and Waterways
520	Lakes
530	Reservoirs
540	Bays and Estuaries
550	Major Springs
560	Slough Waters
610	Wetland Hardwood Forests
620	Wetland Coniferous Forests
630	Wetland Forested Mixed

Table 2.2-5. Hierarchical Listing of Land Use and Cover Classifications--Level II (Page 2 of 2)

640	Vegetated Non-Forested Wetlands
650	Non-Vegetated
710	Beaches Other Than Swimming Beaches
720	Sand Other Than Beaches
730	Exposed Rock
740	Disturbed Land
810	Transportation
820	Communications
830	Utilities
910	Vegetation

Source: FDOT, 1985.

Beyond the 1-mile radius, the land use categories become primarily residential and commercial to the north, west, and south of the Lauderdale Plant site. East of the study area, industrial land uses and the Fort Lauderdale-Hollywood International Airport are predominant. Commercial-and service-related land use are along major roads within the 5-mile study area.

Development of existing vacant land is expected to be guided by the county's Land Use Plan and Zoning Ordinance. Future developments include the Port 95 Commerce Park property within a 1-mile radius east of the site between SR 84 and Griffin Road. The Development of Regional Impact (DRI) was approved by the Broward County Board of County Commissioners in December, 1988 as a high-quality business park with office, distribution, wholesale trade, manufacturing, and utility office/service space. Variable amounts of redevelopment may also be expected to take place within the 5-mile area surrounding the Lauderdale Plant site.

2.2.4 Easements, Titles, Agency Works

All permanent facilities associated with the repowering project are to be located on land currently owned by FPL and utilized for electric power generation. Since no new off-site transmission or natural gas pipeline corridors or rights-of-way will be required for the project, no additional easements or titles will be required for associated facilities. A lease is being provided by Alandco for a construction laydown and parking area immediately east of the Lauderdale Plant site. Sanitary sewage will be collected from the plant and routed to the City of Hollywood's regional publicly owned treatment works (POTW). The Lauderdale Plant's connection will be through a line connected to the Port 95 Commerce Park's connection to this POTW. No easements will be required.

2.2.5 Regional Scenic, Cultural, and Natural Landmarks

Areas identified in Section 2.2.1.2 located within 5 miles of the Lauderdale Plant site include eight neighborhood parks, five regional parks, one CARL land (West Lake), and one Indian reservation. Four of the regional parks contain boardwalks/nature trails and/or boating facilities which may be considered to have scenic value; West Lake also contains similar facilities. The Indian reservation, while being highly urbanized, is considered to have cultural significance. The neighborhood parks and one regional park primarily contain playgrounds and ballfields and thus do not contain significant scenic, cultural, and natural values. Those areas within a 5-mile radius that are considered to contain scenic, cultural, and natural landmarks are briefly described below.

1. Plantation Heritage Park: 90 acres--bicycle paths, jogging paths, nature trails, boating facilities;
2. Secret Woods Nature Center: 37 acres--boardwalk and wood chip nature trail;
3. Tree Tops Park: 257 acres--nature and horse trails, picnic shelters, boat and canoe facilities, fishing, observation tower;
4. T.Y. Park: 150 acres--swimming lagoon, boat facilities, campgrounds, vita/jogging paths, nature trails, picnic shelters;
5. West Lake Park: 1,400 acres--boat and canoe facilities, picnic shelters, vita trails, 1,300 acres under development as a nature conservation and education center;
6. North New River Bend and South Fork New River; 263 acres of urban wilderness, a 102-acre portion of which is set aside in Pond Apple Slough for passive recreation; and
7. Hollywood Seminole Indian Reservation: 480.9 acres with a population of about 400.

2.2.6 Archaeological and Historic Sites

The Florida Department of State, Division of Historical Resources (DHR), was contacted and requested to identify known archaeological or historic sites on the Lauderdale Plant site and determine whether a cultural resource survey was necessary. DHR (1988) indicated that no significant archaeological and/or historical sites are recorded or considered likely to be present on the site and the project may proceed without further DHR involvement. An archaeological study was performed for the Port 95 Commerce Park property (Kennedy, 1988); a small portion of which will be leased for construction laydown/parking. This study consisted of a literature search of known archaeological sites in the area and a detailed survey of the property. Three small, unrecorded midden sites were found in the center of the property. The study concluded that the three archaeological sites are not deemed significant due to (Kennedy, 1988):

1. The nature of these sites, i.e., disturbed kitchen midden deposits,
2. The site does not appear to provide dramatic new information about prehistory, and
3. The presence of other numerous known midden deposits in south Florida.

These sites are not located in areas near or adjacent to the areas that will be affected by the construction or operation of the repowered units.

2.2.7 Socioeconomics and Public Services

Socioeconomic characteristics are described by statistics compiled by various federal, state, and local agencies which report on a county-wide level. Public services are generally described on a more localized basis, depending for the most part on service area.

2.2.7.1 Social and Economic Characteristics

During the period from late 1980 to early 1987, Broward County experienced an 18.4-percent increase in housing from 486,137 units in 1980 to 575,498 in April 1987 (Broward County Office of Planning, 1988). This equates to a 3.1-percent increase in housing units per year for the same time period. Table 2.2-6 lists residential building permit activity from 1970 to May 1988. During this time period, more residential building permits were issued in unincorporated Broward County than in any of the 28 incorporated municipalities listed in Table 2.2-6. This included single-family, duplex, and multifamily dwellings. Municipalities experiencing significant volumes of residential building permit activity include Coral Springs, Sunrise, Pembroke Pines, and Deerfield Beach. The median value of the

Table 2.2-6. Residential Building Permits Issued by Type and Municipality, 1970 to May 1988

Municipality	Number of Building Permits Issued: Single Family	Duplex	Multi-family	Total	Percent of Total
Unincorporated Broward County	12,945	2,516	28,723	44,184	12.0
Coconut Creek	2,157	122	11,044	13,323	3.6
Cooper City	4,550	30	611	5,191	1.4
Coral Springs	12,676	1,284	13,840	27,800	7.5
Dania	570	423	2,280	3,273	0.9
Davie	6,196	402	6,589	13,187	3.6
Deerfield Beach	3,614	336	18,484	22,434	6.1
Fort Lauderdale	2,389	1,426	15,910	19,725	5.4
Hallandale	300	442	8,100	8,842	2.4
Hillsboro Beach	112	0	1,001	1,113	0.3
Hollywood	3,660	1,242	12,944	17,846	4.8
Lauderdale by the Sea	38	18	456	512	0.1
Lauderdale Lakes	1,069	46	13,204	14,319	3.9
Lauderhill	5,714	312	17,072	23,098	6.3
Lazy Lake	0	0	0	0	0.0
Lighthouse Point	363	50	876	1,289	0.3
Margate	5,796	238	11,144	17,178	4.7
Miramar	3,523	449	1,934	5,906	1.6
North Lauderdale	5,163	250	4,346	9,759	2.6
Oakland Park	545	182	6,096	6,823	1.9
Parkland	821	0	0	821	0.2
Pembroke Park	48	0	896	944	0.3
Pembroke Pines	10,346	22	13,891	24,259	6.6
Plantation	6,845	358	11,233	18,436	5.0
Pompano Beach	1,263	516	19,301	21,080	5.7
Sea Ranch Lakes	19	0	0	19	0.0
Sunrise	10,165	304	16,799	27,268	7.4
Tamarac	6,575	326	10,835	17,736	4.8
Wilton Manors	304	84	1,711	2,099	0.6
TOTAL	107,766	11,378	249,320	368,464	100.0

Source: Broward County Office of Planning, 1988.

noncondominium housing units permitted in 1987 in Broward County was $100,032.

Although construction activity is occurring throughout all of Broward County, the majority of new housing construction is generally located in the western sections of the county where vacant land is available.

The total labor force in Broward County in January 1988 was reported to be 625,927 persons, an 11.7-percent increase from January 1985. The unemployment rate in Broward County has decreased from 5.5 percent in January 1985 to 4.2 percent in January 1988. During the same time period, Florida's unemployment rate decreased from 6.5 percent to 5.2 percent and the United State's rate decreased from 8.0 percent to 6.3 percent. Table 2.2-7 presents the labor force and unemployment data by month from January 1985 to January 1988. Table 2.2-8 lists non-agricultural employment by industry. The trade and service industries have historically provided the greatest employment opportunities in Broward County. These industries continue to dominate, collectively providing 57 percent of all employment opportunities.

Table 2.2-9 lists the projected employment distribution by industry, including agriculture, for 1995. In general, employment is projected to increase in most industries, with the greatest increase occurring in the trade and service sectors. The trade and service sectors are expected to employ 58.1 percent of the entire work force.

Broward County's per-capita income is higher than that of the United States and Florida (Table 2.2-10). During the period 1979 to 1986, Broward County's per-capita personal income grew 78.0 percent. For the same period, income grew by 77.2 percent in Florida and 69.2 percent in the United States. In 1979, Broward County's per-capita income was 23.4 percent higher than Florida's per-capita income and 17.7 percent higher than the United States' per-capita income; in 1986, the margin was 23.9 percent and 23.8 percent, respectively. These relationships

Table 2.2-7. Monthly Labor Force and Unemployment Rates for Broward County, the State of Florida, and the United States--1985-1988 (Page 1 of 2)

Year	Period	Broward County Labor Force	Percent Unemployed Broward County	State of Florida	United States
1985	Annual		4.8	6.0	7.1
	Jan	560,175	5.5	6.5	8.0
	Feb	560,558	4.9	5.8	7.8
	Mar	557,506	4.6	5.9	7.5
	Apr	555,665	5.1	6.1	7.1
	May	553,813	4.1	4.9	7.0
	Jun	555,311	5.4	6.9	7.5
	Jul	557,475	5.5	7.0	7.4
	Aug	559,336	4.6	5.8	6.9
	Sep	564,076	5.0	6.5	6.9
	Oct	562,059	4.3	5.3	6.8
	Nov	564,216	4.5	5.5	6.7
	Dec	566,958	4.5	5.6	6.7
1986	Annual		4.4	5.7	6.9
	Jan	561,686	4.6	5.6	7.3
	Feb	565,617	4.4	5.4	7.8
	Mar	570,828	4.6	5.8	7.5
	Apr	568,643	4.3	5.4	7.0
	May	579,090	4.2	5.3	7.0
	Jun	590,033	4.5	6.0	7.3
	Jul	594,666	4.9	6.9	7.0
	Aug	590,193	4.4	5.9	6.7
	Sep	579,590	4.7	6.3	6.8
	Oct	586,079	4.5	5.8	6.6
	Nov	594,263	4.4	5.6	6.6
	Dec	595,880	3.5	4.6	6.3
1987	Annual		4.2	5.3	6.1
	Jan	590,233	4.6	5.8	7.3
	Feb	596,257	4.1	5.2	7.2
	Mar	604,640	4.1	5.4	6.9
	Apr	597,319	4.4	5.2	6.2

Table 2.2-7. Monthly Labor Force and Unemployment Rates for Broward County, the State of Florida, and the United States--1985-1988 (Page 2 of 2)

Year	Period	Broward Labor Force	Percent Unemployed		
			Broward County	State of Florida	United States
	May	607,579	4.1	5.1	6.1
	Jun	608,606	4.1	5.3	6.3
	Jul	617,382	4.6	5.9	6.1
	Aug	611,046	4.6	5.7	5.8
	Sep	607,792	4.1	5.3	5.7
	Oct	617,997	4.0	5.0	5.7
	Nov	615,353	4.1	5.1	5.6
	Dec	631,094	3.9	5.0	5.4
1988	Jan	625,927	4.2	5.2	6.3

Source: Florida Department of Labor and Employment Security, 1989.

Table 2.2-8. Non-Agricultural Employment by Industry, Broward County--1987

Industry	Number of Employees	Percent of Total
Construction	35,400	7.9
Manufacturing	45,300	9.8
Transportation/Public Utilities	22,400	4.9
Trade	139,100	29.9
Finance/Insurance/Real Estate	39,700	8.4
Services and Miscellaneous	125,900	27.2
Government	57,200	11.9
TOTAL	465,000	100.0

Source: Florida Department of Labor and Employment Security, 1989

Table 2.2-9. Projected Employment Distribution By Industry, Broward County--1995

Industry	Number of Employees	Percent of Total
Agriculture	7,845	1.2
Mining	446	0.1
Construction	45,616	7.1
Manufacturing	57,936	9.0
Transportation/Public Utilities	31,091	4.8
Trade	179,315	27.9
Finance/Insurance/Real Estate	51,457	8.0
Services	194,161	30.2
Government	29,535[a]	4.6
Self-Employed Workers	45,917	7.1
TOTAL	643,319	100.0

[a]In Projected Employment Distribution table; Government excludes employment in the post office, state and local hospitals, and educational institutions. Employment in these industries reported in the services divsion.

Source: Florida Department of Labor and Employment Security, 1989.

Table 2.2-10. Per Capita Personal Income for Broward County, the State of Florida, and the United States--1975, 1979, and 1986

Area	Per Capita Personal Income 1975	1979	1986
Broward County	$6,379	$10,186	$18,128
Florida	5,530	8,257	14,630
United States	5,842	8,651	14,639

Source: Florida Statistical Abstract, 1988.

(1979-1986) remain similar to the 1975-1979 comparisons. According to the U.S. Department of Commerce, Bureau of Economic Analysis, 1986 income in Broward County was derived as follows:

Type of Income	Percent
Wages and Salary	50.4
Dividends, Interest, and Rent	29.4
Place of Residence Adjustment	8.6
Transfer Payments	14.7
Social Security Payments	-3.1
	100.0

The Lauderdale Plant currently employs 157 persons with an associated labor cost of $3.9 million (in 1988).

2.2.7.2 Area Public Services and Utilities

Public facilities within 5-miles of the Lauderdale Plant site are described below. These facilities include schools; transportation; hospitals; fire and police services; recreational facilities; and utilities (i.e., electricity and gas, wastewater, potable water, and solid waste utilities).

PUBLIC EDUCATION

Table 2.2-11 lists the public educational facilities located within 5 miles of the Lauderdale Plant site. No public educational facilities are located within 1 mile of the site. The closest facility is Hollywood Hills High School, located 1.5 miles south of the Lauderdale Plant site.

TRANSPORTATION

The highway transportation network near the Lauderdale Plant site in south-central Broward County consists of several major arterials and collectors. These facilities include I-95, the Florida Turnpike, State Road (SR) 84, SR 7 (US 441), Stirling Road, Griffin Road, and Ravenswood Road. I-95 is a six-lane limited-access freeway that traverses north-to-south through the eastern portion of Broward County. The Florida Turnpike is a north-south four- to six-lane toll facility located west of the project site. All of the remaining roadways, except Ravenswood Road, are four- to six-lane principal arterials. Ravenswood Road is a two-lane collector that

Table 2.2-11. Public Educational Facilities Within 5 Miles of the Lauderdale Plant Site

Elementary Schools	Middle Schools	High Schools
Bethune, Mary M.	Apollo	Cooper City
Boulevard Heights	Attucks	Dillard
Broward Estates	Driftwood	Hollywood Hills
Collins	New River	McArthur
Cooper City	Nova	Nova
Crossant Park	Olsen	South Broward
Dania	Parkway	South Plantation
Davie	Pioneer	Stranahan
Dillard	Rogers	
Driftwood	Seminole	
Edgewood		
Eisenhower, D.D.		
Foster, Stephen		
Harbordale		
Hollywood Hills		
Hollywood Park		
King, Martin Luther		
Larkdale		
Meadowbrook		
North Fork		
Nova Blanche Forman		
Oakridge		
Orangebrook		
Pasadena Lakes		
Pembroke Pines		
Peters		
Plantation		
Plantation Park		
Riverland		
Sheridan Hills		
Sheridan Park		
Sterling		
Sunland Park		
Tropical		
Walker		
West Hollywood		
Westwood Heights		

Source: School Board of Broward County, 1988.

parallels I-95 from Stirling Road to SR 84 east of the site. In addition to existing facilities, the I-595 connector from I-75 to the Fort Lauderdale-Hollywood International Airport is currently under construction. I-595 will run parallel to SR 84 and is expected to divert a significant number of trips from SR 84 in future years. Griffin Road and Ravenswood Road provide primary access to the project site via SW 42nd Avenue and SW 42nd Street, respectively. These two access roads are two-lane local streets which serve several residential areas. The existing roadway facilities in the site vicinity are shown on Figure 2.2-7.

The normal day-to-day operations of the Lauderdale Plant contribute to the volume of traffic on the roadway network within the vicinity of the site. Using the Broward County home-base work (HBW) vehicle rate of 1.12 persons per vehicle, the current staff at the Lauderdale Plant (i.e., 157) generate a maximum of 140 round trips to the plant per day. Based on employee origin/destination data from the existing plant, approximately 60 percent of employees arrive from/depart to the north, 25 percent from the south, 10 percent from the west, and 5 percent from the east. This diverse distribution pattern indicates that many major roadways near the site, particularly Griffin Road and Ravenswood Road, are being used by existing plant employees to arrive/depart from the site. The main entrance to the plant off of Griffin Road and SW 42nd Avenue is used by a majority of the employees to access the site. Most of the traffic occurs during the daytime shift (7:30 a.m. to 4:00 p.m.); however, evening and night shifts also generate additional employee traffic.

In addition to plant employee traffic, a minimal amount of truck traffic is generated by the site each day. This truck traffic, which consists of maintenance, delivery, and contractors/vendors vehicles, arrives infrequently and randomly throughout the day. Most of this traffic arrives from Ravenswood Road via SW 42nd Street.

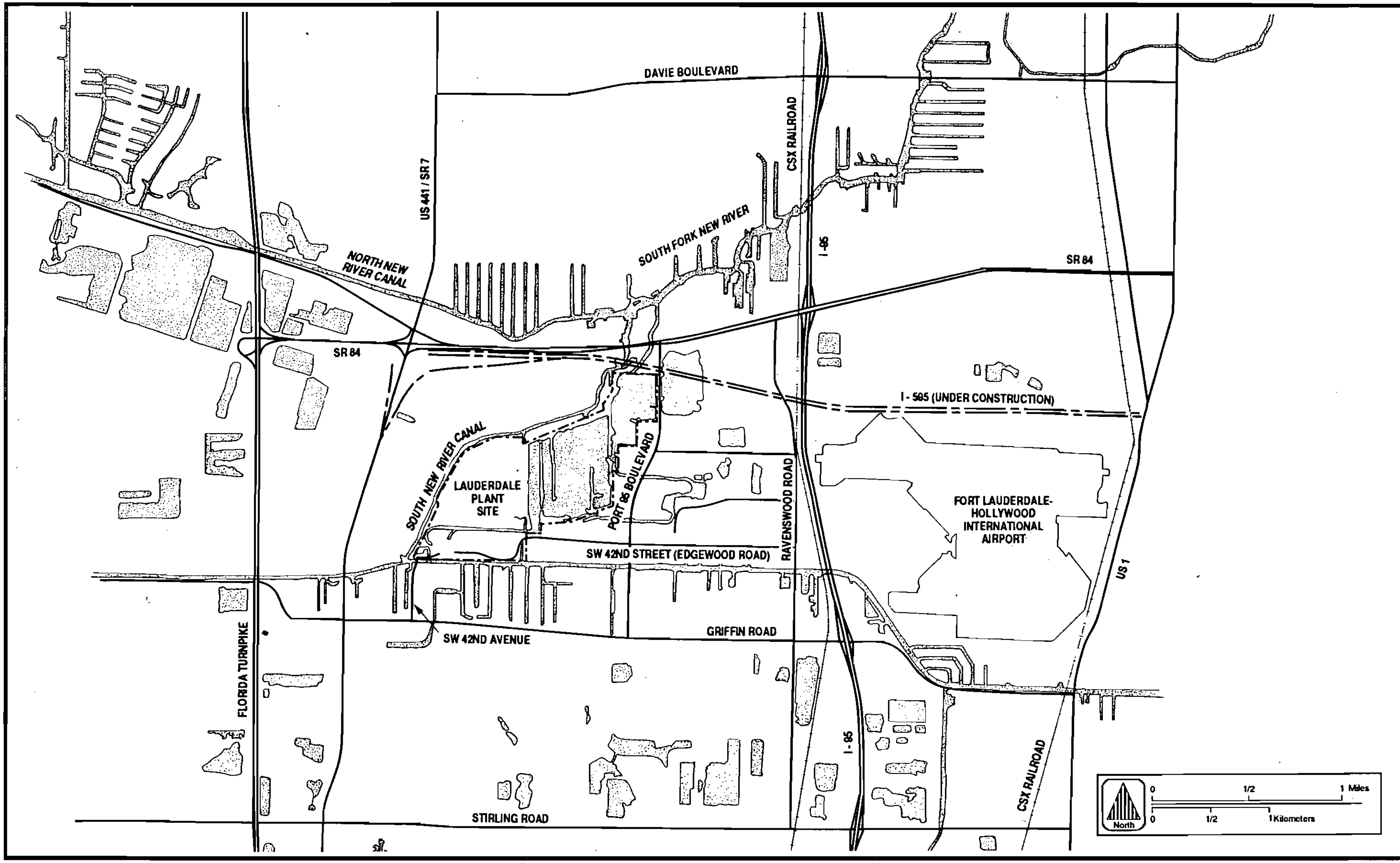

Figure 2.2-7 EXISTING ROADWAY FACILITIES IN THE VICINITY OF THE LAUDERDALE PLANT SITE

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Traffic count data were collected at several locations near the Lauderdale Plant site from three sources:

1. FDOT;
2. The Broward County Transportation Planning Department; and
3. A survey.

All traffic count data obtained from FDOT and Broward County were compiled as average annual daily traffic (AADT) volumes. Traffic data obtained by survey were collected from field studies and compiled as p.m. peak-hour volumes. The traffic count data obtained near the site include traffic from the existing plant. All traffic counts obtained prior to 1989 have been increased by a 4-percent annual growth factor to reflect 1989 existing conditions. Use of this growth factor was based on historic traffic growth patterns along the major roadways within the vicinity of the site.

In order to convert the 1989 AADT volumes to p.m. peak-hour volumes, a peak-hour-volume-to-daily-volume ratio (K factor) was applied to the AADT volumes. The K-factors were based on average regional rates which were accepted by the South Florida Regional Planning Council (1989) for converting daily traffic volumes to peak-hour volumes for roadways in the south Florida planning region. These rates are considered planning guidelines to be used to evaluate traffic impacts generated by developments. The appropriate K factors used were:

Number of Lanes	K Factor (%)
2	9.0
4	8.4
6+	8.0

In addition, a directional distribution (D factor) of 55 percent/45 percent was applied to the peak-hour volumes in order to estimate directional volumes. The D factor used in this analysis was verified though the collection of current traffic data. The appropriate direction of the peak volumes was then determined based on historic traffic distribution patterns in the vicinity of the Lauderdale Plant site.

The p.m. peak-hour volumes obtained were compared to hourly level of service criteria in order to determine the p.m. peak-hour traffic conditions of each roadway. The p.m. peak-hour traffic conditions were analyzed because this peak period represented the worst-case traffic scenario for the project impact area. The level-of-service (LOS) criteria used for this analysis were based on FDOT (1989). Based on the functional classification and lineage of each roadway and the number of signalized intersections per mile along the roadway, an LOS category was assigned to each roadway link within the impact area. There are six LOS categories (A through F), with LOS A representing the best operating condition and LOS F representing the worst. Generally, LOS D is considered the minimum acceptable level of service along a roadway or intersection. Table 2.2-12 provides a general definition of LOS and a description of each LOS category. Based on the procedures outlined above, existing roadway conditions were analyzed within the impact area. Table 2.2-13 indicates the results of this analysis. As shown in Table 2.2-13, a majority of roadway links near the site are currently operating at LOS D or better. The only exceptions are SR 7 from Stirling Road to Griffin Road, I-95 from Stirling Road to SR 84, and SR 84 from I-95 to SR 7. These roadway links are operating at LOS F in at least one direction along each link.

An additional analysis was conducted at two significant intersections near the Lauderdale Plant site: Ravenswood Road at SW 42nd Street and Griffin Road at SW 42nd Avenue. Neither of these intersections has traffic control signals at present. Using the Highway Capacity Manual (HCM) computer software program (Institute of Transportation Engineers, 1985) for intersection analyses and 1989 turning movement volumes at both locations, the 1989 existing p.m. peak-hour operating conditions for these intersections were estimated. The 1989 turning movement volumes were based on field counts. Based on this analysis, the Ravenswood Road/SW 42nd Street intersection is currently operating at LOS A, and the Griffin

Table 2.2-12. Roadway Level-of-Service Descriptions

General Definition of Level of Service: The ability of a maximum number of vehicles to pass over a given section of roadway or through an intersection during a specified time period, while maintaining a given operating condition.

LOS Category	Description
A	Highest level of service. Represents free flow. Individual users are virtually unaffected by the presence of others in the traffic stream. Freedom to select desired speeds and to maneuver within the traffic stream is extremely high. The general level of comfort and convenience provided to the motorist, passenger, or pedestrian is excellent.
B	Within the range of stable flow, but the presence of other users in the traffic stream begins to be noticeable. Freedom to select desired speeds is relatively unaffected, but there is a slight decline in the freedom to maneuver within the traffic stream from LOS A. The level of comfort and convenience provided is somewhat less than at LOS A, because the presence of others in the traffic stream begins to affect individual behavior.
C	Within the range of stable flow, but marks the beginning of the range of flow in which the operation of individual users becomes significantly affected by interactions with others in the traffic stream. The selection of speed is now affected by the presence of others, and maneuvering within the traffic stream requires substantial vigilance on the part of the user. The general level of comfort and convenience declines noticeably at this level.
D	Speed and freedom to maneuver are severely restricted, and the driver or pedestrian experiences a generally poor level of comfort and convenience. Small increases in traffic flow will generally cause operational problems at this level.
E	Represents operating conditions at or near the capacity level. All speeds are reduced to a low, but relatively uniform value. Freedom to maneuver within the traffic stream is extremely difficult, and it is generally accomplished by forcing a vehicle or pedestrian to "give way" to accommodate such maneuvers. Comfort and convenience levels are extremely poor, and driver or pedestrian frustration is generally high.
F	Represents forced or breakdown flow. This condition exists wherever the amount of traffic approaching a point exceeds the amount which can traverse the point. Queues form behind such locations. Operations within the queue are characterized by stop-and-go waves, and they are extremely unstable.

Source: Institute of Transportation Engineers, 1985.

Table 2.2-13. Existing Roadway Link Conditions--1989

Facility	Link	Direction/ Geometrics	LOS D p.m. Peak-Hour Service Volume[a]	Existing p.m. Peak-Hour Traffic Volume	Existing p.m. Peak-Hour LOS Category
Florida Turnpike (6-lane expressway)	Hollywood Boulevard to SR 84	Northbound/3L	5,570	2,430	B
		Southbound/3L	5,570	1,989	A
SR 7 (4/6 lane divided roadway)	Stirling Road to Griffin Road	Northbound/2L	1,720	1,989	F
		Southbound/2L	1,670	1,627	D
	Griffin Road to SR 84	Northbound/3L	2,600	1,849	B
		Southbound/3L	2,530	1,513	C
Ravenswood Road (2-lane undivided roadway)	Stirling Road to Griffin Road	Northbound/1L	880	504	A
		Southbound/1L	890	616	A
	Griffin Road to SW 42nd Street	Northbound/1L	890	415	A
		Southbound/1L	880	340	A
	SW 42nd Street to SR 84	Northbound/1L	890	367	A
		Southbound/1L	880	301	A
I-95 (6-lane freeway)	Stirling Road to Griffin Road	Northbound/3L	5,570	7,270	F
		Southbound/3L	5,570	5,949	E
	Griffin Road to SR 84	Northbound/3L	5,570	7,028	F
		Southbound/3L	5,570	5,750	E
Stirling Road (6-lane divided roadway)	I-95 to SR 7	Eastbound/3L	2,210	1,398	D
		Westbound/3L	2,510	1,708	D
Griffin Road (6-lane divided roadway)	I-95 to SW 42nd Avenue	Eastbound/3L	2,210	1,325	D
		Westbound/3L	2,510	1,619	C
	SW 42nd Avenue to SR 7	Eastbound/3L	2,210	1,181	D
		Westbound/3L	2,510	1,444	C
SR 84 (4-lane divided roadway)	I-95 to SR 7	Eastbound/2L	1,670	1,736	E
		Westbound/2L	1,720	2,122	F

[a]Based on FDOT generalized peak-hour level of service maximum volumes tables, January 1989.

Source: FDOT, 1989.

Road/SW 42nd Avenue intersection operates at LOS C. Results of this computer analysis are provided in Appendix 10.5.5.

Based on the current employee origin/destination data, employees living north of the site likely use the SW 42nd Street entrance and the employees living south, east, and west of the site likely use the SW 42nd Avenue entrance. The maximum traffic volumes generated at the plant would be (by accounting for shift scheduling) 48 vehicles at the Ravenswood Road/SW 42nd Avenue intersection and 32 vehicles at the Griffin Road/SW 42nd Avenue intersection. These traffic movement volumes are less than 13 and 3 percent of the existing peak-hour traffic volumes for Ravenswood Road and Griffin Road, respectively.

HOSPITALS

There are seven hospitals located within 5 miles of the Lauderdale Plant site:

- Broward General Medical Center
- Hollywood Pavilion Psychiatric Hospital
- Hollywood Memorial Hospital
- Hollywood Medical Center
- Outpatient Surgical Care of Fort Lauderdale
- Pembroke Pines General Hospital
- Plantation General Hospital

The closest full-service hospital to the site is the 737-bed Hollywood Memorial Hospital.

FIRE PROTECTION

Fire protection is currently provided by Broward County Fire and Rescue Station No. 5 located at 5301 SW 31st Avenue, approximately 1 mile southeast of the Lauderdale Plant site. This company has four full-time firefighters on staff with two engines, one 1,000-gallon-per-minute (gpm) primer, and a hazardous materials unit. Response time from this location to the site is between 3 to 4 minutes. Access to the site is via

Ravenswood Road and SW 42nd Street. The Lauderdale Plant site has fire protection equipment such as sprinklers and fire retardant materials around the existing facilities and FPL personnel have sufficient training to provide the initial response to emergencies including first aid and use of extinguishers for fire suppression.

POLICE PROTECTION

Police protection currently is provided by the Broward County Sheriff's Department. The Lauderdale Plant site is in the District 1 service area. Staffing for this district is 8 to 10 deputies. Response time for an emergency is no more than 2 to 3 minutes. The Lauderdale Plant site has limited access. Security fences are located around all major plant facilities including remote-controlled fences at the access roads (i.e., SW 42nd Avenue and SW 42nd Street). Remote television cameras at plant access roads are located around the plant facilities.

PUBLIC RECREATION

Table 2.2-14 lists the municipal public recreational facilities within the study area. Table 2.2-2 lists the county-maintained parks within the study area.

UTILITIES

Natural gas is provided to the area surrounding the plant by Peoples Gas Company, and electric service is supplied by FPL. Florida Gas Transmission serves the Lauderdale Plant site.

Domestic wastewater currently being generated at the site is being disposed of by an on-site septic system. Wastewater treatment services in the area surrounding the plant are provided by the City of Hollywood (regional) and Ferncrest Utilities.

Potable water is supplied to the site by Broward County Environmental Services (Utility District 3A). Solid waste is collected by a disposal service and disposed of in one of the following landfills: Miami, West

Table 2.2-14. Public Recreational Facilities Within 5 Miles of the Lauderdale Plant Site (Page 1 of 2)

Cooper City
- Timberlane Park
- Colony Park
- Chase Park
- Community Center
- Cooper City Elementary
- Country Address Park
- Pioneer Middle School
- Proposed Country Address Encore Park
- Cooper City High School

Dania
- Modello Park
- Frost Park
- Northside Park
- Mullikin Park
- Chester Byrd Park

Davie
- Berman Park
- Lange Park
- Potter Park
- Linear Park
- SW 36 Ct. Park
- Lyn-Mar Park
- 39th Street Park
- Davie Arena
- A.D. Griffin Sports Complex

Fort Lauderdale
- Benenson Park
- Boat Ramps
- Bublier Park
- Crossant Park/School
- Dillard School/Park
- Dockmaster
- Flamingo Park
- Harbordale Park/School
- Hardy Park
- Hortt Park/School
- Hull Stadium
- Lincon Park
- North Fork Park/School
- Poincianna Park
- Riverside Park
- Rogers Park/School
- Snyders Park
- St. Thomas Aquinas School
- Stranahan Park/School
- Sunland Park
- Sunset Park/School
- Walker Park/School
- Westwood Heights Park/School

Hollywood
- Orangebrook Golf Course
- Rotary Park
- Hollywood Golf and Country Club
- Boggs Field
- Eco Grande Golf Course
- Dowdy Field
- David Park Center
- Driftwood Center
- Lawn Bowling Courts
- Montella Park
- Multi-Purpose Center
- Shuffleboard Courts
- Washington Park Center
- John Williams Park
- Anniversary Park
- Appolo Middle School/Pool
- Oak Lake Park
- Attucks Middle School/Pool
- Ben Franklin Park
- Zinkil Park
- Beverly Hills Park
- Beverly Park
- Bicentennial Park
- Boulevard Heights Elementary
- Chaminade High
- Colbert Elementary
- Emerald Hills Park
- Garfield St. and 62nd Avenue Park
- Goldman Park
- Hollywood Hills Elementary
- Hollywood Hills High School
- Hollywood West Park
- Kiwanis Park
- Lions Park
- McArthur High
- Nativity Elementary
- Oakridge Elementary

Table 2.2-14. Public Recreational Facilities Within 5 Miles of the Lauderdale Plant Site (Page 2 of 2)

Hollywood (continued)
- Oakwood Hills Park
- Orangebrook Elementary
- Quest School
- Seminole Park
- Sheridan Hills Elementary
- South Broward High
- Stirling Elementary
- Water View Park
- West Hollywood Elementary

Lauderhill
- Wolk Park

Pembroke Pines
- Perry Center
- Fletcher Recreation Center
- Pasadena School

Plantation
- Plantation Isle Park
- City Park
- Community Center and Kenndy Memorial Park
- Deicke Auditorium and Hoffman Park
- Fig Tree Park
- Fumpston Park
- Mini Parks 1, 2, 3
- Park East Park
- Planatation Elementary School
- Planatation Botanical Gardens
- Planatation Point Park
- Seminole Park and Pop Travelers Field
- South Bel Aire Park
- Throwers Park
- Woodbury Park

Sunrise
- No facilities within 5 miles of the Lauderdale Plant site

Sources: Broward County Parks and Recreation Division, 1988.
City of Dania, n.d.
Town of Davie, 1988.
City of Hollywood, n.d.
Keith and Schnars, 1988.
City of Lauderhill, 1988.
Pembroke Pines, n.d.
City of Plantation, 1988.

Broward, or Pompano. Any hazardous waste generated at the facility is collected, manifested, and transported to an approved hazardous waste disposal facility.

2.3 BIOPHYSICAL ENVIRONMENT

2.3.1 Geohydrology

2.3.1.1 Geologic Description of the Site Area

The Lauderdale Plant site is located in the Coastal Plain physiographic province, a region of low relief underlain by unconsolidated to poorly consolidated sediments and indurated carbonate rocks. The subsurface stratigraphy in the region (Table 2.3-1) consists of approximately 15,000 ft of sedimentary rocks of late Cretaceous through late Quaternary age overlying igneous and metamorphic rocks. These basement rocks are overlain by a thick sequence (up to 10,000 ft) of late Cretaceous carbonate rocks of Austin limestones, the Pine Key Formation, and the Lawson Limestone (Carter, 1984). Overlying Cretaceous rocks are 600 to 1,800 ft of Eocene through Early Miocene carbonates of the Oldsmar, Lake City, and Avon Park Limestones, the Ocala Group, the Suwannee Limestone, and the Tampa Limestone. These highly transmissive solution-cavity-riddled rocks comprise the Floridan aquifer in south Florida (Florida Bureau of Geology, 1986). Overlying the Floridan aquifer is a thick sequence (up to 600 ft) of low-permeability clays and marls of the Miocene Hawthorn Formation and the lower portion of the Miocene Tamiami Formation (Anderson et al., 1986).

Overlying these low-permeability clays and marls is a series of porous clastic and carbonate sedimentary rocks of Miocene to late Quaternary age, which comprise the Biscayne aquifer. Distinct lithologic units within the Biscayne aquifer include the upper portion of the Miocene Tamiami Formation, the Pliocene Caloosahatchee Marl, and the Pleistocene Fort Thompson Formation, Key Largo Limestone, Anastasia Formation, Miami Limestone, and Pamlico Sand (Schroeder et al., 1958). The Tamiami Formation varies in composition from pure quartz sand to highly permeable indurated beds of pure limestone. The proportion of limestone to sand increases with depth. The Caloosahatchee Marl consists of sandy marl, clay, silt, and sand with shell beds and yields less water than most other parts of the Biscayne aquifer. The Pleistocene formations are contemporaneous, in part, with the basal Fort Thompson Formation composed of marls, limestones, and sandstones interfingering with coralline reef

Table 2.3-1. Stratigraphic Column of Rock Units in the Vicinity of the Lauderdale Plant Site (Page 1 of 2)

Age	Formation	Lithologic Description	Thickness (ft)	Water-bearing Unit
Holocene	Soils	Peat and muck.	0-12	
	Lake Flirt Marl	White to gray calcareous mud, rich with shells of Helisoma sp., a fresh-water gastropod. In some places cemented to form dense limestone. Relatively impermeable.	0-6	
Pleistocene (formations are contemporaneous in part)	Pamlico Sand	Quartz sand, white to black or red, depending upon nature of staining materials, very fine-to coarse-grained, average medium-grained. Mantles large areas underlain by Miami oolite and Anastasia Formation.	0-40	Biscayne aquifer
	Oolite facies of the Miami Limestone	Limestone, oolitic, soft, white to yellowish containing thin layers of calcite, massive to crossbedded and stratified; generally perforated with vertical solution holes. Fair to good aquifer.	0-40	Biscayne aquifer
	Anastasia Formation	Coquina, sand, calcareous sandstone, sandy limestone, and shell marl. Probably composed of deposits equivalent in age to marine members of Fort Thompson Formation. Fair to good aquifer.	0-120	Biscayne aquifer
	Key Largo Limestone	Coralline reef rock, ranging from hard and dense to soft and cavernous. Probably interfingers with the marine members of the Fort Thompson Formation. Crops out along southeastern coastline of Florida from Soldier Key in Biscayne Bay to Bahia Honda. Excellent aquifer.	0-60	Biscayne aquifer
	Fort Thompson Formation	Alternating marine, brackish-water and fresh-water marls, limestones, and sandstone. A major component of the highly permeable Biscayne aquifer of coastal Dade and Broward Counties, which yields copious supplies of groundwater.	0-150	Biscayne aquifer
Pliocene	Caloosahatchee Marl	Sandy marl, clay, silt, sand, and shell beds. Yields groundwater less abundantly than most other parts of the Biscayne aquifer.	0-25	Biscayne aquifer

Table 2.3-1. Stratigraphic Column of Rock Units in the Vicinity of the Lauderdale Plant Site (Page 2 of 2)

Age	Formation	Characteristics	Thickness (ft)	Water-bearing Unit
Miocene	Tamiami Formation	Cream, white and greenish-gray clayey marl, silty and shelly sands, and shelly marl, locally hardened to limestone. Upper part, where permeability is high, forms the lower part of the Biscayne aquifer. Lower and major part of formation is low permeability and forms the upper beds of the aquiclude that confines water in the Floridan aquifer below.	0-500	Biscayne aquifer and confining horizon
	Hawthorn Formation	Sandy, phosphatic marl, interbedded with clay, shell, marl, silt, and sand. Greenish color predominates. Water is generally scarce, of poor quality, and in the permeable beds is confined under low-pressure head. Comprises the major part of aquiclude confining the Floridan aquifer.	50-500	Confining horizon
	Tampa Limestone	White to tan, soft to hard, often partially recrystallized limestone. Yields artesian water but not as abundantly as lower parts of the Floridan aquifer.	150-250	Floridan aquifer
Oligocene	Suwannee Limestone	Creamy soft to hard limestone, lithologically similar to underlying Ocala Limestone.	0-450	Floridan aquifer
Eocene	Ocala Group Avon Park Limestone Lake City Limestone Oldsmar Limestone	Crystalline carbonate rocks; limestone and dolomite, generally yields highly mineralized water.	1,500-3,000	Floridan aquifer
Paleocene	Absent	--	--	Not a source of water
Cretaceous	Lawson Limestone Pine Key Formation Austin Age Limestone	Crystalline carbonate rocks; limestone and dolomite, not used as source of water.	>10,000	Not a source of water
Precambrian and Palezoic	--	Crystallized igneous and metamorphic rocks.	--	Not a source of water

Sources: Schroeder et al., 1958; Carter, 1984; Sherwood et al., 1973; Vecchiolo and Foose, 1984; Florida Bureau of Geology, 1986; and Anderson et al., 1986.

limestone of the Key Largo Limestone. The Anastasia Formation consists predominantly of coquina and calcareous sandstone representing littoral facies equivalents of the Fort Thompson Formation and Key Largo Limestone. These three units range in thickness from 0 to 150 ft thick (Sherwood et al., 1973). The overlying Miami Oolite is an oolitic facies of the Miami Limestone and is often perforated by vertical solution holes caused by burrowing and slightly developed karst activity. The Pamlico Sand is a well-sorted fine- to coarse-grained quartz sand of littoral origin. Both the Miami Oolite and Pamlico Sand range in thickness from 0 to 40 ft.

The near-surface soils overlying the Biscayne aquifer consist of sand with limestone fragments and organic deposits (peat), the latter of which is characteristic of the flatland areas west of the Atlantic Coastal Ridge.

2.3.1.2 Detailed Site Lithologic Description

A series of investigations were conducted at the Lauderdale Plant site to define the site-specific geologic conditions underlying the facility. These investigations include Law Engineering Testing Company (1976 and 1977), Technos, Inc. (1984), and Ebasco Services, Inc. (1988). Data collected during these investigations are presented in the final reports of each respective study. The scope of work and findings associated with these investigations are summarized in the following paragraphs of this section.

Law Engineering Testing Company (1976) performed a preliminary geotechnical study northwest of the power block in the vicinity of the stub canal. Law Engineering Testing Company (1977) conducted an additional geotechnical study in the area of the present solids settling basin/evaporation percolation pond (SSB/EPP) located east of the plant facility. As part of these field investigations, 11 soil borings and 2 observation wells were installed in the vicinity of the stub canal. The observation wells are labeled OB-2 and OB-3 in Figure 2.3-1. In the vicinity of the present SSB/EPP, two soil borings, B-101 and B-102, were drilled to depths of

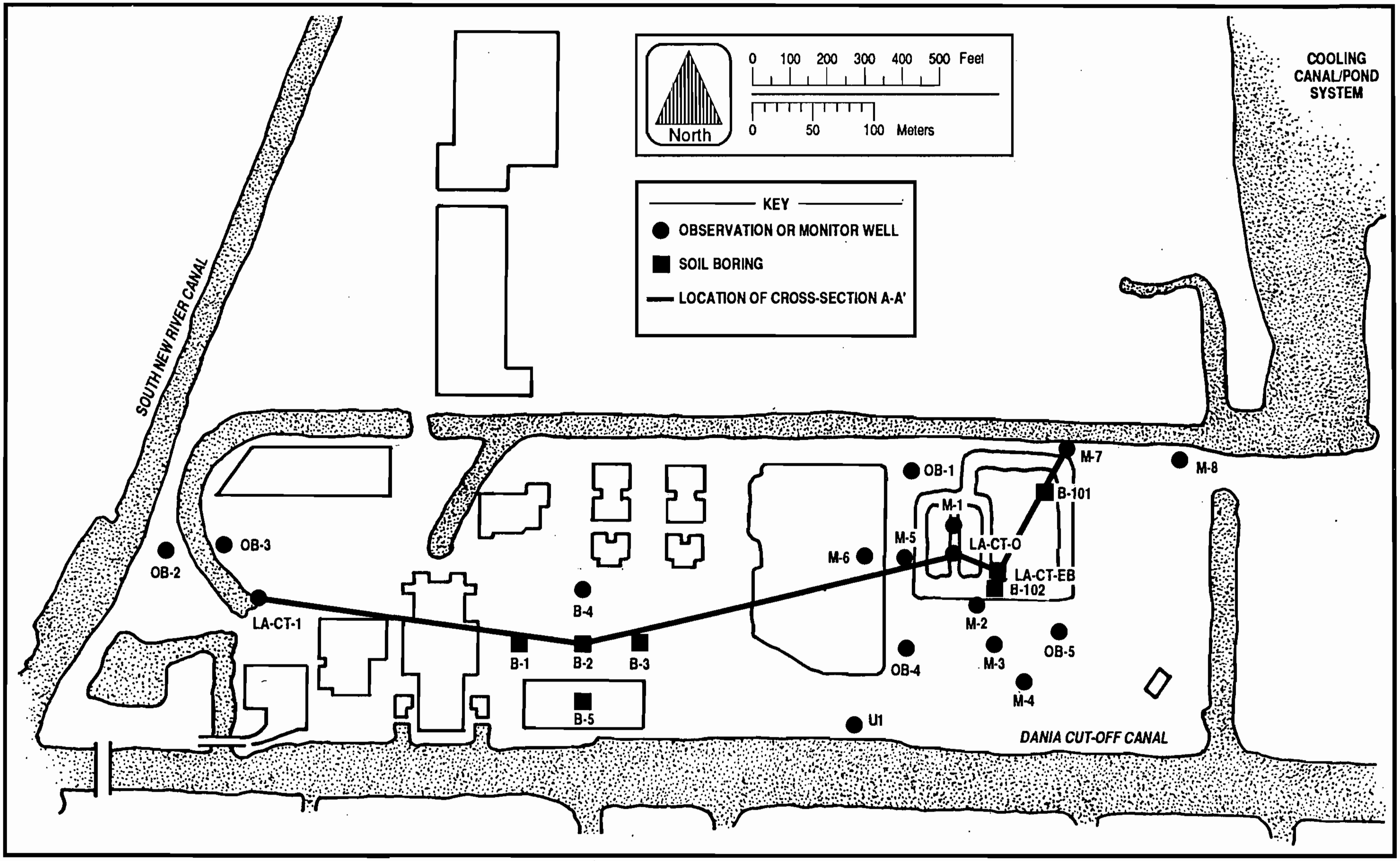

Figure 2.3-1 HISTORICAL OBSERVATION AND MONITOR WELL PLACEMENT AND SOIL BORINGS LOCATIONS AT THE LAUDERDALE PLANT SITE

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30.5 and 25.5 ft, respectively. Five observation wells, OB-1 through OB-5, were installed to depths of 16 to 25 ft. The original observation wells OB-2 and OB-3, in the installed vicinity of the SSB/EPP, were subsequently destroyed during pond construction. The locations of the soil borings and existing observation wells are shown on Figure 2.3-1.

Technos, Inc. (1984) conducted electromagnetic conductivity (EM) surveys in the vicinities of both the stub canal area and the SSB/EPP area to provide data for an FDER-required groundwater monitoring plan. These surveys provided an evaluation of groundwater quality surrounding the stub canal and SSB/EPP areas, focusing on the shallow groundwater regime potentially impacted by plant discharges. The investigation also involved the drilling of eight monitor wells (M-1 through M-8), a source characterization well drilled by cable tool (LA-CT-O), and a boring drilled to collect samples for measurement of cation exchange properties of the soil (LA-CT-EB). An additional vertical profile well (LA-CT-1) was located immediately adjacent to the stub canal to evaluate impacts to the groundwater in the vicinity of the canal. The locations of the monitor wells, vertical profile well, and soil borings are shown on Figure 2.3-1.

Ebasco Services, Inc. conducted a subsurface investigation in the vicinity of the proposed power block area in 1988 that involved five soil borings (B1-B5) completed to a depth of 30 ft. Figure 2.3-1 illustrates the locations of these borings. Continuous Standard Penetration Tests (SPT) were conducted during boring installation, and sieve analyses of the soils were performed for 20 samples collected from the five borings. Soil boring B-4 was converted to a monitor well following completion of the soil investigation.

The detailed site lithologic description which follows was developed based on the evaluation of data from published literature and the aforementioned investigations.

A soil survey for Broward County (Soil Conservation Service, 1973) does not include a classification of the native soils in the immediate area of the plant. The site soils are extensively altered as a result of construction activities in which various fill materials, usually sand, shell, and limestone fragments, were used. Soil Conservation Service (1973) does not assign a capability designation to this soil category, but rather designates it as urban land. Borings completed by Ebasco Services, Inc. (1988) confirm that much of the site is immediately underlain by fill material.

Figure 2.3-2 is a geologic cross-section (A-A') developed from Technos (1984) boring logs and supplemented by Ebasco Services, Inc. (1988) data defining the shallow stratigraphy underlying the site. The location of the cross-section is delineated on Figure 2.3-1. The lithology of the sedimentary unit immediately underlying the site consists of sand with limestone fragments. This sand unit is similar lithologically and likely represents the Pleistocene Pamlico Sand, ranging in thickness from approximately 5 ft near the eastern portion of the property (monitor well M-7) to approximately 12 ft in the vicinity of the proposed power block construction (Ebasco boring B-2). Underlying this sand unit in the SSB/EPP area, shown in Figure 2.3-2 is a peat unit approximately 5 ft thick. This peat unit pinches out westward and is absent in borings from the western portion of the site. The peat unit is underlain by a thin silty sand unit at the eastern end of the cross-section (monitor well M-7).

The surficial Pamlico Sand and the peat or silt units of the eastern portion of the property are underlain by approximately 16 to 24 ft of sandy limestone. This sandy limestone was encountered in all borings along cross-section A-A', indicating lateral continuity of the unit beneath the site. Underlying this sandy limestone at a depth of 28 to 32 ft below ground level is fine sand with limestone fragments. This calcareous sand unit may represent the Pleistocene Anastasia Formation. This unit ranges in thickness from 12 to 15 ft and is underlain by crystalline sandy limestone that extends from a depth of approximately 45 ft below ground

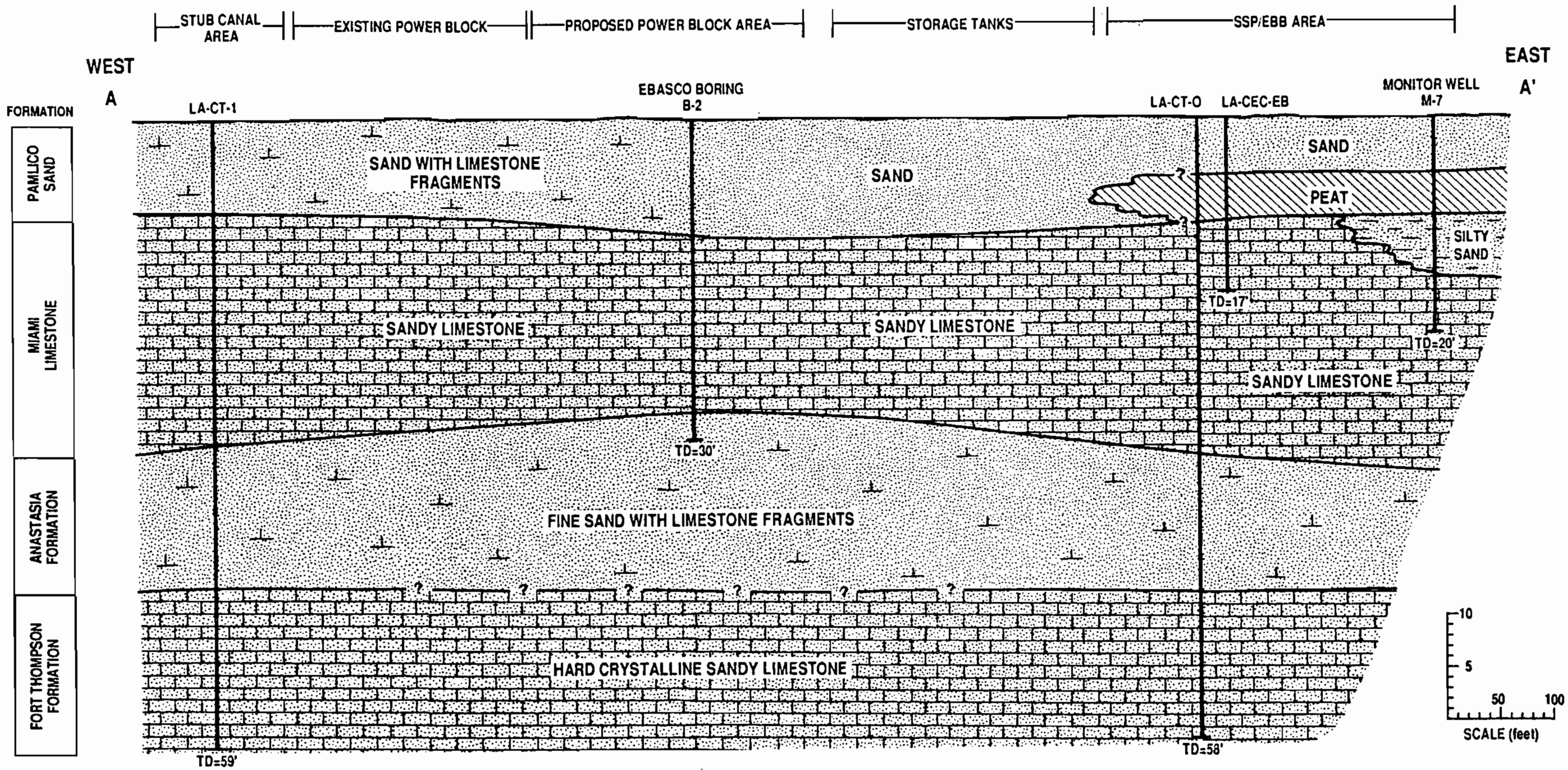

Figure 2.3-2 GEOLOGIC CROSS SECTION A – A'

SOURCES: TECHNOS, INC., 1984; EBASCO SERVICES, INC., 1988.

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level to the base of the borings installed at the site. This crystalline limestone is lithologically similar to the Fort Thompson Formation. This unit is a major component of the highly permeable Biscayne aquifer, which yields copious amounts of groundwater to wells in southeastern Broward County.

2.3.1.3 Geologic Maps

The surficial distribution of lithologic units in south Florida is presented in Figure 2.3-3. This geologic map indicates that the formations which comprise the Biscayne aquifer are exposed at the surface across much of south Florida. In the vicinity of the Lauderdale Plant site, the Pleistocene Miami Limestone oolite facies, Anastasia Formation, and Fort Thompson Formation are exposed at the surface or overlain by a thin sediment cover.

Figure 2.3-4 is an isopleth map indicating the thickness of the Biscayne aquifer and the depth to the underlying impermeable rocks of the Tamiami Formation. In the vicinity of the Lauderdale Plant site, the Biscayne aquifer is approximately 155 to 175 ft thick.

There is no known documentation of karst occurrence at the site. A previous investigation (Technos, 1984) conducted first-order photo analyses to delineate karst formation; however, no evidence of paleo- or recent karst activity was detected. Extensive research on the occurrence and distribution of sinkholes in Florida indicates that sinkhole formation is very rare in south Florida (Lane, 1986; Sinclair and Stewart, 1985).

2.3.1.4 Bearing Strength

A geotechnical investigation of the site was performed by Ebasco Services, Inc. (1988). During that investigation, five soil test borings were drilled, each to a depth of 30 ft. Borings were located to provide a generalized cross-section of the subsurface soils beneath the proposed power block. Subsurface conditions were evaluated by performing SPTs for each boring [American Society for Testing Materials (ASTM) D1586] and by

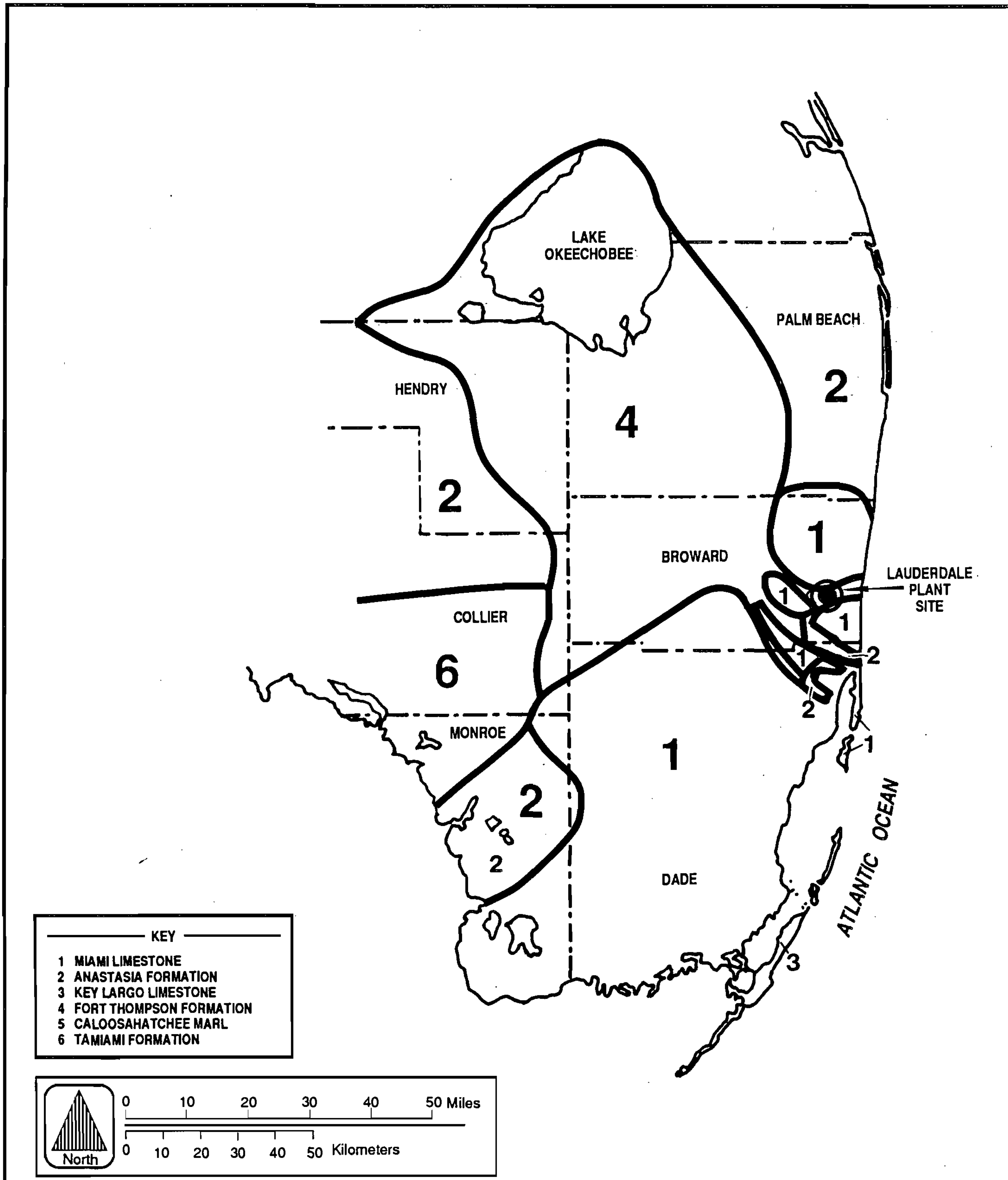

Figure 2.3-3 GEOLOGIC MAP OF SOUTHERN FLORIDA

SOURCE: MODIFIED FROM SCHROEDER et al., 1958.

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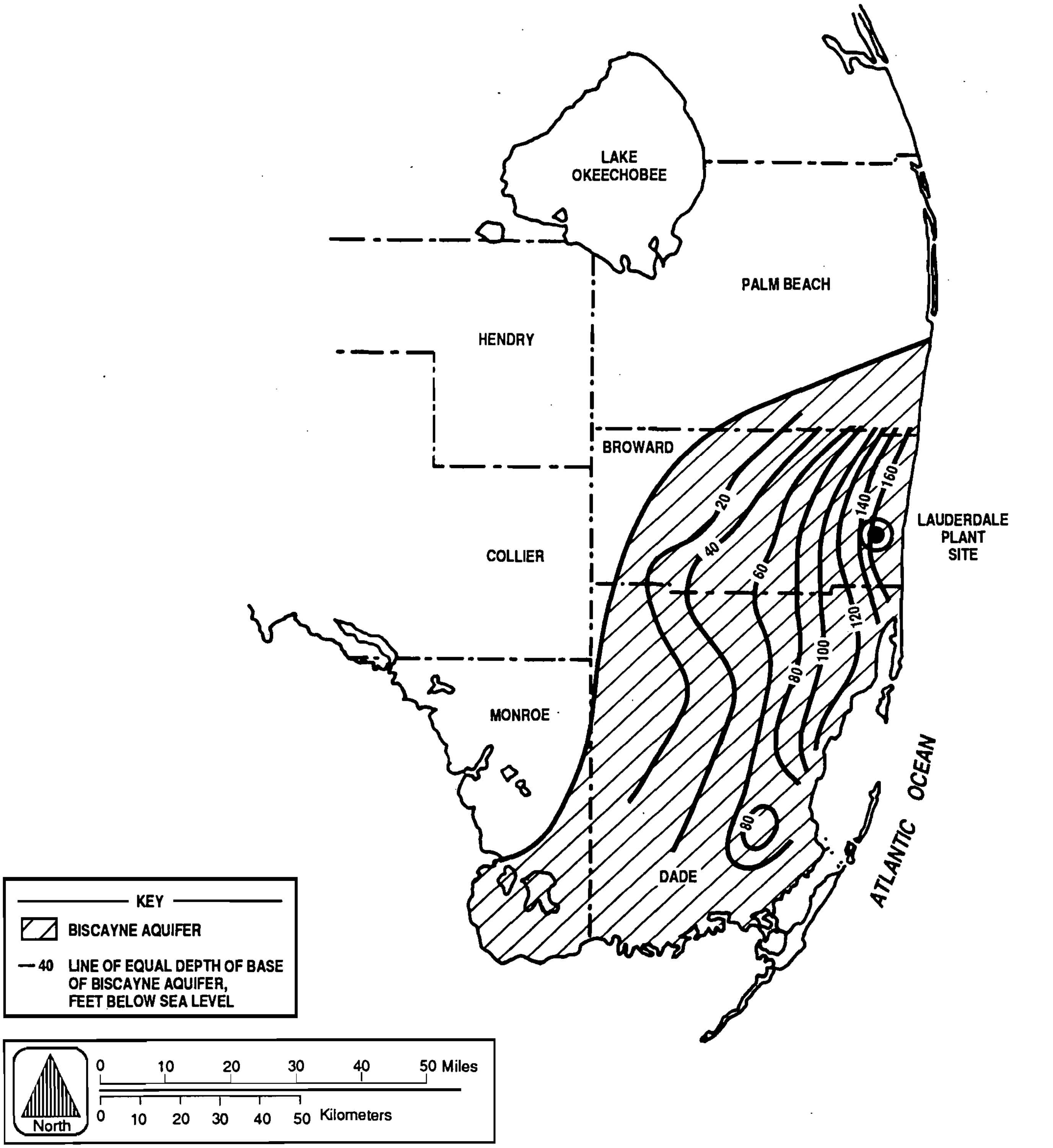

Figure 2.3-4 ISOPLETH MAP OF BISCAYNE AQUIFER

SOURCE: MODIFIED FROM KLEIN AND HULL, 1978.

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laboratory analyses of selected soil samples. The analyses consisted of visual classification and laboratory-conducted sieve analyses of collected samples.

Based on the results of the boring program, Ebasco Services, Inc. (1988) reported that the subsurface conditions are heterogeneous and lack uniformity. Generally, the soils in the vicinity of the proposed power block consist of approximately 0 to 5 ft of medium dense to very dense quartz sand and fragmented limestone fill overlying approximately 5 to 12 ft of loose to very loose quartz sand with organic material, roots, and peat. This sand and organics unit overlies soft sand limestone and loose quartz sand with limestone fragments to the termination of boring (i.e., 30-ft depth). The depth to groundwater at the time of the geotechnical investigation ranged between approximately 4.0 ft and 5.3 ft below ground surface.

Based on the subsurface conditions encountered at the borings, the site will provide adequate foundation support for the proposed structures, provided that measures are taken to account for the soft organic layer. Several foundation alternatives have been identified as being the most feasible:

1. Design of footings such that significant stresses can be imparted only on the dense fill layer,
2. Removal and replacement of the loose organic layer with construction fill, and
3. Transfer of heavier column loads to deeper strata via cast-in-place concrete piles.

Any combination of these foundation alternatives could be used during construction of the proposed structure. Actual foundation alternatives to be used during power block construction are discussed in Chapter 3.0.

2.3.2 Subsurface Hydrology

2.3.2.1 Subsurface Hydrologic Data for the Site

The two aquifers that underlie Broward County are the shallow Biscayne aquifer, which is unconfined, and the deeper Floridan aquifer, which is artesian (Sherwood et al., 1973). The Biscayne aquifer is the source of potable water in Broward County. The top of the Biscayne aquifer generally occurs 10 to 20 ft below ground surface and extends to depths of greater than 200 ft below ground surface near the coast. It is a highly permeable wedge-shaped hydrostratigraphic unit that thins landward to less than 30 ft thick in western Broward County. The Biscayne aquifer is underlain by 500 to 600 ft of low permeability clays and marls which serve as a confining unit between it and the underlying Floridan aquifer. The top of the Floridan aquifer occurs approximately 900 ft below ground surface in coastal Broward County and extends to a depth of more than 3,000 ft below ground surface. The water from the Floridan aquifer generally contains more than 1,500 milligrams per liter (mg/L) of chloride and 3,500 mg/L total dissolved solids (TDS). The Floridan water is sulfurous, hard, and corrosive in this area and not currently suitable as a potable water source.

The Biscayne aquifer is a single hydrologic unit of permeable materials ranging in age from late Miocene through Quaternary. The extent of the aquifer, both horizontal and vertical, is not set by lithologic contacts or chronostratigraphic boundaries but by differences in the hydrologic properties of the sediments. The lowermost component of the Biscayne aquifer is a limestone or shelly calcareous sandstone of the upper part of the Tamiami Formation in the northeastern part of Dade County and the southeastern part of Broward County. The remaining and major portion of the Biscayne aquifer is composed of rocks ranging in age from Pliocene through late Quaternary in the following ascending sequence: Caloosahatchee Marl (as erosional remnants), Fort Thompson Formation, Key Largo Limestone, Anastasia Formation, oolitic and burrowed facies of the Miami Limestone, and Pamlico Sand. The aquifer is underlain by a relatively impermeable greenish marl of the Tamiami Formation. The contact between the marl and the limestone of the Tamiami, Fort Thompson, or Anastasia Formations, or the Key Largo Limestone, forms the lower boundary of the aquifer (Schroeder et al., 1958). A description of each of these rock units is provided in the stratigraphic column presented in Table 2.3-1. The lateral extent of the aquifer and the depth to the underlying low permeability marl are presented in Figure 2.3-4.

The Biscayne aquifer is composed predominantly of limestone, sandstone, and sand of marine origin. The aquifer is reportedly more than 200 ft thick along the coast in Broward County. The thickness of the consolidated limestone sections and the permeability of the aquifer as a unit generally decrease to the north. The aquifer also thins westward to about 70 ft at U.S. 27 in central Broward County and wedges out near the surface in the vicinity of the Collier-Broward county line (Sherwood et al., 1973).

Most of the limestone beds in the Biscayne aquifer are capable of yielding large amounts of water to wells. Wells that tap the thick limestone in the deeper part of the aquifer commonly yield more than 1,500 gpm with only 3 to 6 ft of drawdown (Sherwood et al., 1973). Most municipalities obtain water from the intermediate to deeper part of the aquifer.

The regional flow of groundwater in the Biscayne aquifer is seaward. Locally, however, the direction of flow may be influenced by drainage canals or well fields. Water levels are highest in the water-conservation areas and lowest along the coast, along uncontrolled reaches of canals, and in the centers of large municipal well fields. During rainy seasons, control structures in canals are opened in order to discharge surplus water to prevent flooding in urban and agricultural areas. The control structures are also used to control salinity intrusion. Opening the controls lowers the level in the canals, thereby permitting more groundwater to move to the canals and then seaward. Rainy season high-water levels of June 1968, some of the highest on record in southeast Florida, showed a maximum water level elevation of approximately 4 ft above msl in the vicinity of the Lauderdale Plant site (Leach et al., 1972).

Average water level elevations at the site are approximately 1 to 2 ft above msl (Technos, 1984).

Infiltration of rainfall through surface materials and seepage from controlled canals and the conservation areas are the principal means of recharging the Biscayne aquifer. Recharge by rainfall is greatest during the rainy season from June to November. Recharge from canals is greatest during the dry season, December to May, when canal levels are maintained at higher levels than adjacent water levels in the aquifer. High vertical permeabilities of surficial sediments permit rapid infiltration of rainfall to recharge the Biscayne aquifer. Discharge from the aquifer is by evapotranspiration, by groundwater flow to canals and to the sea, and by pumping from wells. Discharge by groundwater flow to canals and by evapotranspiration is greatest after periods of rainfall when water table levels are high; discharge by pumping from wells is greatest during the dry season as a result of the overall increase in demand from heavy irrigation use when water levels are low. Well yield is only a small part of the total discharge from the aquifer, but during the dry season its importance is amplified because it occurs when recharge and aquifer storage are smallest.

Calculated transmissivity and storativity values for the Biscayne aquifer in Broward County based on aquifer tests have been reported by various authors including Parker (1951), Vorhis (1948), Parker et al. (1955), Schroeder et al. (1958), Sherwood et al. (1973), and Klein and Hull (1978), and summarized by Anderson et al. (1986). Transmissivity values range from approximately 0.3 million gallon per day per foot (mgd/ft) in northeast coastal Broward County to approximately 3 mgd/ft in southeast Broward County. Storativity values, which are dimensionless, generally range from 0.10 to 0.35 and average approximately 0.20. Due to the cavernous nature of the limestone, hydraulic conductivity values are high in southeastern Broward County. Hydraulic conductivity values in shallow monitor wells at the Lauderdale Plant site averaged 4.36 x 10^{-3} feet per minute (ft/min), or 6.28 feet per day (ft/day), based on single well aquifer tests (slug tests) performed during a March 1989 hydrogeologic investigation conducted at the facility.

The chemical quality of the groundwater in Broward County is generally good. Water quality in the Biscayne aquifer differs slightly from place to place; most differences in quality are related to the nature of the aquifer and local land use. In general, the water is hard, a calcium bicarbonate type, neutral to slightly alkaline, and contains different amounts of dissolved iron (Klein and Hull, 1978). Dissolved constituents in the groundwater are influenced by rainfall and dry fallout, reaction with soil and aquifer material, application of fertilizers and pesticides, biological processes at the surface and within the aquifer, infiltration of wastes, chemical reactions among constituents, temperature, and pressure. Groundwater quality in the vicinity of canals is also affected by canal water during dry seasons. However, the areas affected are probably small because of the seasonal reversals of hydraulic gradients between the canals and the aquifer.

Saltwater intrusion affects the entire coastal zone of the Biscayne aquifer. Saltwater extends inland from the coast and tidal streams; manmade canals also serve as avenues of intrusion. It moves inland and upward in response to low groundwater levels, and seaward and downward in response to high groundwater levels. Saltwater encroachment in Broward County (Figure 2.3-5) has progressed farthest inland in the vicinity of the North New River and South New River canals. To prevent further saltwater intrusion, salinity barriers have been constructed and operated on the North New River Canal and South New River Canal by SFWMD. These salinity barriers are located west of SR 7 (US 441). Due to the proximity and brackish nature of the South New River Canal, the Dania Cut-Off Canal, and the cooling canal/pond system of the Lauderdale Plant site, water quality in the Biscayne aquifer obtained from the on-site cooling water wells is brackish with maximum reported chloride concentrations of 3,750 mg/L and TDS concentrations of 5,750 mg/L (Technos, 1984).

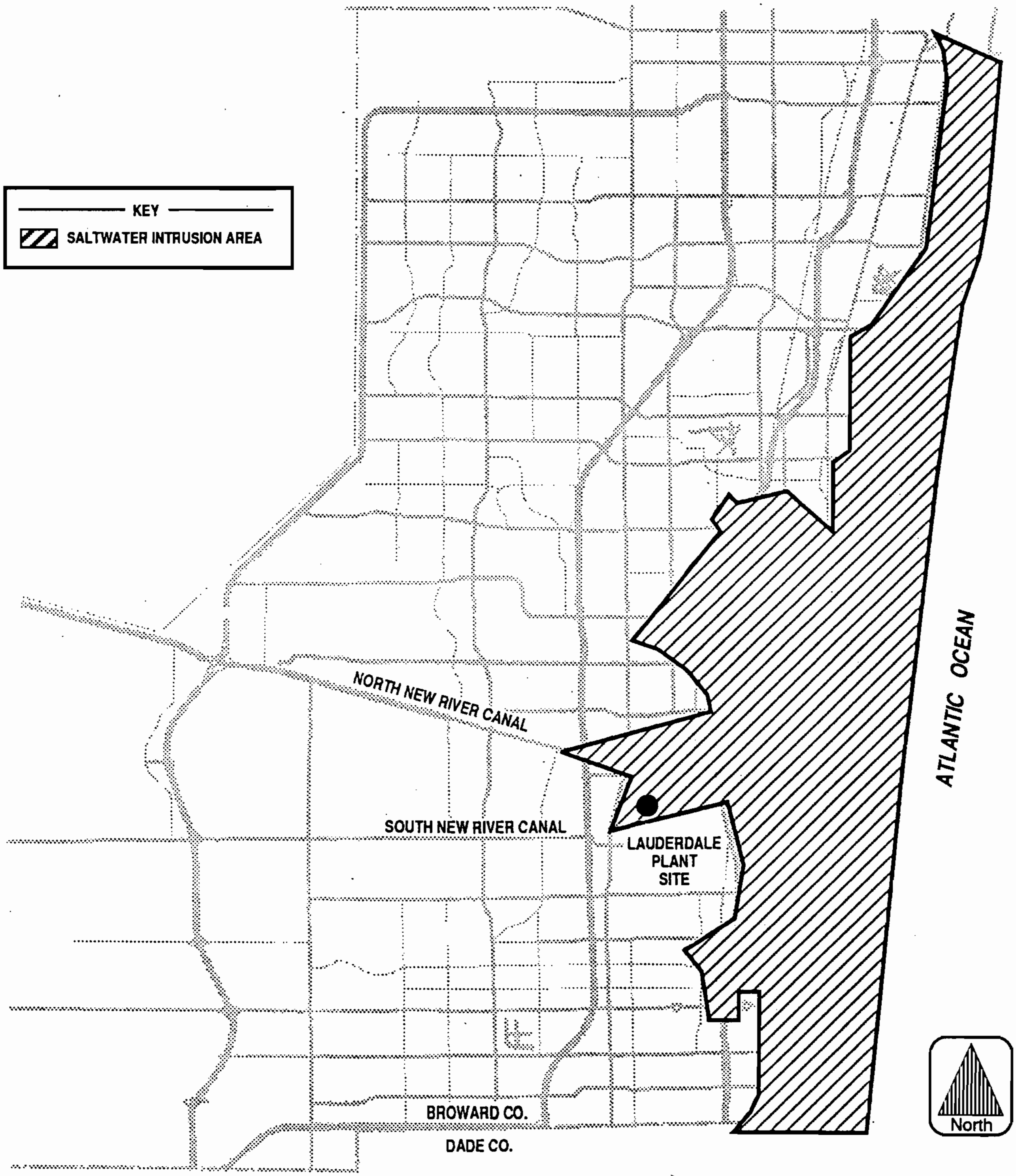

Figure 2.3-5 SALTWATER INTRUSION AREAS IN BROWARD COUNTY

SOURCE: BROWARD COUNTY, 1989.

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In the vicinity of the Lauderdale Plant site, the Biscayne aquifer is approximately 155 to 175 ft thick (Technos, 1984). The upper 25 ft of sediments underlying the site is composed predominantly of sand and limestone with an organic-rich (peat) horizon of varying thickness occurring locally 5 to 14 ft below ground surface. This upper unit has a vertical permeability of 3.3×10^{-4} feet per second (ft/sec). Deeper material, composed predominantly of limestone with sand, has a permeability of 6.6×10^{-3} ft/sec. The shallow peat layer has a permeability of 1.3×10^{-5} ft/sec (Technos, 1984).

A permeability value was obtained from a pumping test on existing plant water supply well 4B during a previous hydrogeologic investigation (Law Engineering Testing Company, 1977). This well was drilled to a depth of 95 ft and was pumped at a rate of 3,000 gpm with a maximum drawdown of 20 ft during the test. Using these data, a permeability value of 2×10^{-1} centimeters per second (cm/sec) was computed for the Biscayne aquifer at the plant site. Such a permeability value falls within the typical range of values calculated for the intermediate portion of the Biscayne aquifer in published literature.

A monitor well network surrounds the wastewater treatment facility in the vicinity of the SSB/EPP basins. The water table potentiometric surface is highly irregular based on water level measurements obtained quarterly in association with the site groundwater monitoring plan, likely indicating non-static conditions from the pumping of on-site productions wells. Water level measurements obtained from shallow monitor wells in this area during the March 1989 hydrogeologic investigation indicate the depth to groundwater ranges from approximately 1.5 to 6.0 ft below ground surface across the site. Due to the proximity of tidally influenced canals, the water table fluctuates in response to tidal changes adjacent to the canals. The water table also varies in response to the control level in the canals, plant operational status, and the loading of the wastewater area. Water level measurements obtained from shallow monitor wells at the Lauderdale Plant site in March 1989 are presented in Table 2.3-2, and a potentiometric

Table 2.3-2. Water Level Data at the Lauderdale Plant Site--March 1989

Well Number	Elevation of Top of Casing (ft) NGVD	Depth to Water (ft)	Elevation of Water - NGVD (ft)
OB-3	7.12	6.30	0.82
U-1	8.50	7.30	1.20
M-1	9.65	8.45	1.20
M-2	6.51	5.48	1.03
M-5	5.84	4.72	1.12
M-6	5.24	4.16	1.08
M-7	5.59	4.44	1.15
M-8	5.87	4.69	1.18

Note: NGVD = national geodetic vertical datum.

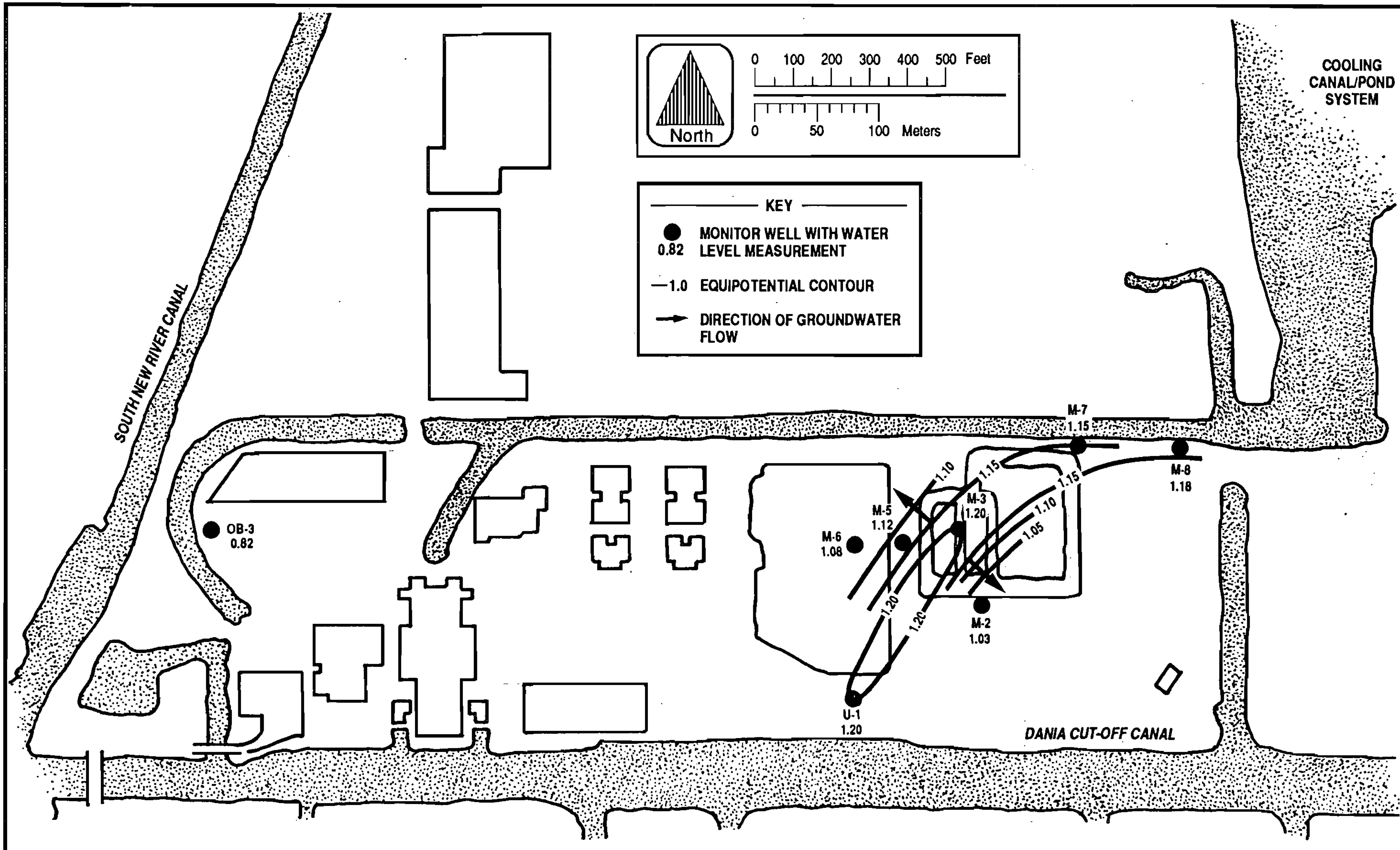

Figure 2.3-6 POTENTIOMETRIC MAP OF THE WATER TABLE SURFACE IN THE VICINITY OF SSB/EPP BASINS, MARCH 1989

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map of the site shown on Figure 2.3-6, was developed from these data. These data are from monitor wells in the vicinity of the SSB/EPP. The flow direction of groundwater in the vicinity of the SSB/EPP varied in March 1989 due to the proximity of surface water canals. Groundwater flow was northwest toward the discharge canal in the northern portion of the area of investigation and south toward the Dania Cut-Off Canal at the southern portion of the site. A ridge in the water table trends northeast-southwest and underlies the SSB/EPP. This ridge serves as a groundwater flow divide. The average hydraulic gradient across the northwestern portion of the SSB/EPP area was 1.25×10^{-3} feet per foot (ft/ft), while the average hydraulic gradient across the southeastern portion of the SSB/EPP area was 1.33×10^{-3} ft/ft.

Single-well aquifer tests (slug tests) were performed in March 1989 on three of the shallow monitor wells in the vicinity of the SSB/EPP area. These three wells are each 20 ft deep and screened from the 10- to 20-ft depth interval. Results of the slug tests are provided in Table 2.3-3. By averaging the results obtained from the slug test of monitor wells M-4, M-5, and M-7, an average hydraulic conductivity in the vicinity of the SSB/EPP area is calculated to be 4.36×10^{-3} ft/min, or 6.28 ft/day.

The groundwater flow rate (velocity) was calculated using the following formula:

$$\bar{v} = K \frac{I}{n}$$

where: $\bar{v}$ = average groundwater velocity,
K = hydraulic conductivity,
I = hydraulic gradient, and
n = sediment porosity.

Using an average hydraulic conductivity value of 6.28 ft/day, an average hydraulic gradient of 1.25×10^{-3} ft/ft for the northwestern portion of the area and 1.33×10^{-3} ft/ft for the southeastern portion of the area and

Table 2.3-3. Hydraulic Conductivity Values (K) Calculated From Slug Test Data

Well	K (ft/min)	K (ft/day)
M-4	5.60×10^{-3}	8.06
M-5	3.91×10^{-3}	5.63
M-7	3.57×10^{-3}	5.14

Note: Average hydraulic conductivity from M-4, M-5, and M-7 = 4.36×10^{-3} ft/min (6.28 ft/day) assuming the average porosity of the sediment is 30 percent, the average groundwater velocity in the upper portion of the Biscayne aquifer was determined to be 2.62×10^{-2} ft/day [9.6 feet per year (ft/yr)] in the northwestern portion of the site and 2.78×10^{-2} ft/day (10.1 ft/yr) in the southeastern portion of the site. This relatively slow groundwater velocity may be attributed to the low hydraulic gradients present at the site, and the relatively low hydraulic conductivity derived for the upper part of the Biscayne aquifer. Hydraulic conductivity values reportedly increase in the deeper, limestone portion of the Biscayne aquifer (Schroeder et al., 1958).

Underlying the Biscayne aquifer at the Lauderdale Plant site and elsewhere in southeast Florida, confining beds of the Tamiami and Hawthorn Formations are reportedly 500 to 600 ft thick (Parker et al., 1955). These low permeability units are composed of marl and clay and are laterally continuous in south Florida. These units have not been encountered in wells at the FPL Lauderdale facility. Leakance of this low-permeability interval (i.e., Tamiami and Hawthorn Formations) in Dade County was calculated at approximately 0.0001 gallon per day per cubic foot (gpd/ft^3) based on aquifer tests performed on the Floridan aquifer (FPL, 1979).

The Floridan aquifer is a thick section of carbonate and evaporite rocks underlying all of Florida and parts of Georgia and Alabama. In southeastern Florida, the aquifer underlies a thick section of impermeable marl and clay at depths below 900 ft and extending to depths of more than 3,000 ft. It is composed primarily of a series of limestones of varying permeability that dips eastward and southward and is thought to intersect the Straits of Florida several miles offshore along the Continental Slope (Sherwood et al., 1973).

In Broward County, water in wells that tap the Floridan aquifer will rise almost 40 ft above msl. Artesian flows range from 75 gpm to over 2,000 gpm and average about 750 gpm (Parker et al., 1955). The water is highly mineralized, containing more than 1,500 mg/L of chloride and 3,500 mg/L of

TDS, and is sulfurous, hard, and corrosive. These characteristics greatly limit the use of water from this aquifer for most purposes. Given the depth and water quality of the Floridan aquifer, current activities at the Lauderdale Plant site have no impact on the Floridan aquifer.

No additional groundwater sampling and analysis was performed in conjunction with the current hydrogeologic assessment of the site since the existing data were sufficient to characterize the site. Technos (1984) summarized the groundwater analytical data on or near the Lauderdale Plant site as part of a groundwater monitoring plan for the site. The locations of the monitoring wells are presented in Figure 2.3-1, and the analytical results are summarized in the following discussion and presented in Table 2.3-4.

Supply Wells 8 and 9, located approximately 1,600 ft south of the Lauderdale Plant site were installed in June 1944 to depths of 55 ft. These wells currently provide water to the plant's pretreatment system. Between 1973 and 1983, Wells 8 and 9 were sampled annually and analyzed for the following: pH, total hardness, sulfate, calcium, magnesium, chloride, iron, carbonate, bicarbonate, sodium, silica and hydroxide. Of these, iron was the only constituent to exceed the secondary drinking water standards.

Supply Wells 4B and 5B, located near the plant power block, were constructed in 1955 and 1956, respectively, to depths of 95 ft. These wells currently supply auxiliary cooling water for various heat exchangers throughout the plant. Sampling and analysis of Wells 4B and 5B for TDS, pH and chlorides was conducted in March 1982. Concentrations of 5,750 mg/L for TDS, 3,750 mg/L for chlorides, and a pH value of 7.3 were reported from a composite sample of Wells 4B and 5B (Technos, 1984).

Shallow monitor wells OB-1A and 1B, OB-2, OB-3, OB-4A and 4B, and OB-5B, located in the vicinities of the SSB/EPP and stub canal areas, were sampled monthly from March 1978 to December 1983. These samples were analyzed for the following parameters: pH, oil and grease, chlorides, chromium, copper,

Table 2.3-4. Summary of Groundwater Quality Monitoring at the Lauderdale Plant Site (Page 1 of 2)

Well Number	Well Location	Sampling Event(s)	Parameters Sampled For	Parameters Generally Exceeding Primary Drinking Water Standards	Parameters Generally Exceeding Secondary Drinking Water Standards
Supply Well 8 Supply Well 9	Approximately 1,600 ft south of the plant	Annually from 1973 to 1983	pH, TDS, total hardness, calcium, magnesium, chloride, iron, carbonate, biocarbonate, sodium silica, hydroxide	None	Iron
Supply Well 4B Supply Well 5B	On-site near plant power block	March 1982	pH, TDS, chloride	None	TDS (5,750 mg/L), chloride (3,750 mg/L)
OB-1A OB-1B OB-2 OB-3 OB-4A OB-4B OB-5B	Vicinity of the SSB/EPP and stub canal areas	Monthly from March 1978 to December 1983	pH, oil & grease, chloride, chromium, copper, iron, zinc, nitrate-nitrite, phosphorus, vanadium	None	Chloride, iron
U-1 OB-2 M-2 M-3 M-4	Vicinity of the SSB/EPP and stub canal areas	Quarterly from May 1985 to October 1988 [see Table 2.3.2-4]	pH, oil & grease, arsenic, copper, silver, fluoride, sodium, nickel, sulfates, chloride, iron, manganese, chromium, zinc	None	Chloride, iron, manganese

Table 2.3-4. Summary of Groundwater Quality Monitoring at the Lauderdale Plant Site (Page 2 of 2)

Well Number	Well Location	Sampling Event(s)	Parameters Sampled For	Parameters Generally Exceeding Primary Drinking Water Standards	Parameters Generally Exceeding Secondary Drinking Water Standards
OB-1A OB-1B OB-2 OB-3 OB-4A OB-4B OB-5B	Vicinity of the SSB/EPP and stub canal areas	November 1982	Arsenic, barium, cadmium, chromium, lead, mercury, nitrate, selenium. sodium, fluoride, endrin, lindane, methoxychlor, toxaphene, 2-dichlorophenoxyacetic acid, 2,4,5-TP, silver	Fluoride (OB-1B), sodium (OB-1A, OB-5B)	None
OB-1A OB-1B OB-2 OB-3 OB-4A OB-4B OB-5B	Vicinity of the SSB/EPP and stub canal areas	August 1983	Fecal coliform, gross alpha, gross beta, radium-226 radium-228	Fecal coliform (OB-3), gross alpha (OB-1B)	None
OB-1A OB-1B OB-2 OB-3 OB-4A OB-4B OB-5B	Vicinity of the SSB/EPP and stub canal areas	September 1983	Trihalomethane	None	None

Note: Wells designated by A or B are in the same general location shown in Figure 2.3-1.

iron, zinc, nitrite-nitrate, phosphorus, and vanadium. From these data, only chloride and iron numerically exceeded drinking water standards.

On November 16, 1982, these wells were sampled and analyzed for the primary drinking water parameters excluding turbidity, coliform, trihalomethane, gross alpha, and gross beta. With the exception of elevated sodium concentrations at OB-1A and OB-5B, the parameters were below primary drinking water standards. These monitor wells were sampled for fecal coliform, gross alpha, gross beta, radium-226 and radium-228 in August, 1983 and for trihalomethane in September 1983. Of these parameters, those exceeding primary drinking water standards were fecal coliform at well OB-3 and gross alpha at well OB-1B.

Subsequent to the submittal of the Groundwater Monitoring Plan (Technos, 1984), groundwater monitoring wells U-1, OB-2, OB-3, M-2, M-3, and M-4, located in the SSB/EPP and stub canal areas, have been sampled on a quarterly basis to meet the monitoring requirements of Ch. 17-28.700, F.A.C. The parameters analyzed include pH, oil and grease, silver, arsenic, copper, fluoride, iron, sodium, nickel, chloride, manganese, chromium, zinc, and sulfates. Data for the period of May 1985 to October 1988 indicate that in general only sodium, chloride, iron, and occasionally manganese have exceeded secondary drinking water standards with no primary drinking water standards being exceeded (FPL, 1988). The results of the 1985 to 1988 analyses are presented in Table 2.3-5.

2.3.2.2. Karst Hydrogeology

There is no documentation of karst development at this site (Technos, 1984). In addition, no mention is made in the geologic literature of karst development in this region of south Florida (e.g., Sinclair and Stewart, 1985; Lane, 1986). A first-order photo analysis (Technos, 1984) showed no evidence of any paleo-or recent karst activity. Further karst investigation was, therefore, not undertaken at the time of the preparation of the Groundwater Monitoring Plan (Technos, 1984) or in connection with this application.

Table 2.3-5. Summary of Analytical Results from Quarterly Groundwater Monitoring Plan Sampling--May 1985 Through October 1988

Well Designation/	U-1			OB-2			OB-3			M-2			M-3			M-4			Primary Drinking Water	Secondary Drinking Water
Parameter	Min	Max	N[a]	Min	Max	N[a]	Min	Max	N[a]	Min	Max	N[a]	Min	Max	N[a]	Min	Max	N[a]	Standards	Standards
Silver	BDL	BDL	0	BDL	BDL	0	BDL	BDL	0	BDL	BDL	0	BDL	BDL	0	ND	ND	ND	0.050	-
Arsenic	BDL	BDL	0	BDL	BDL	0	BDL	BDL	0	BDL	BDL	0	BDL	BDL	0	BDL	0.0160	0	0.050	-
Fluoride	0.49	0.31	0	0.17	0.23	0	0.16	0.25	0	0.60	0.94	0	0.10	0.23	0	0.08	0.30	0	4.0	2.0[b]
Sodium	35	528	8	10	279	1	10	316	1	112	376	6	15	164	1	6	12	0	160	-
Chromium	0.02	0.03	0	BDL	BDL	0	BDL	BDL	0	BDL	BDL	0	BDL	BDL	0	BDL	BDL	0	0.05	-
Chloride	169	1,438	9	17.9	735	1	4.97	887	1	177	796	3	19	578	1	6.3	226	0	-	250
Copper	<0.02	0.37	0	BDL	0.03	0	BDL	0.05	0	BDL	0.05	0	BDL	BDL	0	ND	ND	ND	-	1.0
Iron	0.07	2.7	1	0.05	4.57	7	BDL	0.61	4	0.08	0.70	3	0.16	1.60	9	0.66	8.8	10	-	0.3
Sulfate	34	279	1	6.0	72	0	12	89	0	29	108	0	3.1	21	0	1.8	12	0	-	250
Manganese[c]	0.02	0.06	3	0.020	0.07	4	BDL	0.01	1	BDL	0.02	1	BDL	0.05	4	0.02	0.06	5	-	0.05
Zinc[c]	BDL	0.185	0	0.026	0.031	0	0.010	0.060	0	BDL	0.059	0	BDL	0.0610	0	0.010	0.055	0	-	5
pH (standard units)	7.05	7.09	0	6.85	7.20	0	6.92	7.16	0	7.00	7.23	0	6.82	7.23	0	6.82	7.23	0	-	> 6.5
Nickel	BDL	0.05	-	BDL	BDL	-	BDL	BDL	-	BDL	BDL	-	BDL	BDL	-	BDL	BDL	-	-	-
Oil and Grease	BDL	4.6	-	BDL	4.4	-	BDL	3.4	-	BDL	3.6	-	BDL	3.6	-	BDL	4.8	-	-	-

[a]Total number of times primary and/or secondary drinking water standards were exceeded, May 1985 to October 1988.
[b]Requires public notification.
[c]Not sampled during all quarterly sampling events.

Note: All measurements are in milligrams per liter (mg/L) unless otherwise specified.
BDL = below detection limits.
ND = no data obtained.
\- = no standard.

2.3.3 Site Water Budget and Area Users

The climate of south Florida is classified as subtropical savanna with distinctive periods of wet and dry. Mean annual temperature in Fort Lauderdale is 73 degrees Fahrenheit (°F), with monthly average temperatures ranging from 66 to 83°F in January and August, respectively. The average annual rainfall in the Fort Lauderdale area is approximately 60 inches, with wide fluctuations in yearly totals. Rainfall is unevenly distributed throughout the year, with roughly 75 percent of the rain falling during June through October. January is usually the driest month, whereas September is usually the wettest month.

The average annual rainfall of approximately 60 inches, if distributed evenly over Broward County, would be equivalent to approximately 3,400 million gallons per day (mgd). Evaporation from surface waters would return approximately 22 inches (1,250 mgd) to the atmosphere. Transpiration from the water table would return approximately 20 inches (1,135 mgd) to the atmosphere. Total evapotranspiration would return approximately 42 inches (2,385 mgd), or 70 percent of the total rainfall, back to the atmosphere. Approximately 1 inch (60 mgd) of total rainfall would run off directly to the canal system. The remaining 17 inches of precipitation percolates into the aquifer, with less than 2.5 inches (142 mgd) withdrawn for use and approximately 14.5 inches (820 mgd) discharged to the sea by coastal canals (13.5 inches) or groundwater outflow (1 inch). These data, derived from Sherwood et al. (1973), are highly generalized and do not take into account variations in rainfall due to both location and time and minor changes in aquifer storage. In addition, water imported into the county by canals of the SFWMD flood control system and introduced to the aquifer plays a role in the total flow system.

The Broward County Health Department was contacted to obtain information about water wells in the vicinity of the site. In addition, SFWMD files were accessed to determine the location and use of nearby wells. There are more than 20 wells located within 1,500 ft of the site; these wells are private irrigation wells and are located in the vicinity of SW 37th Avenue and SW 38th Terrace. These wells are exempt from permit requirements as nonpotable sources, generally used for local lawn irrigation only. No additional groundwater withdrawal beyond that currently used at the plant will be required for the Lauderdale Repowering Project; however, an inventory and description of privately owned, permitted supply wells and utility water supply facilities located within a 1-mile radius of the Lauderdale Plant site has been prepared. These data are presented in Table 2.3-6 and described below.

The Broward County Utilities Division District 3A wellfield is located approximately 0.5 mile southwest of the Lauderdale Plant site. This wellfield consists of four operating production wells. A fifth well, located to the south of the existing 3A wellfield, is currently under construction. Figure 2.3-7 indicates the extent of the wellfield protection zones surrounding the wellfield. County regulations restrict the types of activities that are permissible within a wellfield protection zone. The District 3A wellfield is currently permitted to withdraw an average of 4.288 mgd and a maximum daily allocation of 5.430 mgd. The Lauderdale Plant site is not within the protected 210-day travel time zone surrounding this public utility. When the new production well at the 3A wellfield becomes operational, the wellfield protection zone will be expanded to the south, which will not affect current or proposed FPL activities.

Potable water is supplied to the Lauderdale Plant by Broward County Environmental Services. Water usage from this source is approximately 3.5 million gallons per year (mgy).

Supply Wells 8 and 9, located approximately 1,600 ft south of the plant, were installed in June 1944 to depths of 55 ft. These wells provide water to the plant's pretreatment system at an average withdrawal rate of 93 gpm (approximately 49 mgy).

Table 2.3-6. Off-Site Well Inventory of Permitted Wells Within a 1-Mile Radius of the Lauderdale Plant Site

Location	Description
General Use Permit (Non-Community System)	
Oakridge Country Club 3490 Griffin Road	One well, 75 ft deep, 4-inch-diameter, pump capacity 180 to 240 gallons per minute (gpm)
Marino's Italian Restaurant 5191 S. SR 7	One well, depth unknown
Charge Service Station 4700 S. SR 7	One well, depth unknown
Oasis Truck Stop 5470 S. SR 7	One well, depth unknown
Woods Nursery 3400 S. SR 7	One well, depth unknown
Amoco Service Station 3612 S. SR 7	One well, depth unknown
Powell Brothers North of Dania Cut-Off Canal 9th East of 441 (4400 S. SR 7)	One well, depth unknown
Consumptive Use Permit (Community System)	
Broward County Utility 3A Wellfield SW 40 Ave. and Griffin Rd.	Four wells, 100 ft deep, casing diameter 10 inches, cased section 0 to 100 ft, open internal 100 to 110 ft, permitted pumpage 4.288 mgd
Ferncrest Utilities, Inc. 3015 SW 54th Avenue Average Pumpage: 2.1 mgd	Two wells; well No. 1 89 ft deep, 6 inches diameter; well No.2 87 ft deep, 4 inches diameter; cased and open intervals not available, average pumpage 2.1 mgd

Source: Technos, 1984.

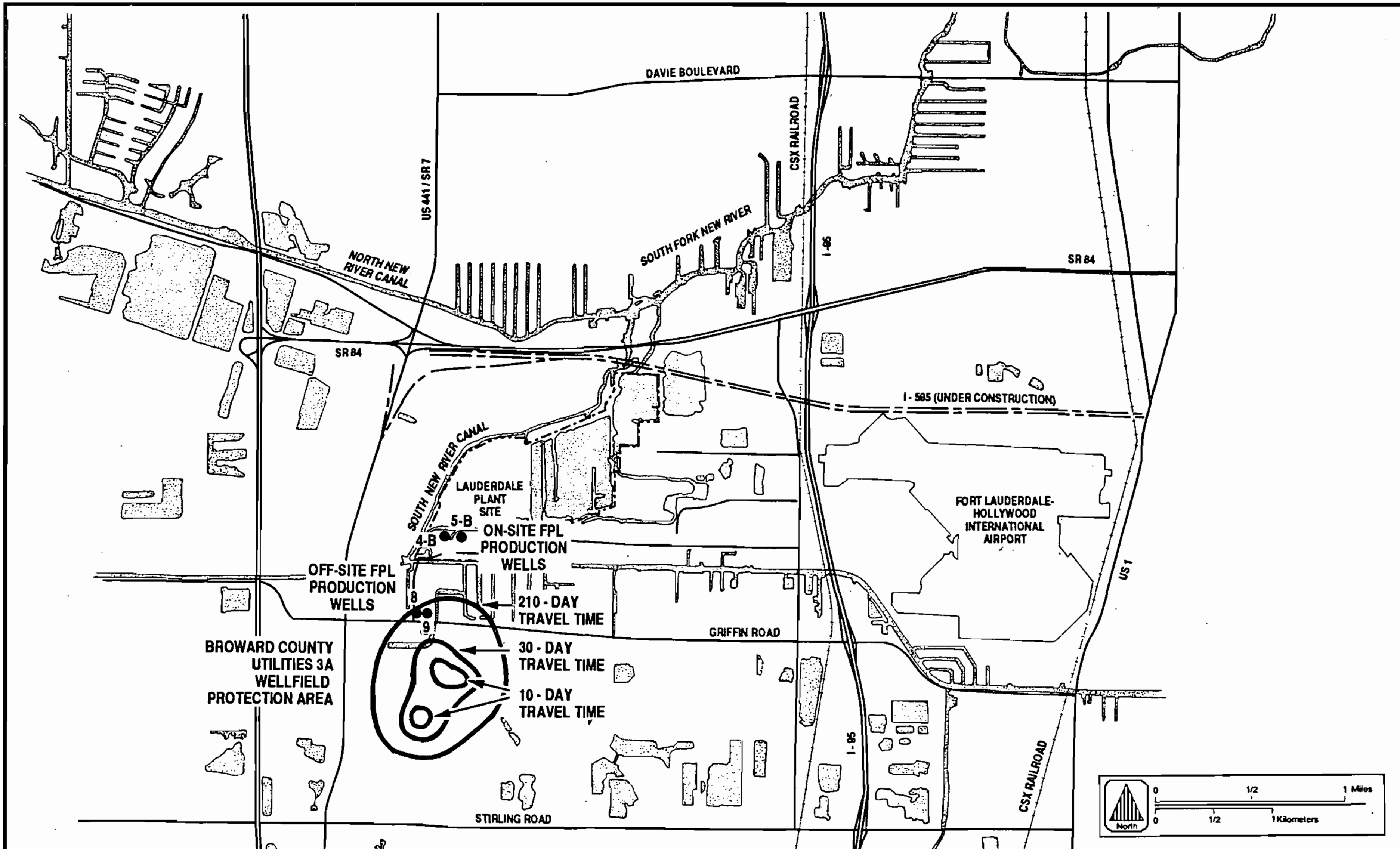

Figure 2.3-7 LOCATION OF BROWARD COUNTY UTILITIES DIVISION DISTRICT 3A WELLFIELD PROTECTION ZONES AND LAUDERDALE PLANT ON-SITE AND OFF-SITE PRODUCTION WELLS

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Supply Wells 4B and 5B, located near the plant power block, were constructed in 1955 and 1956, respectively, to depths of 95 ft. These wells supply cooling water for various heat exchangers throughout the existing plant at an average monthly withdrawal rate of 4.32 mgd per well (3,150 mgy). The quality of this water is brackish due to the proximity of surface water canals.

To evaluate the effects of pumping of the Biscayne aquifer from Supply Wells 4B and 5B at the Lauderdale Plant site, drawdown was calculated using PLASM, a two-dimensional groundwater flow model. PLASM, developed by Prickett and Lonnquist (1971) of the Illinois State Water Survey, simulates water levels in an aquifer in response to stresses such as that caused by pumping wells.

Input parameters to the model included a hydraulic conductivity value of 4,241 gallons per day per square foot (gpd/ft^2) (2×10^{-1} cm/sec) and an aquifer thickness of 150 ft. Aquifer storage was assumed to be zero to simulate steady state conditions. Constant head boundaries were coded at the surface water canals surrounding the site. Constant heads at the canals are justified as the canals provide an infinite source of water to the aquifer. Recharge from rainfall was assumed to be negligible since stormwater runoff is collected and routed to the surrounding canals.

The modeling was performed with pumping from the two on-site wells at the existing pumping rate of 3,000 gpm each. Under these pumping conditions, a cone of depression develops around the pumping wells as shown in Figure 2.3-8. Maximum drawdown in the production wells at pumping rates of 3,000 gpm each was calculated to be approximately 2.5 ft. Both existing wells (i.e., 4B and 5B) are located adjacent to the discharge canal, which serves as a constant recharge boundary. Therefore, the cone of influence surrounding the pumped wells has an asymmetrical shape, with more pronounced areal impact to the south. The area influenced by greater than 0.1 ft of drawdown extends approximately 500 ft to the east and south from the production wells. To the north and west, areas influenced by greater

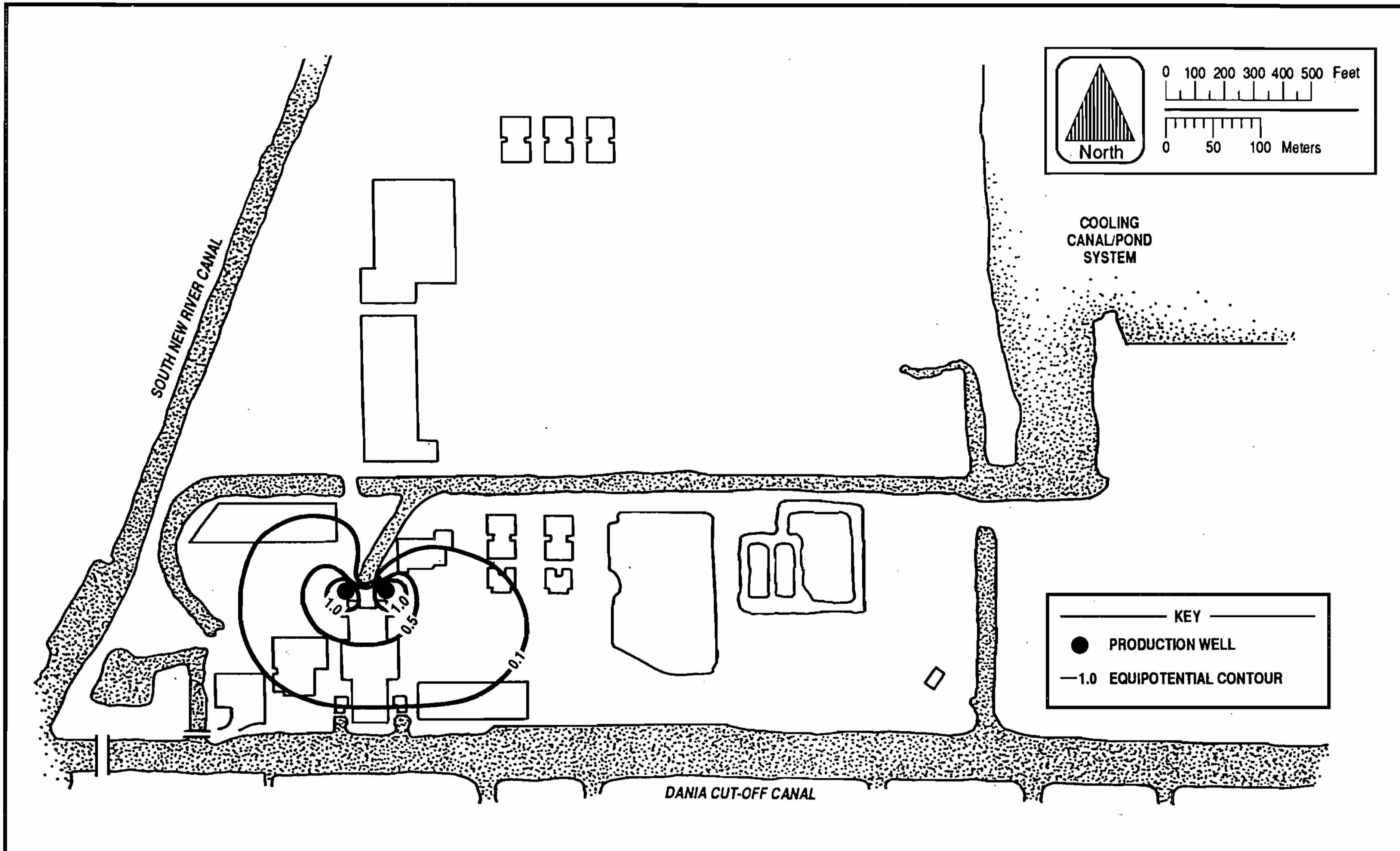

Figure 2.3-8 STEADY-STATE DRAWDOWN FROM PUMPAGE OF WELLS 4B AND 5B AT 3,000 GPM EACH

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than 0.1 ft drawdown extend approximately 100 ft and 400 ft, respectively, away from the pumped wells. As long as the canals contain water and function as constant head boundaries, the cone of depression will not extend beyond the site boundaries.

2.3.4 Surficial Hydrology

2.3.4.1 Hydrologic Characterization

HYDROLOGY OF ADJACENT STREAMS AND CANALS

Surface Water Features Description--Several surface water features border the Lauderdale Plant site (the Dania Cut-Off Canal to the south and the South New River Canal on the west and north). A cooling canal/pond system of approximately 185 acres is located on the northeast portion of the site. The cooling system is manmade and was created by rock and sand removal. The condenser cooling system is a once through system which uses the Dania Cut-Off Canal as the cooling water source and flows through the cooling canal/pond system. The discharge from the cooling canal/pond system is through a box culvert under SR 84 to a 1,100-ft canal connected to the South Fork New River. An old intake canal not currently used, which is connected to the Dania Cut-off Canal and South New River Canal, is located in the southwestern portion of the site. A map of the surface water features relevant to the Lauderdale Plant site is shown in Figure 2.3-9.

The flow of fresh water into the South New River Canal and the South Fork New River is controlled by the SFWMD at structures located approximately 1 mile west of the plant site. Fresh water flows in the Dania Cut-Off Canal are from the South New River Canal. All surface water bodies adjacent to the site (including the cooling canal/pond system) are tidally influenced.

The cooling canal/pond system can receive surface flow either from the cooling water condenser (at the west end of the system) or from tidal inflow from the South Fork New River at the northeast end of the system. The sole surface water discharge from the cooling canal/pond system is to the South Fork New River.

The condenser cooling water flow rate is 116,000 gpm per unit or 232,000 gpm [517 cubic feet per second (cfs)] when both units are in operation. There is an additional discharge of 6,000 gpm (1.34 cfs)

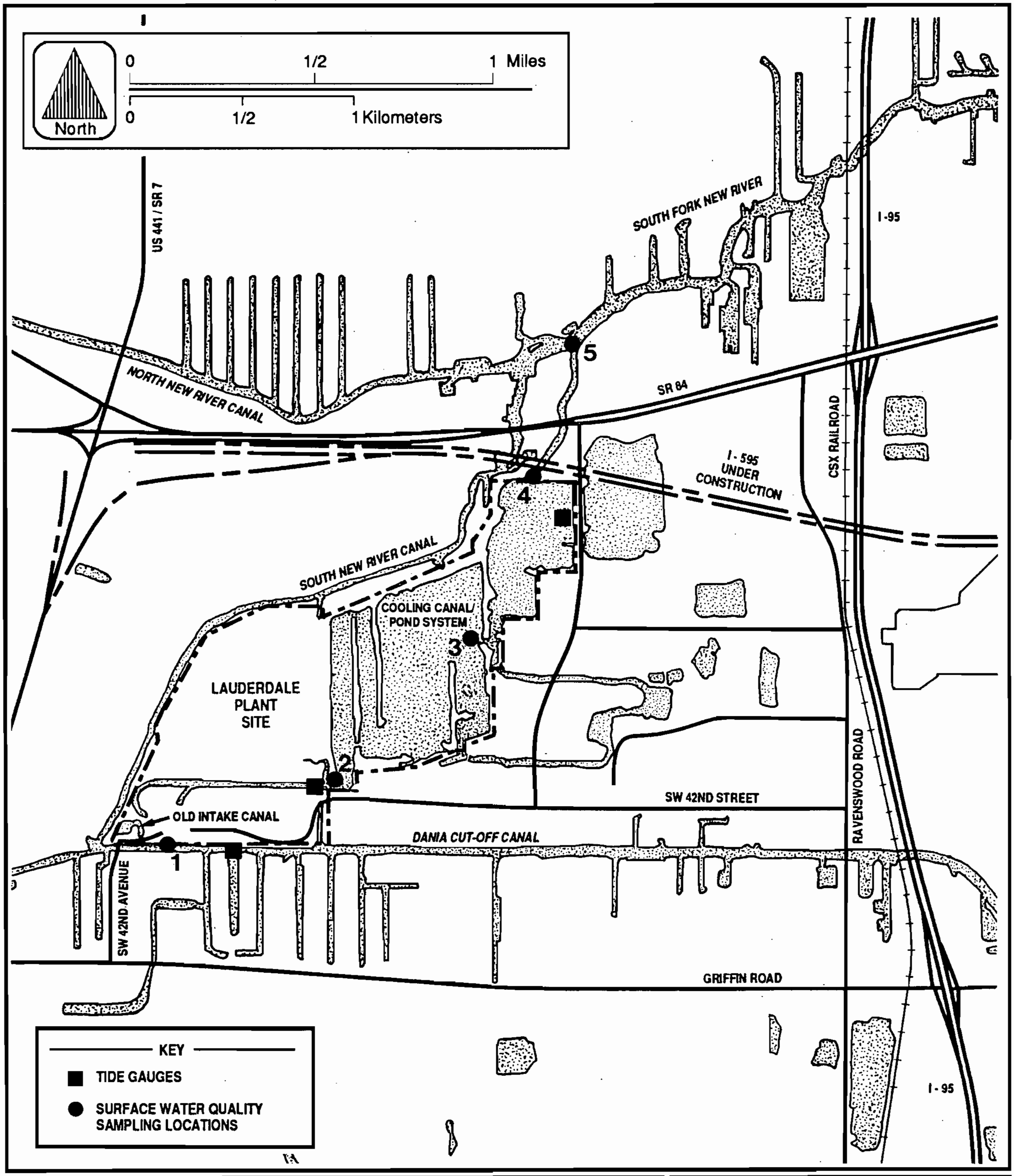

Figure 2.3-9 SURFACE WATER FEATURES IN THE VICINITY OF THE LAUDERDALE PLANT SITE AND WATER QUALITY SAMPLING STATIONS

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from auxiliary cooling water presently obtained from on-site production wells. When the cooling water systems are not in operation, surface water inflow to the cooling canal/pond system is tidal inflow from the South Fork New River.

<u>Streamflow Data</u>--The U.S. Geological Survey (USGS) operates a stream gauging station on the South New River Canal upstream of the site. The daily flow records from the period 1957 to 1985 were obtained for this station for a statistical analysis of hydrologic characteristics, especially seasonal flow regimes. The flow records show that streamflow in the South New River Canal (and hence, the Dania Cut-Off Canal) can be less than or equal to 0 during all months of the year (Table 2.3-7 and Figure 2.3-10). Releases of fresh water from the upstream control structure are variable in timing and quantity. The monthly average flow rate in the South New River Canal is fairly consistent throughout the year, ranging from 115 cfs in April to 219 cfs in June and July. Minimum flows show somewhat more temporal variability, with lower flows reported for the period from August to December. The highly controlled nature of the South New River Canal obscures the seasonal trends that would otherwise be evident. Flows to the west (i.e., negative flows) are due to back pumping at the control structure by SFWMD.

Low-flow frequency in the South New River Canal was determined. The frequency distribution for each month shows a fairly strong seasonal trend for flows of zero or less (Figure 2.3-11). The greatest probability of flows zero or less is during the months of February through June.

The magnitude of the Lauderdale Plant withdrawals with respect to flow in the South New River Canal was also evaluated. During periods of plant operation, the majority of the South New River Canal flow is diverted by the plant intake pumps. Table 2.3-8 presents the relative flow frequency distribution for the period of record in the South New River Canal. The median flow in the South New River Canal is approximately 158 cfs (compared to an average flow of 178 cfs), and flows equaling or exceeding the plant

Table 2.3-7. Flow Statistics by Month, South New River Canal, for USGS Daily Stream Flow (cfs) 1957-1985

Month	Average (cfs)	Maximum (cfs)	Minimum (cfs)	Percent of Time Flow ≤0
October	192	830	-111	2.53
November	192	987	-59	2.26
December	166	603	-27	3.00
January	171	712	0	3.23
February	163	646	0	4.30
March	146	791	-58	15.80
April	115	821	0	32.30
May	140	940	0	24.69
June	219	716	0	6.09
July	219	777	0	1.78
August	199	833	-26	4.67
September	215	709	-128	1.49

Source: USGS, 1987.

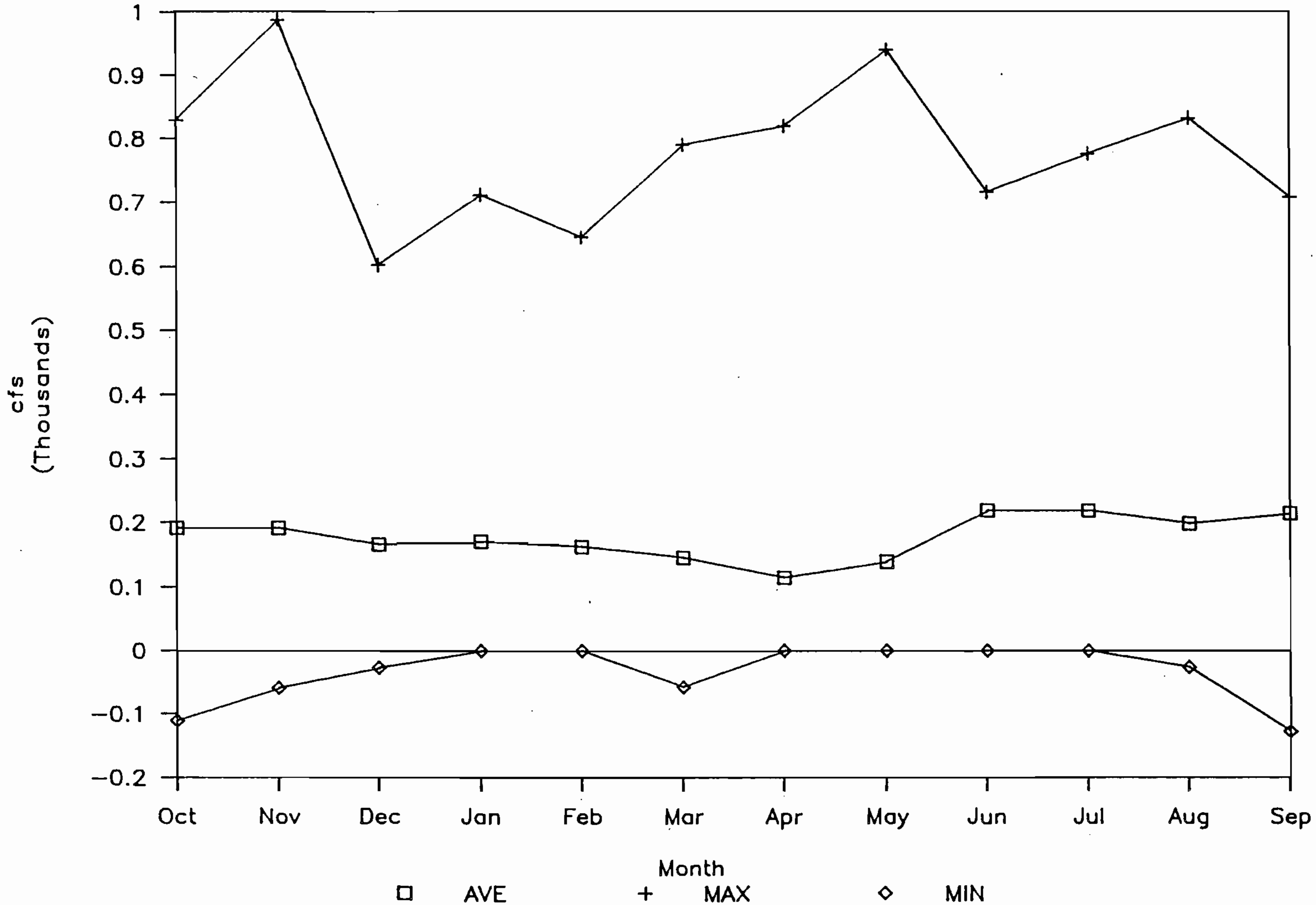

Figure 2.3-10 SUMMARY OF DAILY FLOW DATA 1957-1985, SOUTH NEW RIVER CANAL

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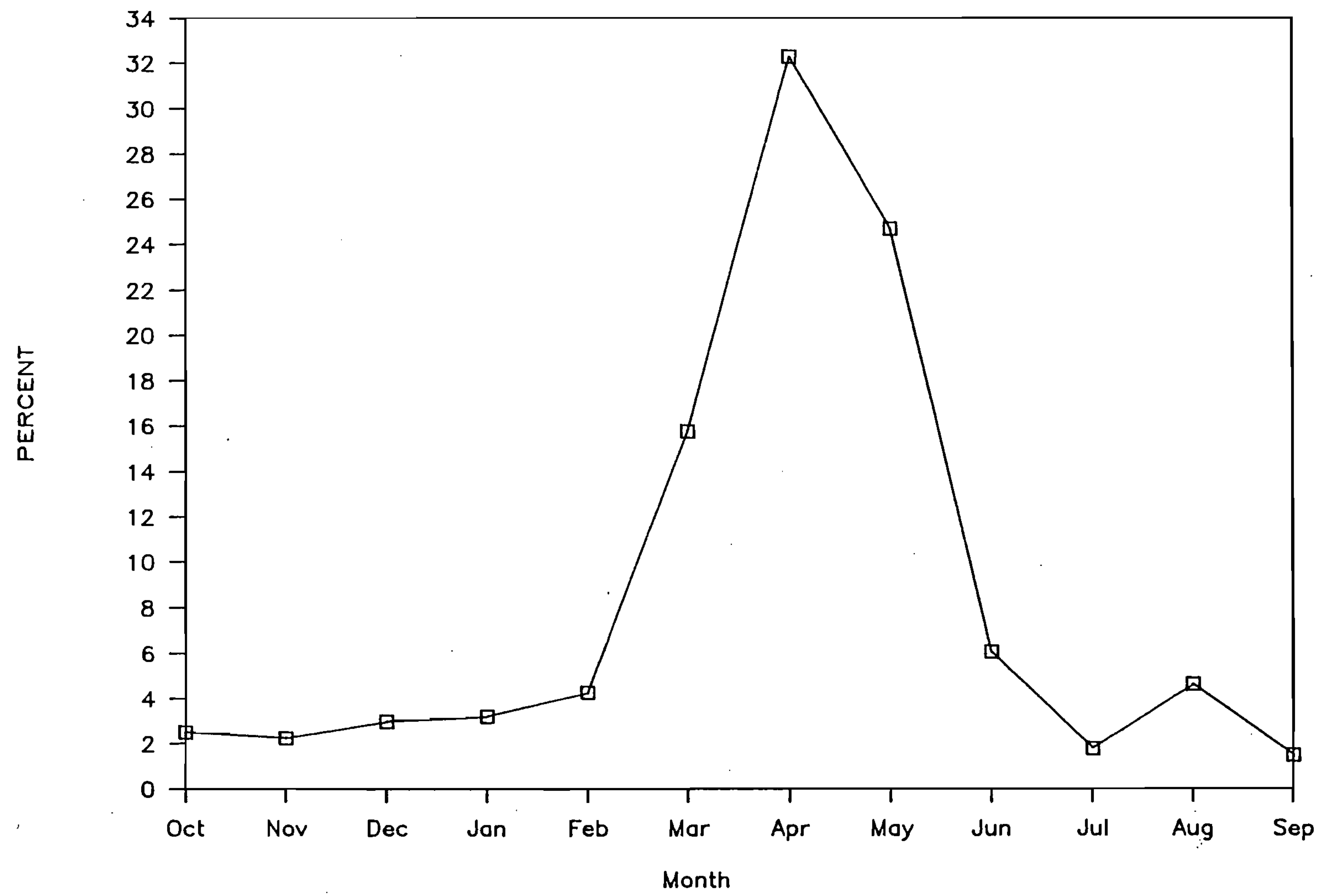

Figure 2.3-11 PROBABILITY OF DAILY FLOW OF ZERO OR LESS AT THE SOUTH NEW RIVER CANAL

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Table 2.3-8. Freshwater Flow Frequency Distribution for the South New River Canal

Flow Interval (cfs)	Number of Observations	Relative Frequency (%)	Cumulative Frequency (%)
-150 - -100	3	0.03	0.03
-100 - -50	6	0.06	0.09
-50 - 0	889	8.51	8.60
0 - 50	1,211	11.60	20.20
50 - 100	1,554	14.88	35.08
100 - 150	1,355	12.98	48.06
150 - 200	1,233	11.81	59.87
200 - 250	1,063	10.18	70.05
250 - 300	1,088	10.42	80.47
300 - 350	916	8.77	89.24
350 - 400	534	5.11	94.36
400 - 450	276	2.64	97.00
450 - 500	124	1.19	98.19
500 - 550	82	0.79	98.98
550 - 600	37	0.35	99.33
600 - 650	29	0.28	99.61
650 - 700	13	0.12	99.73
700 - 750	12	0.11	99.85
750 - 800	7	0.07	99.91
800 - 850	5	0.05	99.96
850 - 900	1	0.01	99.97
900 - 950	2	0.02	99.99
950 - 1,000	1	0.01	100.00

Note: Flow statistics data are based on USGS daily stream flow records for Water Years 1957-1985 with a total number of observations of 10,441.

withdrawal rate of 517 cfs occur less than 0.8 percent of the time. Therefore, a large portion of the water diverted by the plant is from east-to-west flow in the Dania Cut-Off Canal.

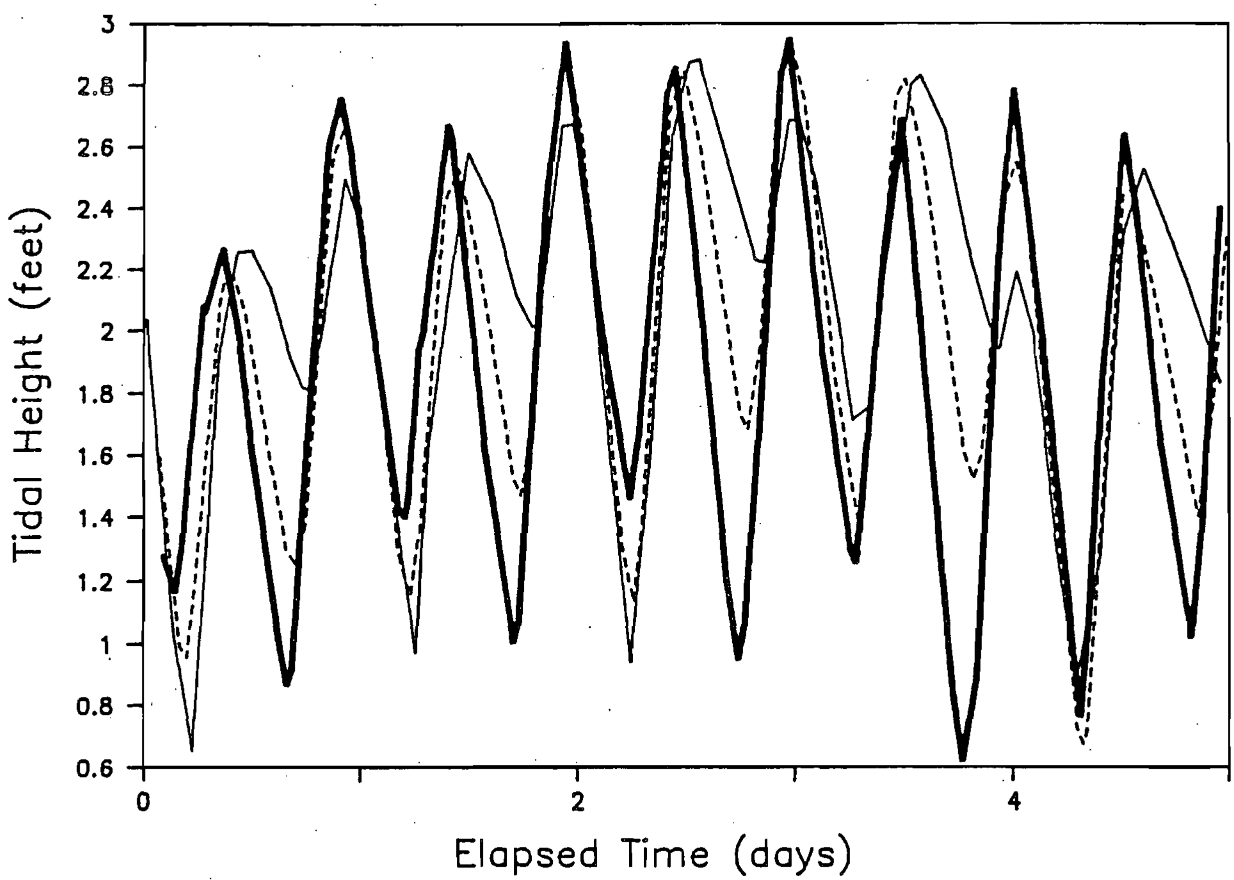
Tidal Influence--All surface water in the immediate vicinity of the Lauderdale Plant site is tidally affected. The tides in the area are semi-diurnal (i.e., two high and two low tides per day). The USGS maintained a tide gauge on the South New River Canal from 1974 through 1985 immediately east of U.S. Highway 441. A review of the average daily high and low tide elevations from this station show that the average tidal range in the South New River Canal is 1.6 ft with a maximum average tidal range of 2.4 ft.

Tide gauges were installed in the Dania Cut-Off Canal (at the FPL tidegate), the inlet to the cooling canal/pond system (southwest corner), and near the cooling canal/pond system outlet (northeast corner) in August 1988 (see Figure 2.3-9). Evaluation of the tide gauge data shows minimal tide phase lag (i.e., timing of high and low tides) throughout the cooling canal/pond system (see Figure 2.3-12). The tide data also show a decrease in tidal range at the cooling canal/pond system inlet relative to the outlet. The tidal ranges for the three gauges are summarized as follows:

	Tidal Range (ft)	
Location	Average	Maximum
Dania Cut-Off Canal	1.3	2.2
Canal/Pond Outlet	0.9	1.4
Canal/Pond Inlet	0.6	1.4

The tidal range at the cooling canal/pond system is approximately 50 percent of the tidal range observed in the Dania Cut-Off Canal. The primary reasons for this dampening of the tidal ranges are the physical flow constrictions in the cooling canal/pond system.

A complete record of the tidal data for the three gauges is presented in Appendix 10.5.2.



KEY

- DANIA CUT-OFF CANAL AT TIDE GATE
- COOLING CANAL/POND SYSTEM INLET
- COOLING CANAL/POND SYSTEM OUTLET

NOTE: TIDE GAUGE DATUM IS APPROXIMATELY +2.0 FEET, MEAN SEA LEVEL.

ACTUAL DATA SHOWN WERE TAKEN IN SEPTEMBER 1988. TIDAL HEIGHTS AND LAG BETWEEN STATIONS ARE REPRESENTATIVE OF ALL DATA OBTAINED.

Figure 2.3-12 COMPARISON OF TIDAL HEIGHT AND PERIODS

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Cooling Canal/Pond System--The cooling canal/pond system was created by the excavation of rock and sand in an area northeast of the Lauderdale Plant power block. The system originally consisted of a series of serpentine canals. As currently configured, the berms between most adjacent canals have been excavated, resulting in the formation of two ponds and three canals as shown in Figure 2.3-13. The approximate surface area of the cooling canal/pond system is 185 acres.

A bathymetric survey of the cooling canal/pond system was conducted in October 1988 to determine the average depth of the system. The cooling canal/pond system bathymetric contours are shown in Figure 2.3-14. The system has an average depth of approximately 33 ft, with a shallow area present in the northeast corner of the west pond. It should be noted that the depths shown in the figure are representative of the major features of the system. In all portions of the system (and especially the southern third of the west pond) highly localized ridges and valleys are present and thus, the details of the cooling canal/pond system bottom topography are not as uniform as depicted.

The theoretical detention time in the cooling canal/pond system was calculated to be 6 days using an area of 185 acres, an average depth of 33 ft, and a discharge rate of 238,000 gpm. The actual detention time through the system is less than the theoretical time due to the effects of short circuiting and tidal flow contributions. A dye study of the cooling canal/pond system was conducted in February 1989 to determine the actual detention time for the system.

The dye study was conducted using a slug injection of fluorescent dye and tracking the dye movement through the system. The details of the dye study are presented in the Appendix 10.5.2. A summary of the findings includes:

1. The mean travel time through the cooling canal/pond system is approximately 30 hours;
2. There are several areas of short circuiting in the system;

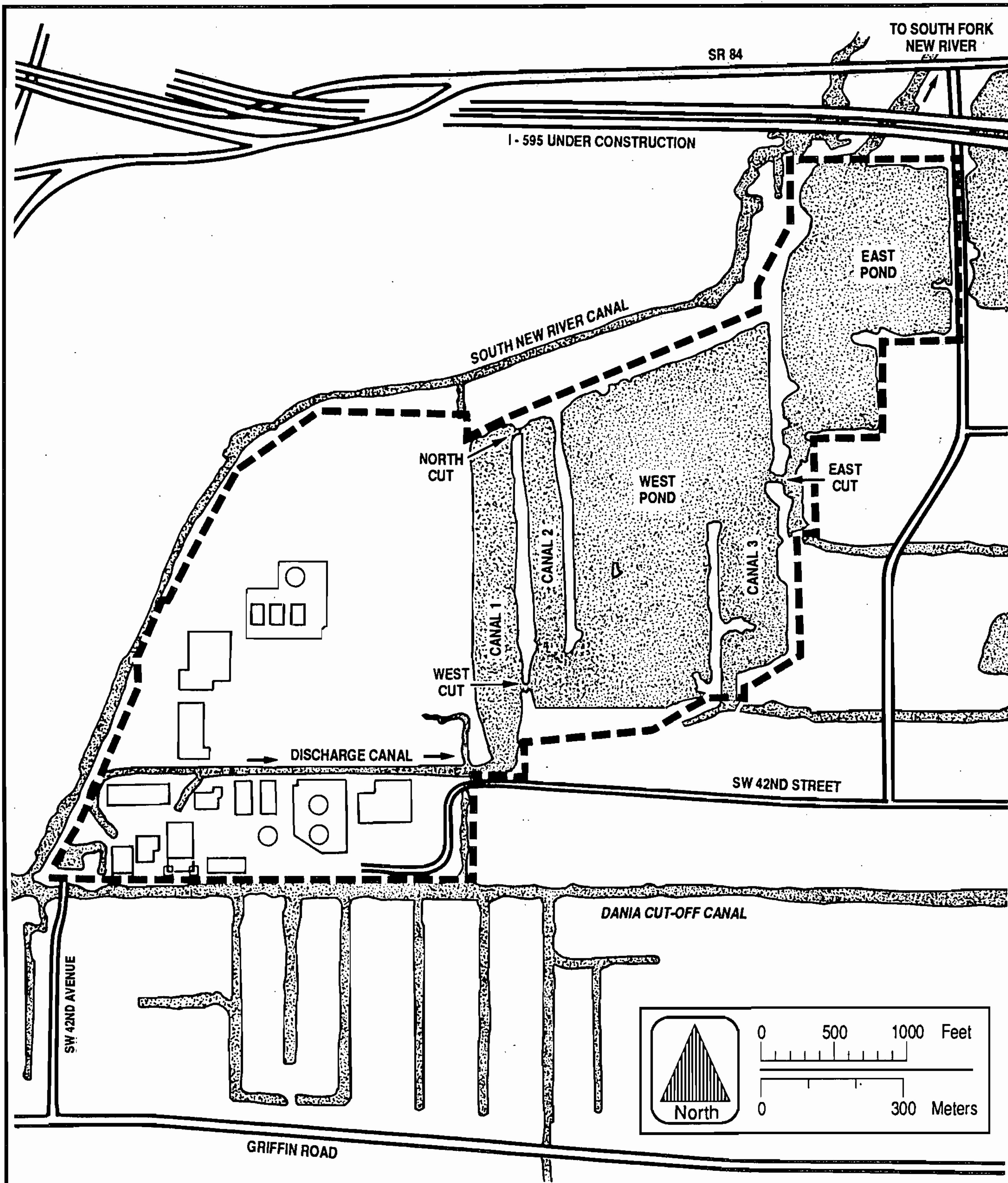

Figure 2.3-13 COOLING CANAL/POND SYSTEM LAYOUT

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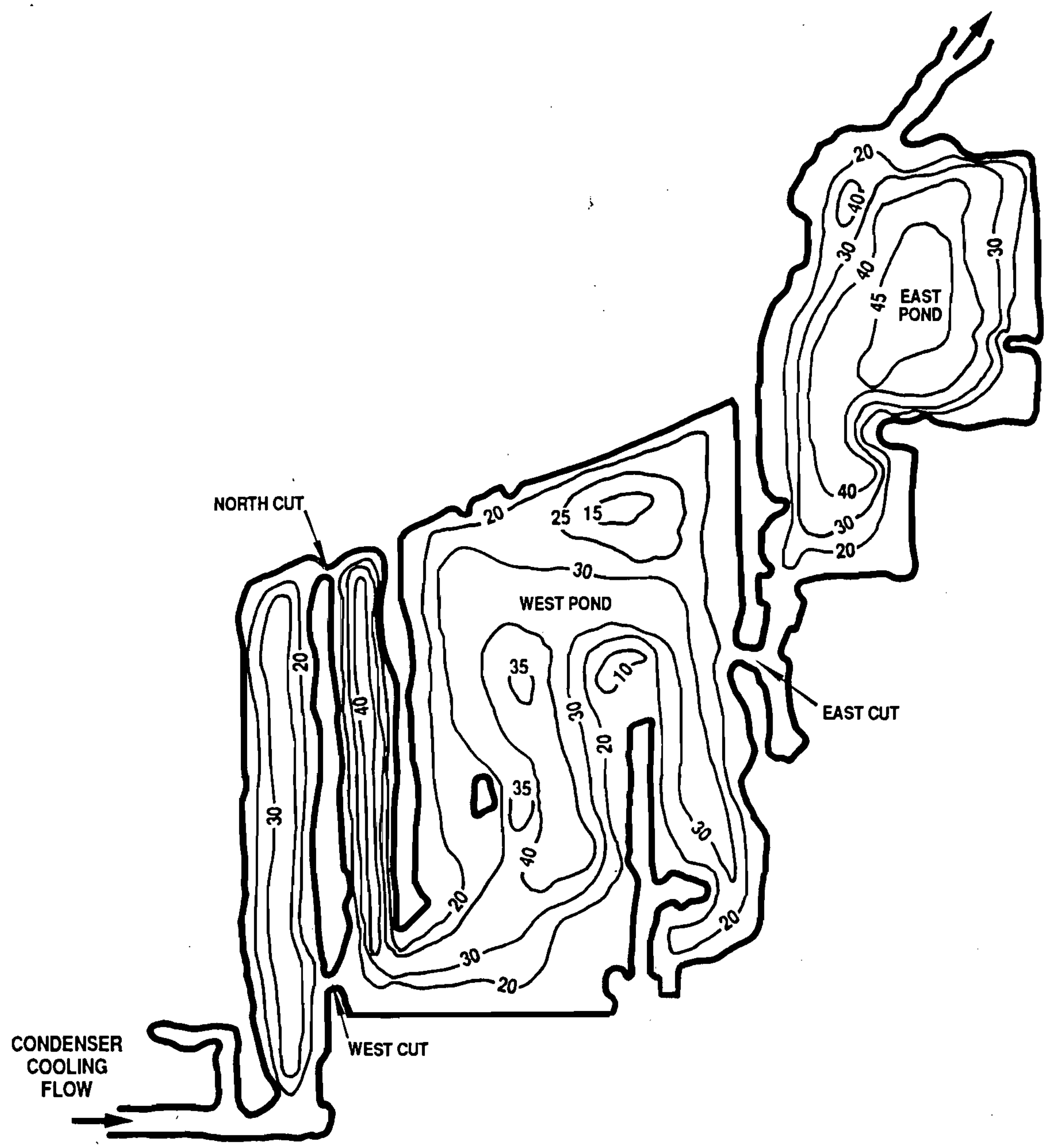

NOTE: BATHYMETRY SHOWS MAJOR FEATURES; HIGHLY LOCALIZED BARS AND HOLES ARE PRESENT THROUGHOUT THE POND.

DEPTH OF DISCHARGE CANAL AND EAST AND WEST CUTS IS ~10 FEET; NORTH CUT IS RESTRICTED TO 2–3 FEET DEPTH.

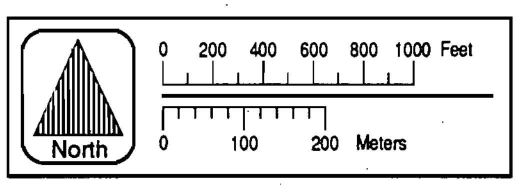

Figure 2.3-14 COOLING CANAL/POND SYSTEM BATHYMETRIC CONTOURS

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3. A portion of the flow through the cooling canal/pond system will be mixed with the tidal inflow, resulting in vertical mixing through the pond depth; and
4. It appears that there is a small amount of recirculation from the cooling canal/pond system discharge back to the condenser cooling water intake.

WATER QUALITY

Surface water bodies adjacent to the Lauderdale Plant site are tidally influenced and range in salinity from fresh to brackish. Water bodies in the area include the South Fork New River, the South New River Canal, the North New River Canal, the Dania Cut-Off Canal, and the Lauderdale Plant's cooling canal/pond system (see Figure 2.3-9). Water bodies surrounding the Lauderdale Plant site have been classified as Class III marine surface waters by FDER (Chapter 17-3, F.A.C.). Existing NPDES permits do not identify any significant water quality requirements of the existing intake or discharge for the Lauderdale Plant.

A literature search was conducted to identify any existing water quality data that could be used to characterize water bodies surrounding the Lauderdale Plant site. With the exception of several water quality monitoring stations maintained by BCEQCB, no additional water quality data were available. The BCEQCB has maintained water quality sampling stations on the South New River Canal, the North New River Canal, the South Fork New River, and the Dania Cut-Off Canal since the mid-1970s. However, only a limited number of parameters have been analyzed from these stations, and the data are inadequate to fully characterize water quality in these water bodies.

A water quality sampling program was initiated in August 1988 to establish baseline conditions in the water bodies surrounding the Lauderdale Plant site. Samples were collected on a monthly basis at five stations shown in Figure 2.3-9. All samples were analyzed for Class III marine water quality parameters defined in Chapter 17-3.121, F.A.C. In addition, a priority pollutant scan was conducted on one sample from each of the five locations. A detailed discussion of the methodology for the water quality sampling program is presented in Section 2.3.4.2, Measurement Programs.

Chemical Water Quality--Results of the water quality monitor program are summarized in Tables 2.3-9 and 2.3-10, with complete analytical results in Appendix 10.5.2. Figure 2.3-9 shows monitoring station locations. Water quality data for Station 1, located at the existing Lauderdale Plant intake structure, showed a high degree of temporal variability, with tidally influenced parameters such as specific conductivity, salinity, sulfate, sodium, and chloride varying by as much as a factor of 10 over the 12-month sampling period. Salinity at this station ranged from 0.36 to 19.3 parts per thousand (ppt) during the 12-month sampling program. Similar trends were observed at Stations 2, 3, and 4, located within the cooling pond/canal system, and Station 5 located on the South Fork New River.

Analytical results from the surface water monitoring program were compared to both state water quality standards for Class III marine surface waters (Chapter 17-3.121, F.A.C.) and Broward County marine surface water quality standards (Chapter 27-5.071, Code of Regulations of the BCEQCB). As shown in Table 2.3-11, numerous dissolved oxygen (DO) concentrations were found to exceed the state and county standard for marine waters of 4.0 mg/L. DO concentrations in surface waters surrounding the Lauderdale Plant site appear to be highly variable with naturally occurring low values. DO concentrations in the Dania Cut-Off Canal (Station 1) exceed the state and county standard during 5 of the 12 sampling events. Similar results were observed at Station 5, located in the South Fork New River. The number of DO exceedances at Stations 2, 3, and 4 ranged from four at Station 4 to nine at Station 3.

Five-day biochemical oxygen demand (BOD_5) was relatively low at all five stations, with mean values ranging from 1.3 to 1.5 mg/L. BOD_5 levels were all below the county standard of 7 mg/L. Chemical oxygen demand (COD) values exceeded the county standard of 15 mg/L on numerous occasions at all

Table 2.3-9. Summary Water Quality Data for Stations 1, 2, and 3--August 1988 Through July 1989

		Station 1			Station 2			Station 3		
			Range			Range			Range	
Parameters	Units	Mean	Minimum	Maximum	Mean	Minimum	Maximum	Mean	Minimum	Maximum
Dissolved Oxygen	mg/L	4.2	2.8	6	4.0	2.4	5.5	2.3	0.1	7
pH, Field	Std. Units	7.4	6.4	7.9	7.4	6.9	8.1	7.5	7	8.7
Specific Conductance	µmho/cm	17,288	770	31,000	16,851	862	31,400	17,311	985	31,800
Salinity	ppt	10.2	0.36	19.3	9.9	0.41	19.6	10.2	0.48	19.8
Temperature	°C	26.7	21.4	30.8	30.5	25	36.2	28.5	23.2	33
Alkalinity Total	mg/L-$CaCO_3$	228.3	153	457	226	159	456	228.5	184	460
BOD_5	mg/L	1.5	0.6	2.5	1.3	0.4	1.8	1.4	0.4	2.8
COD	mg/L	118.8	40	573	86.2	40	222	90.4	25	382
Fecal Coliforms	No./100 mL	85.0	10	190	60.8	10	180	13.3	10	30
Total Coliforms	No./100 mL	127.5	10	300	97.5	10	280	34.2	10	80
Ammonia	mg/L as N	0.144	0.054	0.309	0.123	0.055	0.332	0.116	0.019	0.337
Ammonia Unionized	mg/L as N	0.007	0.001	0.050	0.003	0.001	0.008	0.004	0.001	0.020
NO_2+NO_3	mg/L as N	0.119	0.018	0.452	0.125	0.020	0.440	0.131	0.010	0.515
Nitrogen Total	mg/L as N	1.21	0.57	2.20	1.19	0.65	2.30	1.19	0.46	2.40
Total Kjeldahl Nitrogen	mg/L as N	1.05	0.40	1.80	1.06	0.43	1.80	1.06	0.45	1.90
Fluoride	mg/L	0.45	0.10	0.70	0.47	0.10	0.68	0.46	0.10	0.71
Phosphorus Total	mg/L as P	0.043	0.020	0.087	0.0	0.013	0.055	0.035	0.011	0.068
Oil and Grease	mg/L	0.5	0.02	1.8	0.8	0	2.2	0.6	0.1	1.8
Turbidity	NTU	3.2	1.48	6.1	4.1	1.98	14	3.5	1.5	7.5
Chloride	mg/L	6,030	87	11,400	5,957	124	11,200	6,498	165	11,400
Sulfate	mg/L	695.3	5	1,620	625.8	5	1450	800.3	12	1,620
Aluminum Total	µg/L	83.6	29	147	76.8	29	147	73.7	29	147
Beryllium Total	µg/L	2.0	1.8	3.3	2.0	1.8	3.3	2.0	1.8	3.3
Chromium Total	µg/L	6.8	5.7	10	6.8	5.7	10	6.8	5.7	10
Copper Total	µg/L	8.7	3.8	21.5	9.1	4.5	24	6.5	3.8	14.6
Iron Total	µg/L	693.0	79.1	1,620	734.7	73.7	1,720	553.9	10	1,600
Nickel Total	µg/L	19.8	16	23	19.8	16	23	19.8	16	23
Sodium Total	mg/L	2,509.8	51.6	4,670	2,490.6	75.9	4,620	2,690.3	99.9	4,640
Zinc Total	µg/L	16.5	2.9	58.9	13.7	2.4	45.3	9.1	2.9	20
Antimony Total	µg/L	18.3	4	25	19.5	4	30	19.5	4	30
Arsenic Total	µg/L	6.1	1.8	12.4	7.2	2.7	24	7.2	2.6	24
Cadmium Total	µg/L	1.0	0.2	2.5	1.0	0.2	2.5	1.0	0.2	2.3
Lead Total	µg/L	2.8	1.4	7	2.9	1.4	7	2.3	1.4	7
Selenium Total	µg/L	12.7	2.6	34.5	13.0	2.6	37	13.2	2.6	39.5
Silver Total	µg/L	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Mercury total	µg/L	0.6	0.2	2.4	0.5	0.2	1.3	0.5	0.2	1.8

Note: NTU = Nephelometric turbidity units.
µmho/cm = micromhos per centimeter.

Table 2.3-10. Summary Water Quality Data for Stations 4 and 5--August 1988 Through July 1989

Parameters	Units	Station 4			Station 5		
			Range			Range	
		Mean	Minimum	Maximum	Mean	Minimum	Maximum
Dissolved Oxygen	mg/L	5.0	3.1	7.5	4.3	3.5	5.9
pH Field	Std. Units	7.6	7.2	8.1	7.6	7.1	8.4
Specific Conductance	μmho/cm	15,674	1,140	31,600	1,965	969	77,910
Salinity	ppt	9.2	0.56	19.7	9.5	0.47	19.4
Temperature	°C	28.1	22.9	32.4	27.8	22.9	32.5
Alkalinity Total	mg/L-$CaCO_3$	227.1	165	460	226	179	464
BOD_5	mg/L	1.5	0.4	4.2	1.5	0.4	3.5
COD	mg/L	76.5	9	216	106.2	41	530
Fecal Coliforms	No./100 mL	29.2	10	130	59.2	10	170
Total Coliforms	No./100 mL	55.8	10	150	90.8	10	220
Ammonia	mg/L as N	0.082	0.026	0.214	0.075	0.024	0.200
Ammonia Unionized	mg/L as N	0.003	0.001	0.007	0.003	0.001	0.009
NO_2+NO_3	mg/L as N	0.168	0.012	0.521	0.144	0.010	0.442
Nitrogen Total	mg/L as N	1.18	0.67	2.20	1.1	0.31	2.2
Total Kjeldahl Nitrogen	mg/L as N	1.00	0.55	1.60	1.0	0.16	1.7
Fluoride	mg/L	0.42	0.10	0.71	0.4	0.1	0.67
Phosphorus Total	mg/L as P	0.036	0.020	0.069	0.0	0.03	0.068
Oil and Grease	mg/L	0.8	0.1	3.3	1.1	0	5.6
Turbidity	NTU	3.2	1.48	6.6	3.3	1.5	6.5
Chloride	mg/L	5,579	214	11,400	5,656.0	152	11,400
Sulfate	mg/L	690.3	10	1,410	673	11	1,430
Aluminum Total	μg/L	75.1	29	151	76.2	29	212
Beryllium Total	μg/L	2.0	1.8	3.3	2.0	1.8	3.3
Chromium Total	μg/L	6.8	5.7	10	6.8	5.7	10
Copper Total	μg/L	8.9	3	32.8	9.2	3.8	19.6
Iron Total	μg/L	530.1	10	1,550	572.0	10	1,620
Nickel Total	μg/L	19.8	16	23	19.8	16	23
Sodium Total	mg/L	2,391	115	4,660	2,561.9	90.6	5,560
Zinc Total	μg/L	13.0	2.9	40.4	14.2	2	36.5
Antimony Total	μg/L	18.3	4	25	18.3	4	25
Arsenic Total	μg/L	7.2	2.2	24	7.2	2.2	24
Cadmium Total	μg/L	0.9	0.2	1.7	1.0	0.2	2.5
Lead Total	μg/L	2.5	1.4	7	2.5	1.4	7
Selenium Total	μg/L	12.6	2.6	31.5	12.3	2.6	32.5
Silver Total	μg/L	0.5	0.5	0.5	0.5	0.5	0.5
Mercury total	μg/L	0.6	0.2	2.7	0.8	0.2	3.3

Note: NTU = Nephelometric turbidity units.
μmho/cm = micromhos per centimeter.

Table 2.3-11. Comparisons with Broward County Standards for Marine Waters and FDER Class III Standards for Predominantly Marine Waters

Parameter	Number of Sampling Days When Standards Were Exceeded by Station					Most Stringent Standard
	1	2	3	4	5	
Dissolved Oxygen	5	7	9	4	6	4 mg/L
pH	1	0	1	0	0	6.5 - 8.5
BOD_5	0	0	0	0	0	7 mg/L[a]
COD	7	7	6	5	7	15 mg/L[a]
Fecal Coliform	0	0	0	0	0	200/100 mL
Total Coliform	0	0	0	0	0	1,000/100 mL
Total Nitrogen	2	2	2	2	2	1.5 mg/L[a]
Fluoride	0	0	0	0	0	5.0 mg/L
Total Phosphorus	4	1	3	3	3	0.05 mg/L[a]
Oil and Grease	1	3	2	2	3	1.0 mg/L[a]
Turbidity	0	0	0	0	0	>29 NTU
Aluminum	0	0	0	0	0	1,500 μg/L
Beryllium	0	0	0	0	0	1,100 μg/L
Chromium	0	0	0	0	0	50 μg/L
Copper	1	1	0	1	1	15 μg/L
Iron, total	8	7	5	5	5	300 μg/L
Nickel	0	0	0	0	0	100 μg/L
Zinc	0	0	0	0	0	1,000 μg/L
Antimony	0	0	0	0	0	200 μg/L
Arsenic	0	0	0	0	0	50 μg/L
Cadmium	0	0	0	0	0	5 μg/L
Lead	0	0	0	0	0	30 μg/L
Selenium	1	1	1	1	1	25 μg/L
Silver	0	0	0	0	0	0.05 μg/L
Mercury[b]	2	1	1	0	1	0.1 μg/L

[a]Broward County water quality standard is more stringent.
[b]Analytical results for mercury suspect due to sample contamination. Reported exceedances were observed after the February sampling event and were not subject to sampling contamination.

Note: NTU = Nephelometric turbidity units.

stations. However, the analytical method for this parameter has a positive interference with chloride ions in samples from saline environments. When chloride levels exceed 1,000 mg/L, the minimum acceptable value for COD is 250 mg/L. COD levels below this value are highly questionable because of the high chloride correction which must be made (EPA, 1983). Since all five stations had mean chloride concentrations far in excess of 1,000 mg/L, it is likely that the reported COD values do not accurately reflect the true chemical oxygen demand in the water bodies sampled.

Concentrations of nitrogen and phosphorus were relatively constant among the five sampling sites. Mean total nitrogen concentrations ranged from 1.10 mg/L at Station 5 to 1.21 mg/L at Station 1. Individual total nitrogen concentrations exceeded the county standard of 1.5 mg/L during two sampling events at each of the five stations. Total phosphorus also showed little variability among stations, with mean concentrations ranging from 0.036 mg/L at Station 4 to 0.043 mg/L at Station 1. Individual total phosphorus concentrations were found to exceed the county standard of 0.05 mg/L on several occasions at each station.

Oil and grease was generally low at all stations but did exceed the county standard of 1.0 mg/L at least once at all five sampling locations. Mean oil and grease concentrations ranged from 0.5 to 1.1 mg/L with the highest mean concentration reported at Station 5 in the South Fork New River.

Concentrations of metals, with the exception of iron, were generally low at all stations. Total iron concentrations were elevated at all stations and demonstrated a high degree of temporal variability. Total iron in the Dania Cut-Off Canal (Station 1) ranged from 79.1 to 1620 micrograms per liter (μg/L), with a mean value of 693 μg/L. Total iron concentrations demonstrated similar trends at all five stations, but were highest in the Dania Cut-Off Canal. Total iron concentrations exceeded the state standard of 300 μg/L during at least five of the sampling events at each of the sampling sites.

Analytical results for mercury initially were viewed as being above the state standard for Class III marine waters of 0.1 μg/L at all stations. However, it was determined that mercury contamination was introduced into the samples from the sample collection bottle during the early sampling events. The source of contamination was identified and eliminated following the February sampling. As a result, mercury levels reported above the analytical detection limit from August through February are suspect and likely the result of sample contamination and should not be considered reliable. Analytical results for mercury after February did not show signs of contamination. Mercury concentrations of 0.2 μg/L (the analytical detection limit) were reported at Stations 1, 2, and 5. Mercury levels of 0.4 μg/L were detected on one occasion each at Stations 1 and 3. Overall, mercury concentrations in surface waters surrounding the Lauderdale Plant site were at or below the analytical detection limit in the majority of noncontaminated samples.

Individual copper and selenium concentrations exceeded the Class III standards for marine waters on one occasion at each of the five stations. Mean concentrations of copper at the various stations were below the Class III standard of 15 μg/L, and ranged from 8.7 μg/L at Station 1 to 9.2 μg/L at Station 5. Analytical results for all other metals were consistently below both the state and county standards.

A priority pollutant scan was conducted on one sample from each of the five stations. All analyses were below the analytical detection limit at all stations, with the exception of total phenols. Detectable levels of phenols were found at Station 1 (6 μg/L), Station 2 (2 μg/L), and Station 4 (4 μg/L). The phenols detected were at low levels, just slightly above the analytical detection limit, and were likely the result of naturally occurring phenolic compounds generated by the degradation of organic material.

In addition to data from the monthly water quality sampling program, water samples from the Lauderdale Plant intake and cooling system discharge

(Station 5) were collected and analyzed by FPL personnel on July 13, 1988. A comparison with Broward County effluent and water quality standards indicates that the discharge water met all of the effluent limits (see Table 2.3-12). However, the intake water did not meet water quality standards set by Broward County for COD, total nitrogen, odor, oil and grease, DO, and total phosphorus; these results are consistent with water quality results for Station 1 discussed previously.

Cooling Canal/Pond System Thermal Data--The thermal discharges of the Lauderdale Plant to surface waters are condenser cooling and auxiliary cooling water. The temperature of the cooling water output for existing condenser design is 13.2°F (7.3°C) above ambient. Because the repowered units will use the existing cooling system, the thermal performance of the cooling canal/pond system was investigated. A series of thermograph stations was deployed at the plant intake, in the cooling canal/pond system, and in the South Fork New River in August 1988. Figure 2.3-15 shows the thermograph station locations. (Note: Thermographs recorded temperature in degrees Celsius (°C); actual values are presented with conversion to °F provided in tables and graphs).

The average temperatures of the thermographic data for the sampling period are presented in Table 2.3-13. The complete set of thermograph data is presented in Appendix 10.5.2. Two types of thermal performance can be readily observed from the data; namely, temperature responses when the plant is on line and the responses from when the plant is idle for several days. Two sets of data, representing each of these two conditions, were extracted from the data base and are discussed in detail below.

The current operation of the Lauderdale Plant is as a cycling facility. The current cycling pattern has the units coming on line in the morning and going off line at night. During August 1988, and February and May 1989 the plant was operating in this mode daily for extended periods. The periods of August 25-31, and May 1-4, 1989 were chosen as examples of typical summer operation of the plant. The period of February 6-11, 1989 was

Table 2.3-12. Cooling Water Analyses--July 13, 1988

Parameter	Cooling Water Intake[a]	County Water Quality Limits	Cooling Water Discharge[a]	County Effluent Limit
Arsenic	BDL	0.05	BDL	0.05
Cadmium	BDL	.005	BDL	0.5
Chlorinated Hydrocarbons	BDL	0.01	BDL	0.01
Chromium, total	BDL	0.05	BDL	1.0
Chromium, hexavalent	BDL	--	BDL	0.1
COD	40	15	29	100
Coliform, total	BDL	1,000/100 mL	54	1,000/100 mL
Coliform, fecal	BDL	800/100 mL[b]	BDL	400/100 mL
Copper	BDL	0.015	BDL	0.5
Cyanide	BDL	0.005	BDL	0.1
Detergent	BDL	0.5	BDL	6.0
Lead	BDL	0.03	BDL	0.3
Mercury	BDL	0.0001	BDL	0.001
Nickel	BDL	0.1	BDL	1.0
Nitrogen	2.6	1.5	2.0	30
Odor	1.0 TON	None	1.0 TON	None
Oil and Grease	9.9	1.0	3.1	10.0
Dissolved Oxygen	2.8	Min 4.0	3.05	Min 2.0
PCBs	BDL	0.001	BDL	0.000001
pH	7.74	6.5-8.5	7.71	6-8.5
Phenolics	BDL	0.001	BDL	0.01
Phosphorus	0.08	0.05	0.07	10.0
Selenium	BDL	0.025	BDL	0.25
Silver	BDL	0.00005	BDL	0.1
Total Suspended Solids	14	--	9	30
Total Dissolved Solids	405	--	400	500[c]
Turbidity	2.3 NTU	10 JTU	2.0 NTU	30 JTU
Zinc	BDL	1.0	BDL	1.0

[a] Cooling water intake and cooling water discharge corresponds to water quality sampling Stations 1 and 5 respectively.
[b] Any one sample.
[c] Exceeding natural salts of sea water.

Note: All data provided are result of one sampling and analysis cycle.
All analytical results reported in units of milligrams per liter (mg/L) unless otherwise noted.

BDL = below detection limits.
JTU = Jackson turbidity unit.
NTU = Nephelometric turbidity unit.
TON = threshold odor number.
-- = no limit.

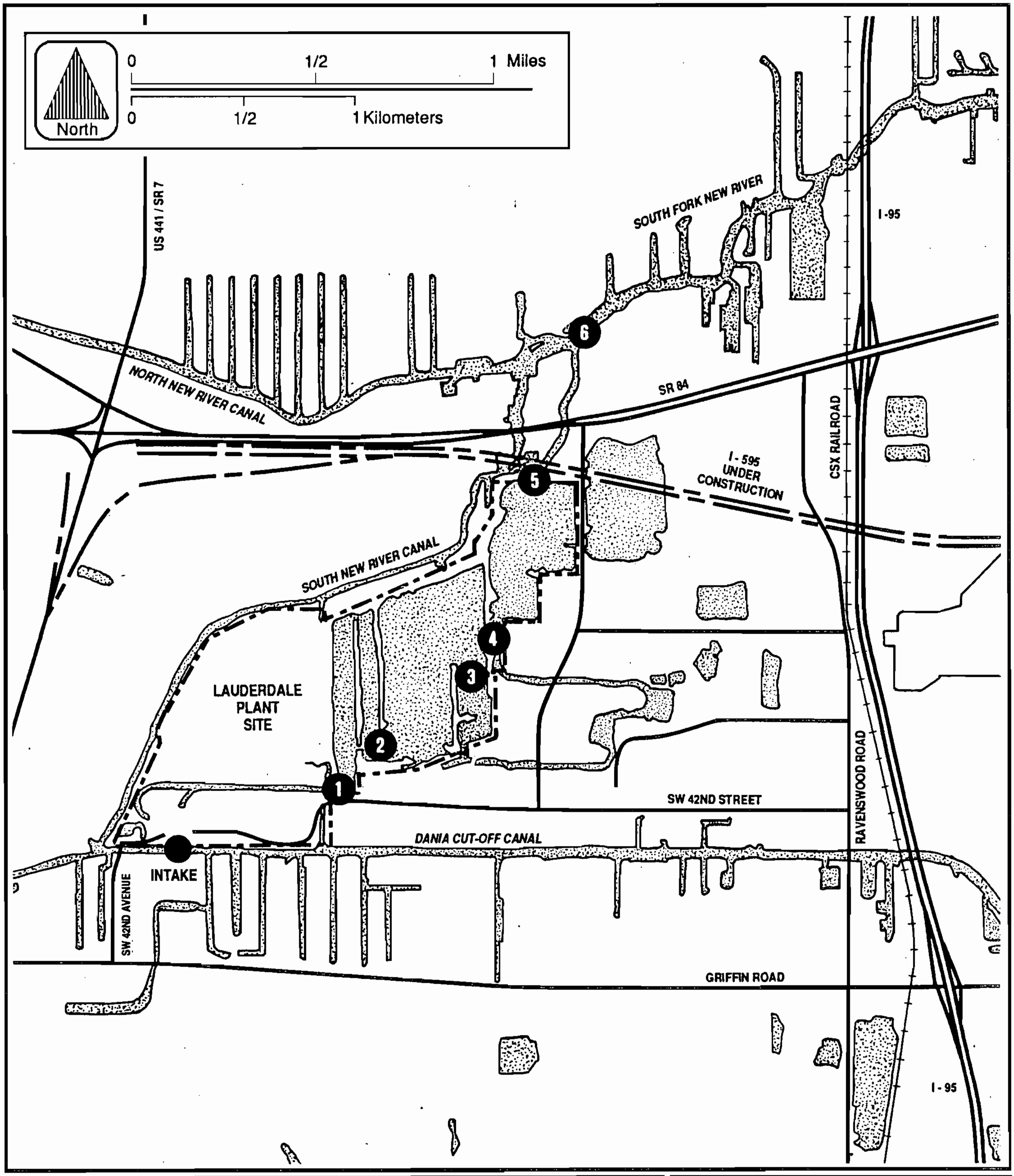

Figure 2.3-15 LOCATIONS OF THERMOGRAPH STATIONS

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Table 2.3-13. Average Temperatures During the Sampling Periods.

Date	Inlet		Station 1		Station 2	Station 3		Station 4		Station 5			Station 6	
	Surface	Bottom	Surface	Bottom	Surface	Surface	Bottom	Surface	Bottom	Surface	Middle	Bottom	Surface	Bottom
Aug. 25 - Sep. 19, 1988	28.8	28.6	32.4	32.4	32.4	32.2	30.3	31.0	31.8	31.0	31.1	30.8	31.0	30.1
Sep. 20 - Oct. 25, 1988	28.2	28.0	30.9	31.6	29.4	30.5	30.6	29.1	30.4	29.4	30.3	29.2	--	28.8
Oct. 26 - Nov. 22, 1988	26.2	26.6	28.7	29.5	27.1	28.2	27.9	26.6	27.3	28.0	28.2	27.0	--	26.6
Nov. 23 - Dec. 13, 1988	24.1	23.9	27.2	26.9	23.0	28.2	--	24.5	25.2	25.4	25.9	25.5	25.6	--
Dec. 14 - Jan. 24, 1989	23.2	22.8	25.7	25.2	21.2	24.1	--	23.0	23.7	24.2	23.9	22.8	--	--
Jan. 25 - Mar. 01, 1989	--	23.5	26.2	26.3	22.4	24.6	--	23.4	24.2	--	--	23.8	--	23.2
Mar. 02 - Apr. 05, 1989	24.5	22.3	--	--	22.5	25.4	21.2	23.7	22.4	--	24.3	--	24.3	23.6
Apr. 06 - May 01, 1989	28.7	26.8	--	--	25.9	25.2	26.5	27.3	--	27.8	--	27.3	26.8	26.8
May 02 - May 25, 1989	30.2	28.7	31.9[a]	31.1	--	29.7	28.0	29.2	--	29.1	29.2	29.4	28.5	30.9
May 25 - June 21, 1989	--	--	34.5	33.9	--	25.7	30.4	31.3	--	--	31.4	31.7	30.8	31.3
June 21 - Aug. 3, 1989	--	--	32.7	32.8	31.7	26.6	30.3	--	--	30.3	30.5	30.8	30.4	30.6

[a]Average temperature taken at mid-depth.

Note: All temperatures measured and recorded in degrees Celsius (°C). °F = 1.8°C + 32. 20°C = 68°F; 24°C = 75.2°F; 28°C = 82.4°F and 32°C = 89.6°F.

chosen as an example of typical winter operation. Table 2.3-14 and Figure 2.3-16 present the average temperatures in the cooling canal/pond system during the August, February, and May operating periods. As seen in the table, temperature increased an average 4.6°C (8.3°F) in August, 3.1°C (5.6°F) in February, and 3.2°C (5.8°F) in May from the intake to Station 1.

Moving through the West and East Ponds of the system, water temperature generally dropped until the average temperature differential between the intake and the cooling canal/pond system outlet (Station 5) was 3.4°C (6.1°F) in August, 0.2°C (0.4°F) in February, and -0.2°C (-0.4°F) in May. Given the mixing with the ultimate receiving water, the temperature differential between the intake and the South Fork New River (Station 6) was 2.1°C (3.8°F) in August, -0.3°C (-0.5°F) in February and 0.4°C (0.7°F) in May. The temperature differentials for the sampling period are shown in Table 2.3-15.

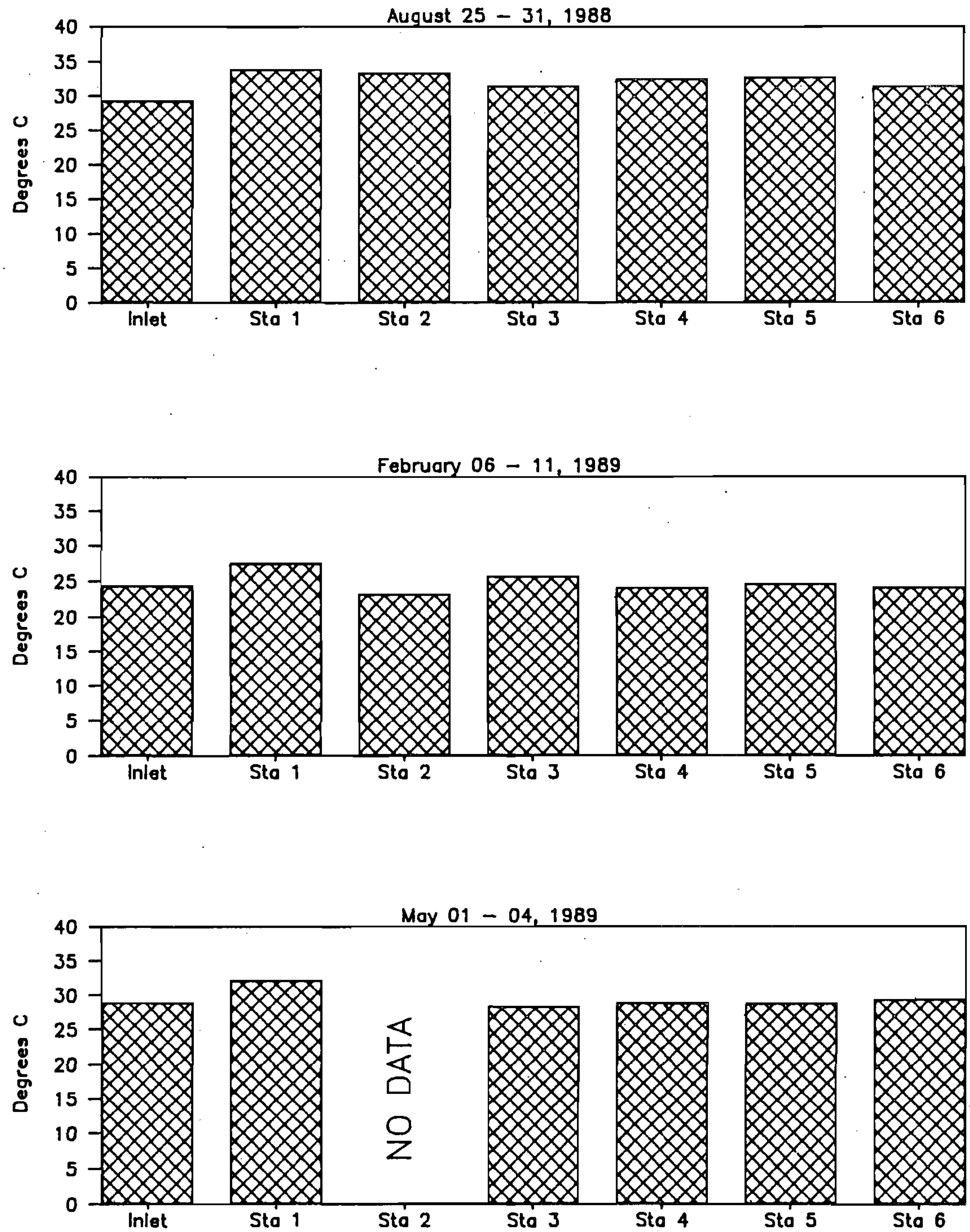
From the thermograph data, the temperature dynamics within the cooling canal/pond system were determined. The water temperature at the West Pond inlet (Station 1) varies dramatically with the plant cycling as shown by the examples presented in Figure 2.3-17. The Station 1 temperature varies directly with plant operation, exhibiting an instantaneous temperature increase of up to 9°C (16°F) in August, 7°C (13°F) in February and 8°C (14°F) in May. The South Fork New River temperature data (Station 6) follows a similar trend except that the range is greatly attenuated, i.e., <3°C (5°F). One of the causes of the temperature variations at Station 6 is the plant cycling; a lag of approximately 30 hours is evident between peaks at Station 1. A second cause of the variability is tidal influences.

To assess the cooling canal/pond system thermal performance without the periodic heat inputs of the plant, the periods of November 3 through 11 and December 20 through 28, 1988 were used. During these periods (plus one day before and after), the plant was idle. Table 2.3-14 presents the average temperatures in the cooling canal/pond system during the November and December idle periods. During the two idle periods, an average temperature

Table 2.3-14. Comparison of Average Pond Temperatures for Selected Plant Operation Periods

	Average Temperature (°C)					
	Units On				Units Off	
	Aug	Feb	May	July	Nov	Dec
Inlet	29.4	24.5	29.0	--	25.7	21.8
Station 1	34.0	27.6	32.2	34.9	28.2	24.1
Station 2	33.5	23.3	--	32.5	26.0	20.6
Station 3	31.6	25.8	28.4	28.4	27.2	23.1
Station 4	32.6	24.2	28.9	--	26.2	22.4
Station 5	32.8	24.7	28.8	31.9	27.3	22.7
Station 6	31.5	24.2	29.4	32.2	25.8	--
Temperature Differential Between:						
Intake and Station 1	4.6	3.1	3.2	--	2.5	2.3
Intake and Station 5	3.4	0.2	-0.2	--	1.6	0.9
Intake and RBW	2.1	-0.3	0.4	--	0.1	0.9

Note: All temperatures measured and reported in °C. °F = 1.8°C + 32.
Average temperatures: 20°C = 68°F, 25°C = 77°F and 30°C = 86°F
Temperature differentials: 1°C = 1.8°F, 3°C = 5.4°F and 5°C = 9°F



NOTE: ALL TEMPERATURES MEASURED IN °C. °F = 1.8°C + 32; 20°C = 68°F, 25°C = 77°F, 30°C = 86°F, AND 35°C = 95°F.

Figure 2.3-16 AVERAGE WATER TEMPERATURE IN COOLING CANAL/POND SYSTEM DURING LAUDERDALE PLANT OPERATION

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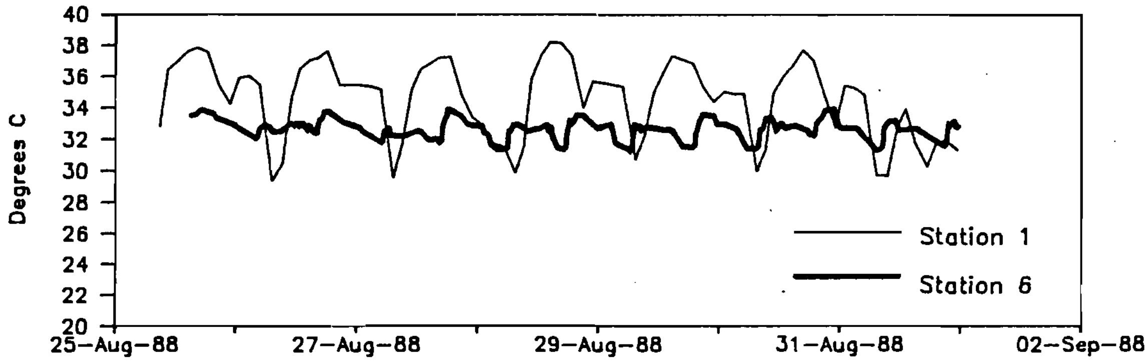
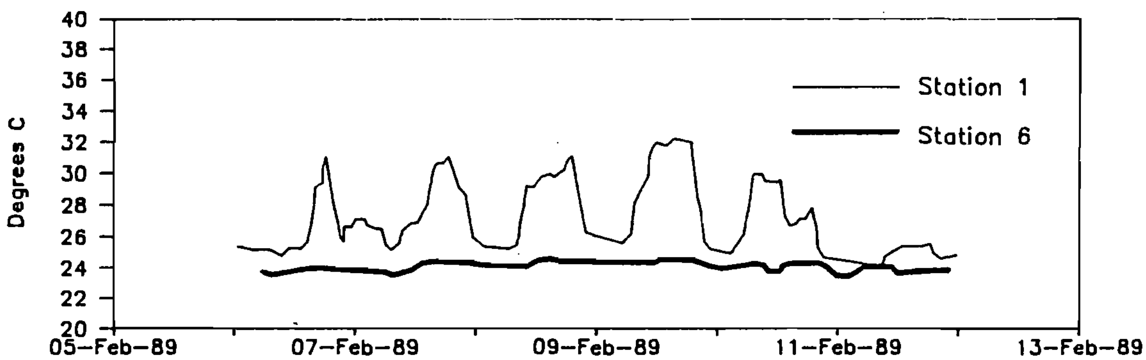
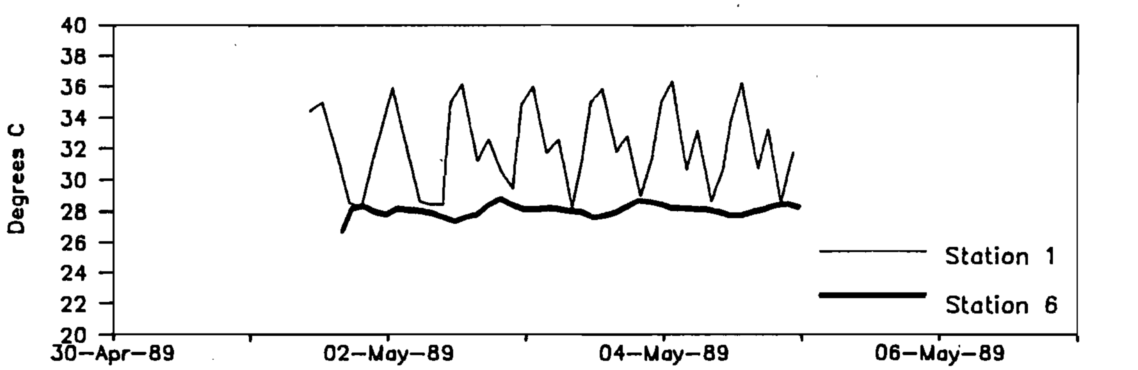
Table 2.3-15. Temperature Differential Between Intake and Receiving Water

Date	Temperature (°C)		
	Average Intake	Average Receiving Water	Differential
08/25/88 through 09/19/88	28.7	30.6	1.9
09/20/88 through 10/25/88	28.1	28.8	0.7
10/26/88 through 11/22/88	26.4	26.6	0.2
11/23/88 through 12/13/88	24.0	25.6	1.6
12/14/88 through 01/24/89	23.0	23.4	0.4
01/25/89 through 03/01/89	23.5	23.2	-0.3
03/02/89 through 04/05/89	23.4	24.0	0.6
04/06/89 through 05/01/89	27.8	26.8	-1.0
05/02/89 through 05/25/89	29.4	29.7	0.3
05/25/89 through 06/21/89	--	31.02	--
06/21/89 through 08/03/89	--	30.52	--

Note: All temperatures measured and reported in °C. °F = 1.8°C + 32. 20°C = 68°F, 25°C = 77°F, and 30°C = 86°F.







NOTE: ALL TEMPERATURES MEASURED IN °C. °F = 1.8°C + 32; 20°C = 68°F, 25°C = 77°F, 30°C = 86°F, AND 35°C = 95°F.

Figure 2.3-17 COOLING CANAL/POND SYSTEM TEMPERATURE DATA COMPARISON OF POND INLET (STATION 1) AND RECEIVING WATER (STATION 6) DATA DURING LAUDERDALE PLANT OPERATION (AUGUST 25-29, 1988)

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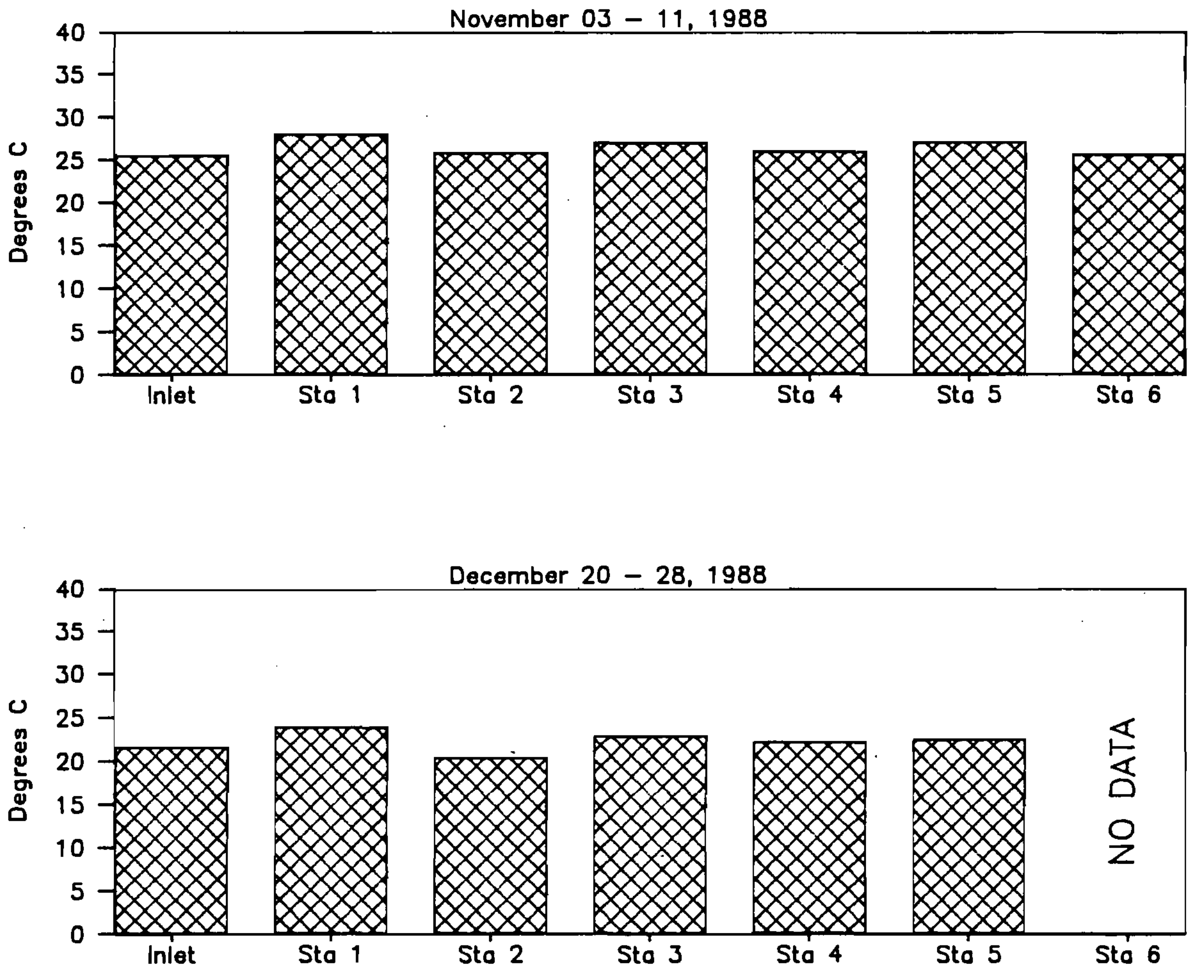
differential of 2.5°C (4.4°F) and 2.3°C (4.1°F) from the Dania Cut-Off Canal intake to Station 1 was noted in November and December, respectively. Throughout the west and east ponds, however, water temperature remains relatively constant as seen in Figure 2.3-18. The temperature differential between the intake and the South Fork New River (Station 6) was 0.1°C (0.2°F) in November and 0.9°C (1.6°F) in December. The temperature dynamics within the system during the idle periods do not show the dramatic variability exhibited during plant operation (Figure 2.3-19). The retention of heat by the canal/pond system is to be expected given the large volume of the system.

2.3.4.2 Measurement Programs

The purpose of the water quality baseline studies was to provide information on the existing surface water hydrology and water quality conditions. This information provided the background for the incremental impact assessments. The studies described below focus on the intake from the Dania Cut-Off Canal and the discharge to the South Fork New River. The following studies were performed:

Continuous Water Level Recording--Three continuous water level recorders (Stephens Type A) were installed and operated for 12 months. The recorders were located on the FPL tide gate in the Dania Cut-Off Canal, at the entrance to the cooling canal/pond system (upstream end), and in the cooling canal/pond system near the discharge to the South Fork New River. The recorders recorded changes in water level due to tidal influence, fresh water flow, and/or wind effects. These data provided vital information required for modeling and also provided a reference for other field collection efforts.

Water Quality Sampling--Water quality sampling was conducted on a monthly basis for 12 months to quantify baseline water quality. This period is sufficient to obtain wet season and dry season conditions. Samples were collected from five stations; one located at the cooling water intake,



NOTE: ALL TEMPERATURES MEASURED IN °C. °F = 1.8°C + 32; 20°C = 68°F, 25°C = 77°F, 30°C = 86°F, AND 35°C = 95°F.

Figure 2.3-18 AVERAGE WATER TEMPERATURE IN COOLING CANAL/POND SYSTEM WITH LAUDERDALE PLANT IDLE

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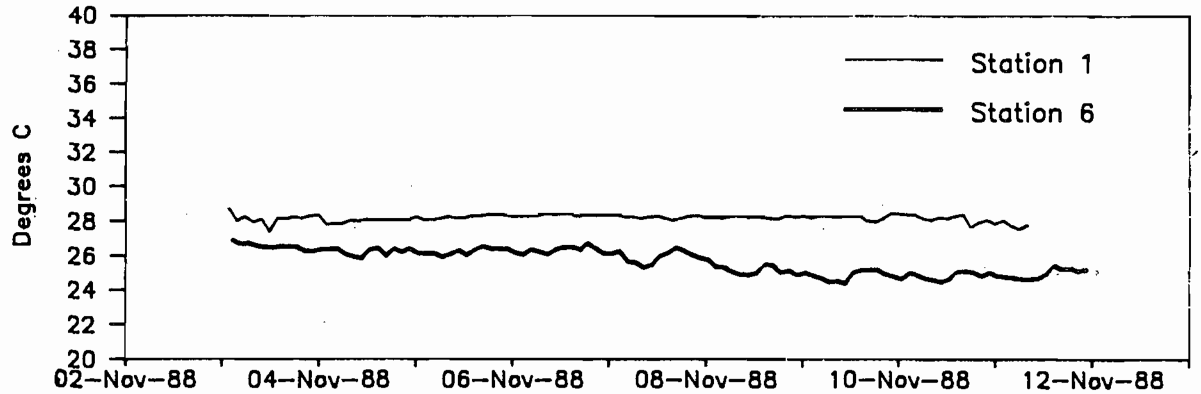

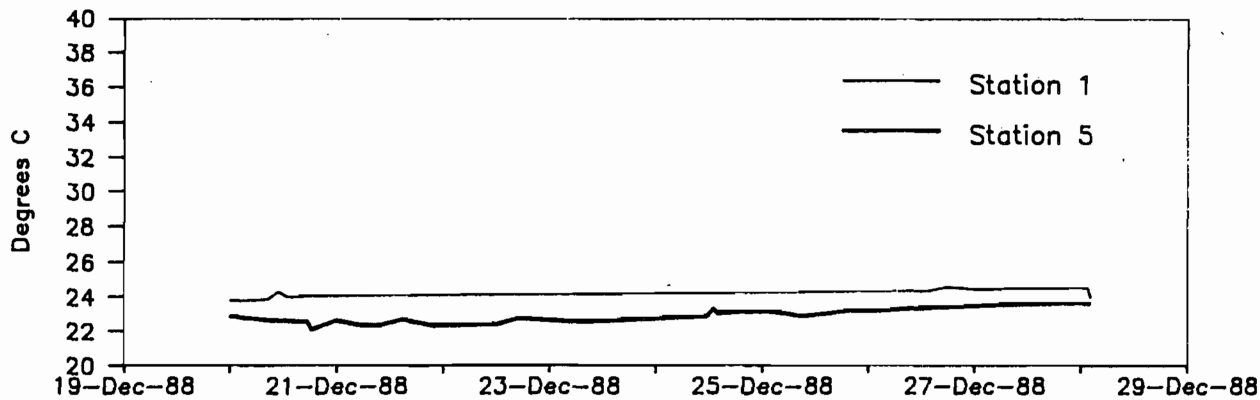

NOTE: ALL TEMPERATURES MEASURED IN °C. °F = 1.8°C + 32; 20°C = 68°F, 25°C = 77°F, 30°C = 86°F, AND 35°C = 95°F.

Figure 2.3-19 **COOLING POND TEMPERATURE DATA COMPARISON OF INLET AND OUTLET WITH LAUDERDALE PLANT IDLE**

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three located at the cooling canal/pond system, and one located within the receiving water.

The locations of the water quality sampling stations are shown in Figure 2.3-9. Water quality was sampled at mid-depth using a Van Dorn sampler. A Hydrolab (Model 4041) multiple electrode was used to determine pH, temperature, conductivity, and DO in the field. The classical and metal parameters were analyzed monthly using EPA Methods for Chemical Analyses of Water and Waste (EPA, 1981). Analyses for pesticides, radioactive substances, chlorinated organic compounds, and other parameters were performed once during the 12-month monitoring period.

Dye Dispersion Study--One dye dispersion study to determine flow characteristics in the system was conducted. This study entailed a slug injection of dye (Rhodamine WT) into the existing Lauderdale cooling water discharge and mapping the resultant plume in the cooling canal/pond system. The study was begun during low-tide conditions. The dye study methodology was as specified by Florida Department of Natural Resources (FDNR), 1988. The results from the dye studies were analyzed and mapped and are contained in Appendix 10.5.2. The dye study results showed plume movement and dispersion, and provided a quantitative assessment of the travel time of the discharge through the cooling canal/pond system.

Synoptic Current Studies--A synoptic current study was conducted in the cooling canal/pond system and the adjacent canals to measure current speed and direction. The study was performed using a deck readout type current meter. These data augmented the dye study data for quantifying circulation patterns within the cooling canal/pond system.

Thermographs--Seven sets of continuously recording thermographs were installed to provide data on ambient intake temperature and discharge temperatures at various locations in the cooling canal/pond system. Locations of the thermograph stations are shown in Figure 2.3-15. Each thermograph station consisted of two instruments located at the water surface and bottom (except for Station 2 which had an instrument at the surface only, and Station 5 which had an additional instrument located at mid-depth). The thermographs were Ryan Instruments Model J-90 that have a range from 10°C to 40°C and were serviced monthly during the field sampling strips. Table 2.3-16 presents a history of the thermograph operations.

Table 2.3-16. Thermograph Data Collected During the Sampling Periods

Date	Intake		Station 1			Station 2	Station 3		Station 4		Station 5			Station 6	
	S	B	S	M	B	S	S	B	S	B	S	M	B	S	B
08/25/88 through 09/19/88	X	X	X		X	X	X	X	X	X	X	X	X	X	X
09/20/88 through 10/25/88	X	X	X		X	X	X	X	X	X	X	X	X	N	X
10/26/88 through 11/22/88	X	X	X		X	X	X	X	X	X	X	X	X	N	X
11/23/88 through 12/13/88	X	X	X		X	X	X	N	X	X	X	X	X	X	X
12/14/88 through 01/24/89	X	X	X		X	X	X	N	X	X	X	X	X	V	N
01/25/89 through 03/01/89	N	X	X		X	X	X	N	X	X	N	N	X	V	X
03/02/89 through 04/05/89	X	X	V		V	X	X	X	X	X	N	X	N	X	X
04/06/89 through 05/01/89	X	X	V		V	X	X	X	X	N	X	N	X	X	X
05/02/89 through 05/25/89	X	X	X		X	V	X	X	X	N	X	X	X	X	X
05/25/89 through 06/21/89	V	V			X	V	X	X	X	N	N	X	X	X	X
06/21/89 through 08/03/89	V	V	V	X	X	X	X	X	N	N	X	X	X	X	X

Note: B = Bottom
M = Mid-depth
N = Thermograph data was not used due to malfunction of thermocouple.
S = Surface
V = Thermograph data was vandalized.

2.3.5 Vegetation/Land Use

Figure 2.3-20 presents a land use map of the Lauderdale Plant site and adjoining properties that categorizes the site using Level III of the FLUCFCS (FDOT, 1985). Figure 2.3-21 is a vegetation map that shows the locations of plant communities as classified under the FLUCFCS system. FLUCFCS Level II land use categories are presented in Table 2.2-5; however, since parts of the site could be classified by vegetation type as well as land use, plant communities have been mapped separately. (Some transmission line areas, for example, could be labeled as 832, Electrical Power Transmission Lines, or 422, Brazilian Pepper.)

2.3.5.1 Areas Affected by Repowering Project

Because portions of the Lauderdale Plant site have been disturbed by human activities since the 1920s, there are virtually no natural plant communities remaining. The vegetation associations are generally stressed, second-growth mixtures of exotics and weedy native species. On the actual proposed power block location, there is no natural vegetation.

Around the most intensively developed areas of the Lauderdale Plant site (shown as Area I in Figure 2.3-22), ragged lawns and patches of vegetation between paved areas include a variety of weeds and grasses. Typical plants include Brazilian pepper (*Schinus terebinthifolius*), Virginia creeper (*Parthenocissus guinquefolia*), hempvine (*Mikania* spp.), camphorweed (*Heterotheca subaxillaris*), muscadine (*Vitis rotundifolia*), Madagascar periwinkle (*Catharanthus roseus*), tridax (*Tridax procumbens*), spurges (*Chamasyee* spp.), matchweed (*Lippia nodiflora*), peppergrass (*Lepidium virginicum*), St. Augustine grass (*Stenotaphrum secundatum*), bushy beardgrass (*Andropogon glomeratus*), sawgrass (*Cladium jamaicense*), goosegrass (*Eleusine indica*), bermudagrass (*Cynodon dactylon*), and *Paspalum* species. Landscape plants around the developed part of the plant site include black olive (Bucida burceras), Washingtonia palm (Washingtonia spp.), and coconut palm (Cocos nucifera). These areas are so small and have such insignificant vegetation that they are not mapped in Figure 2.3-22.

The SSB/EP area east of the main power plant (shown as Area 2 in Figure 2.3-22) has been mapped as Freshwater Marshes, FLUCFCS Code 641. This code has been used for both the giant reed communities, which are most notable along canal banks, and for other herbaceous wetland species. Whereas giant reed (Phragmites australis) covers the eastern pond, torpedo grass (Panicum repens) dominates the other two. Other common species growing on low ground in this area include Brazilian pepper, pond apple (Annona glabra), milkweed vine (Sarcostemma clausum), purple sedge (Cyperus ligularis), and a variety of other grasses and sedges. Weeds like tridax, ragweed (Ambrosia artemisiifolia), camphorweed, Madagascar periwinkle, dog fennel (Eupatorium spp.), Spanish needles (Bidens spp.), goosegrass, smutgrass (Sporobolus indicus), lovegrass (Eragrostis spp.), and Paspalum species grow on the berms, which were not mapped separately.

The area just north of the recreation pavilion (shown as Area 3 in Figure 2.3-22) is mapped 617, Mixed Wetland Hardwoods. Red maple (Acer rubrum) and royal palm (Roystonea spp.) are the dominant species. This is not a natural stand of the native royal palm, but a population derived from seedlings of planted landscape specimens, probably of Cuban origin. (Austin, personal communication, 1988.)

The area designated for the construction parking and the east construction laydown area (shown as Area 4 in Figure 2.3-22) has been recently (summer 1989) cleared of vegetation as part of the development of the Port 95 Commerce Park.

2.3.5.2 Areas Not Affected by the Repowering Project

The northern portion of the site has been designated by Broward County as part of the South New River urban wilderness area as shown in

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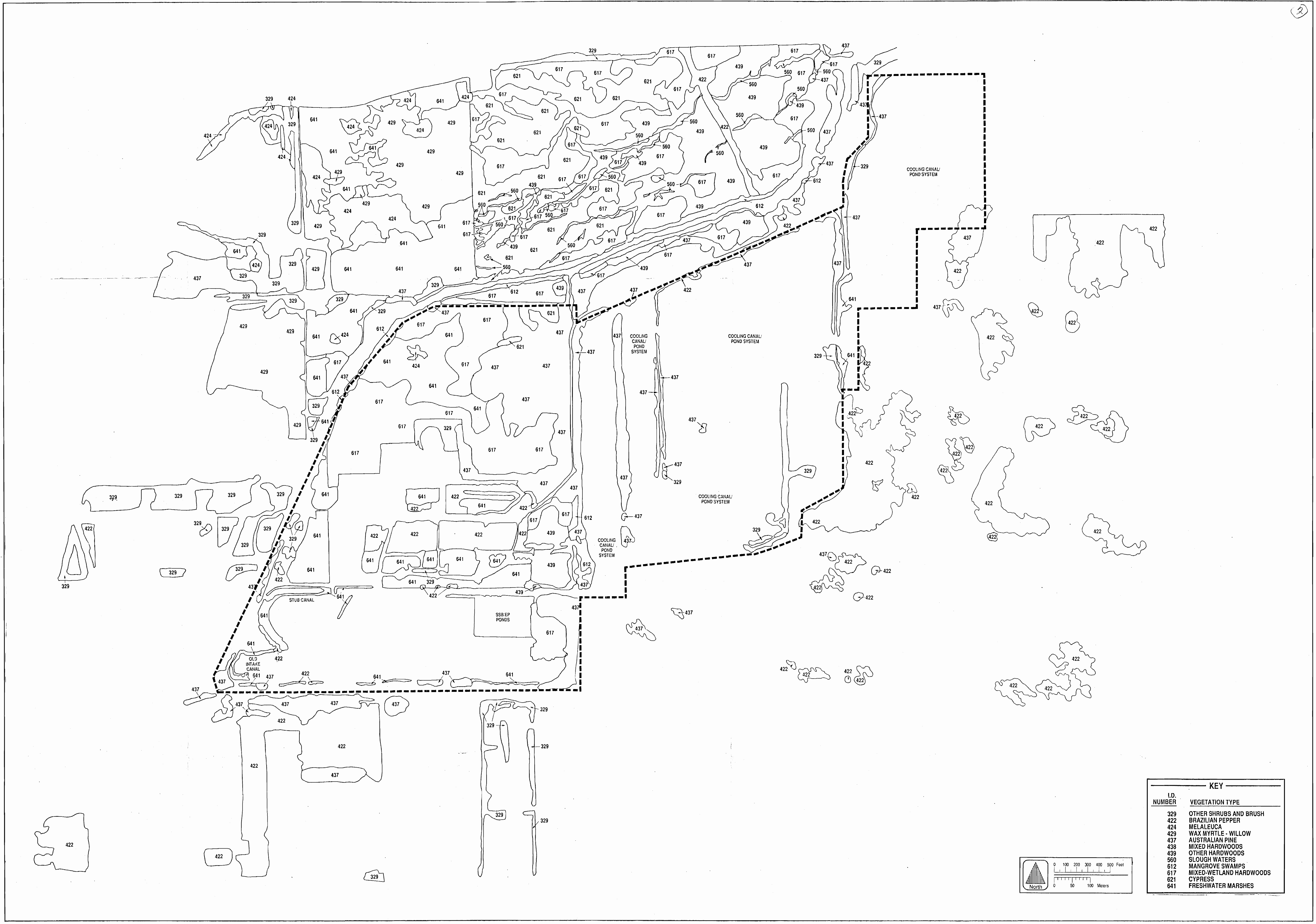

Figure 2.3-21 VEGETATION MAP OF LAUDERDALE PLANT SITE AND ADJACENT PROPERTIES

Lauderdale Repowering Project

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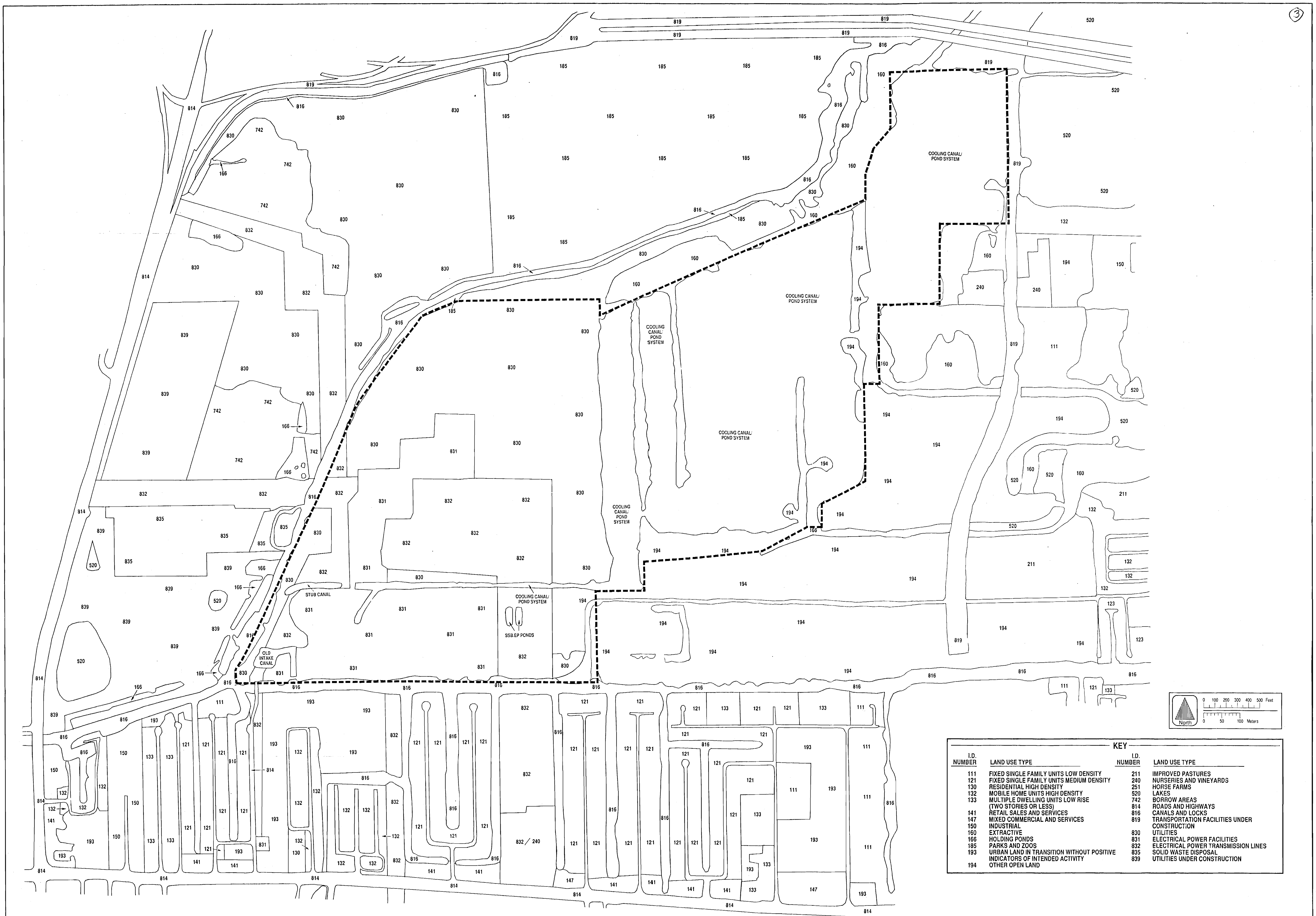

Figure 2.3-20 LAND USE MAP OF LAUDERDALE PLANT SITE AND ADJACENT PROPERTIES

Lauderdale Repowering Project

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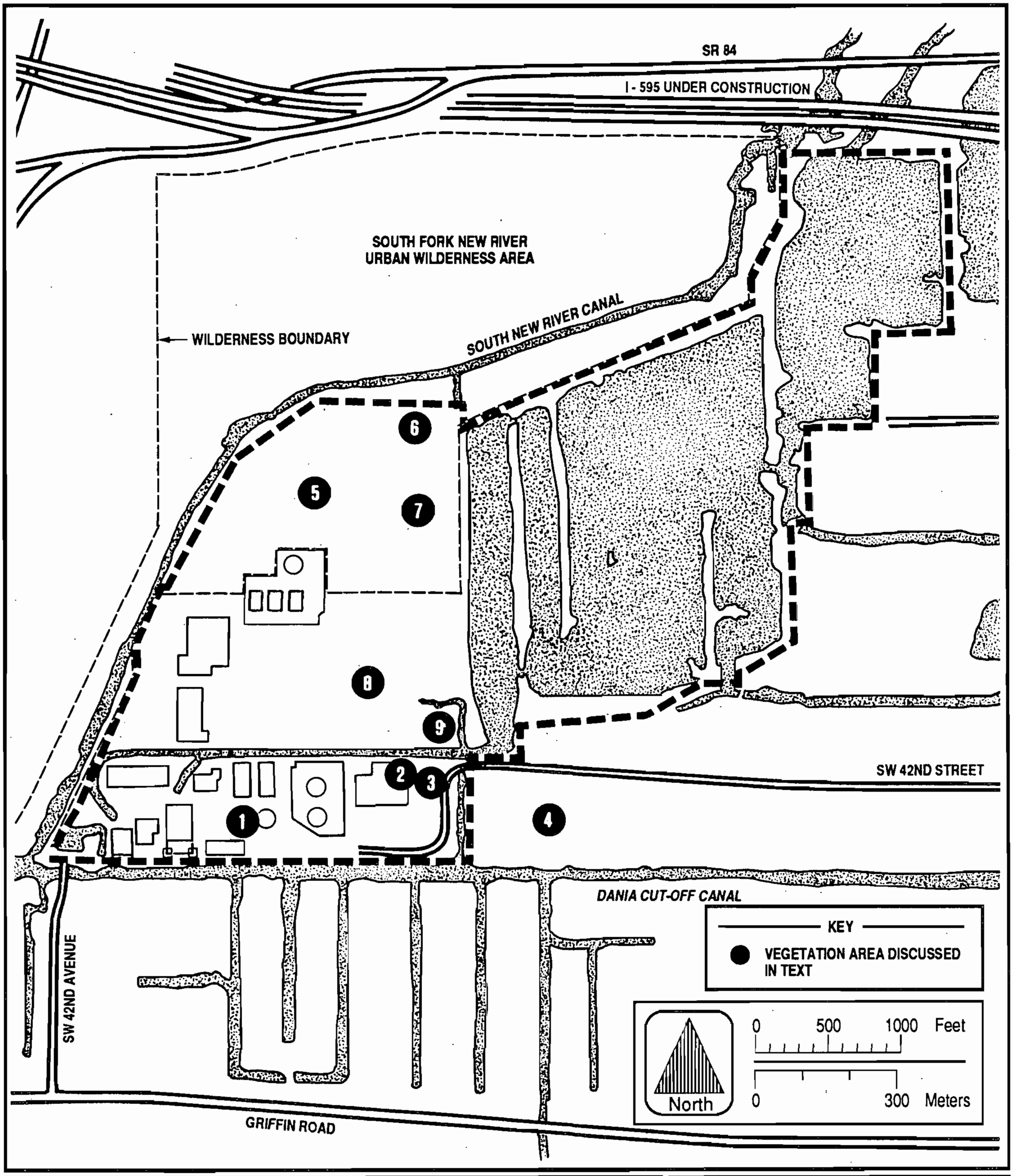

Figure 2.3-22 VEGETATION AREAS DESCRIBED IN SECTION 2.3.5

FPL
Lauderdale Repowering Project

Figure 2.3-22. None of the activities associated with the Lauderdale Repowering Project will affect this area. Sawgrass/shrub marsh covers much of the northern third of the site (shown as Area 5 in Figure 2.3-22) and is categorized as 641. It has scattered trees, including native red maple, pond cypress (Taxodium ascendens), exotic melaleuca (Melaleuca quinquenervia), and Australian pine (Casuarina spp.). Shrubs include dahoon holly (Ilex cassine), wax myrtle (Myrica cerifera), saltbush (Baccharis spp.), and coastal plain willow (Salix caroliniana). Bulltongue sagittaria (Sagittaria lancifolia) and royal fern (Osmunda regalis) are among the common herbaceous species. Laurelleaf greenbriar (Smilax laurifolia), lizard tail (Saururus cernuus), swamp lily (Crinum americanum), and Hyptis, Verbena, Hypericum, and Pluchea species were also observed. Practically all these understory/groundcover species are native, but there is some exotic Brazilian pepper. Patches dominated by melaleuca or cypress have been mapped separately as 424 and 621, respectively.

The vegetation on the berm of fill dirt covering the gas pipeline at the north end of the site (shown as Area 6 in Figure 2.3-22) is sparse and predominantly weedy. Species growing along the edges of the berm include Brazilian pepper, Australian pine, tropical almond (Terminalia catappa), pond apple, cabbage palm (Sabal palmetto), myrsine (Myrsine floridana), strongbark (Bourreria spp.), potatowood (Solanum erianthum), mahogany (Swietenia mahagoni), saltbush, white lantana (Lantana involucrata), canalbank cassia (Cassia coluteoides), cocoplum (Chrysobalanus icaco), pitch apple (Clusia rosea), castor bean (Ricinus communis), leather fern (Acrostichum spp.) and swamp fern (Blechnum serrulatum). The herbaceous vegetation covering the center of the berm and the clearing where the pipeline crosses the South Fork New River is composed of a variety of herbs, grasses, and sedges including Spanish needles, seaside goldenrod (Solidago sempervirens), lantana (Lantana camara), mistflower (Conoclinium coelestinum), procession flower (Polygala incarnata), wedelia (Wedelia trilobata), asters (Aster spp.), bladderpod (Sesbania spp.), flat-top goldenrod (Euthamia minor), coinwort (Centella asiatica), bluehearts (Buchnera spp.), yellow heliotrope (Heliotropium polyphyllum), white-top sedge (Dichromena spp.), beggarticks (Desmodium spp.), seaside gentian (Eustoma exaltatum), smutgrass, knotroot foxtail (Setaria geniculata), and bushy beardgrass.

The primary forested plant community in this area is 437 of the FLUCFCS, i.e., Australian Pine, which is dominated by Casuarina spp. Australian pine covers much of the eastern portion of this area. On high ground, such as alongside roads, the understory and groundcover layers are composed of mostly exotic upland species, including Madagascar periwinkle, wedelia, wandering jew (Zebrina pendula), Brazilian pepper, castor bean, woman's tongue (Albizia lebbeck), and Washingtonia palm. There are some natives such as Boston fern (Nephrolepsis spp.), cabbage palm, lantana, trema (Trema spp.), potatowood, seagrape (Coccoloba uvifera), morning glory (Ipomoea spp.), and matchweed. In many places, the Australian pine needles have smothered practically all groundcover vegetation except for clumps of exotic oyster plant (Rhoeo spathacea).

In low-lying areas, such as Area 7 in Figure 2.3-22, the vegetation beneath the Australian pine canopy is characterized by predominantly native wetland species like red maple, royal palm, pond apple, red bay (Persea spp.), dahoon holly, cabbage palm, pond cypress, cocoplum, myrsine, wax myrtle, sawgrass, royal fern, swamp fern, and leather fern.

As described in Section 2.2, Areas 5, 6 and 7 have been designated as Urban Wilderness by Broward County. Canal berms and other areas of recently disturbed high ground in the interior and southern areas of the site do not generally have a tree canopy. Instead, they support a dense weedy growth of shrubs such as Brazilian pepper, lantana, strangler fig (Ficus aurea), wild coffee (Psychotria spp.) pond apple, woman's tongue, trema, saltbush, strongbark, and potatowood mixed with herbs such as dog fennel, Spanish needles, ragweed, castor bean, periwinkle, nightshade (Solanum spp.), spurges, tridax, wedelia, seaside goldenrod, wild poinsettia (Poinsettia cyathophora), and yellow heliotrope. Common grasses and sedges on these sites include giant reed, bushy beardgrass, lovegrass, smutgrass, goosegrass, paragrass, (Brachiaria mutica), and sawgrass. In places, the thicket is laced with vines of Virginia creeper, muscadine, wild balsam apple (Momordica charantia), milkweed vine, and morning glory. Where Brazilian pepper, wax myrtle, or giant reed are major components of these weedy disturbed sites, the community has been labeled accordingly: 422 for Brazilian Pepper, 429 for Wax Myrtle/Willow, and 641 for Freshwater Marshes (giant reed). Where the mixed shrub community extends into a canal fringe and includes mangrove, it has been labeled 612, Mangrove. Disturbed shrub thickets with such a mixture of species that dominants categorized under FLUCFCS cannot be discerned have been labeled 329, Other Shrubs and Brush.

Brazilian pepper, royal palm, red maple, coastal plain willow, marsh fleabane (Pluchea spp.), leather fern, bulltongue sagittaria, sugarcane plumegrass (Erianthus giganteus), cattail (Typha spp.), sawgrass, giant reed, and similar herbaceous wetland species grow in other low-lying areas, i.e., within the grid of roads in the center of the site, south of the existing north gas turbines (shown as Area 8 in Figure 2.3-22). Where these areas are dominated by herbaceous species, they are also labeled 641.

Shrub-dominated areas are classified as 617, Mixed Wetland Hardwoods, although they include and grade into marsh vegetation, as well as Brazilian pepper, Australian pine, melaleuca, and other exotics.

The areas north of the discharge canal (Area 9 in Figure 2.3-22) have a canopy of pond apple, Brazilian pepper, and/or willow in places and herbaceous cover in others. Common species include Brazilian pepper, sawgrass, saltbush, cattail, leather fern, swamp lily, and lemon bacopa (Bacopa caroliniana). There are scattered cabbage palms. Shrub-dominated parts of this area are classified as 617, Mixed Wetland Hardwoods, or 439, Pond Apple, whereas the herbaceous areas are mapped as 641, Freshwater Marshes.

2.3.6 Ecology

2.3.6.1 Species-Environmental Relationships

AQUATIC ECOLOGY

Aquatic systems in the vicinity of the Lauderdale Plant site are shown on Figure 2.3-23 and include the Dania Cut-Off Canal, South New River Canal, North New River Canal, South Fork New River, and the cooling canal/pond system. These systems exhibit considerable variability in physical and chemical composition and range from freshwater to estuarine in character. The Lauderdale Plant site lies approximately 5 miles west of the Intracoastal Waterway, and waters surrounding the site are subject to tidal fluctuations and the saline influence of this waterway and the contiguous Atlantic Ocean. Waters in the plant vicinity also receive freshwater discharge through the network of canals, managed by the SFWMD, which drain the interior of south Florida. The salinity of area waters at any time is largely dependent upon rainfall and the amount of water released into the canal network.

Selected components of the aquatic biological system were studied on a quarterly basis to characterize potentially affected communities in the vicinity of the intakes on the Dania Cut-Off Canal and discharge on the South Fork New River. These system components included fish (adult, larvae, and eggs), other free-swimming (nektonic) organisms, and benthic macroinvertebrates. Observations of aquatic macrophytes and epibenthic fauna were made, also on a quarterly basis, to aid in the evaluation of area resources. Measurements of water temperature, conductivity/salinity, pH, and dissolved oxygen were made during each survey period. The aquatic ecology measurement program is described in Section 2.3.6.3.

BACKGROUND INFORMATION

Previous surveys of aquatic biological communities in the vicinity of the Lauderdale Plant site were conducted in 1974 and 1975 by Applied Biology, Inc. (ABI, 1976). These studies were designed to characterize the biota of the area and to assess the effects of plant operation on the aquatic

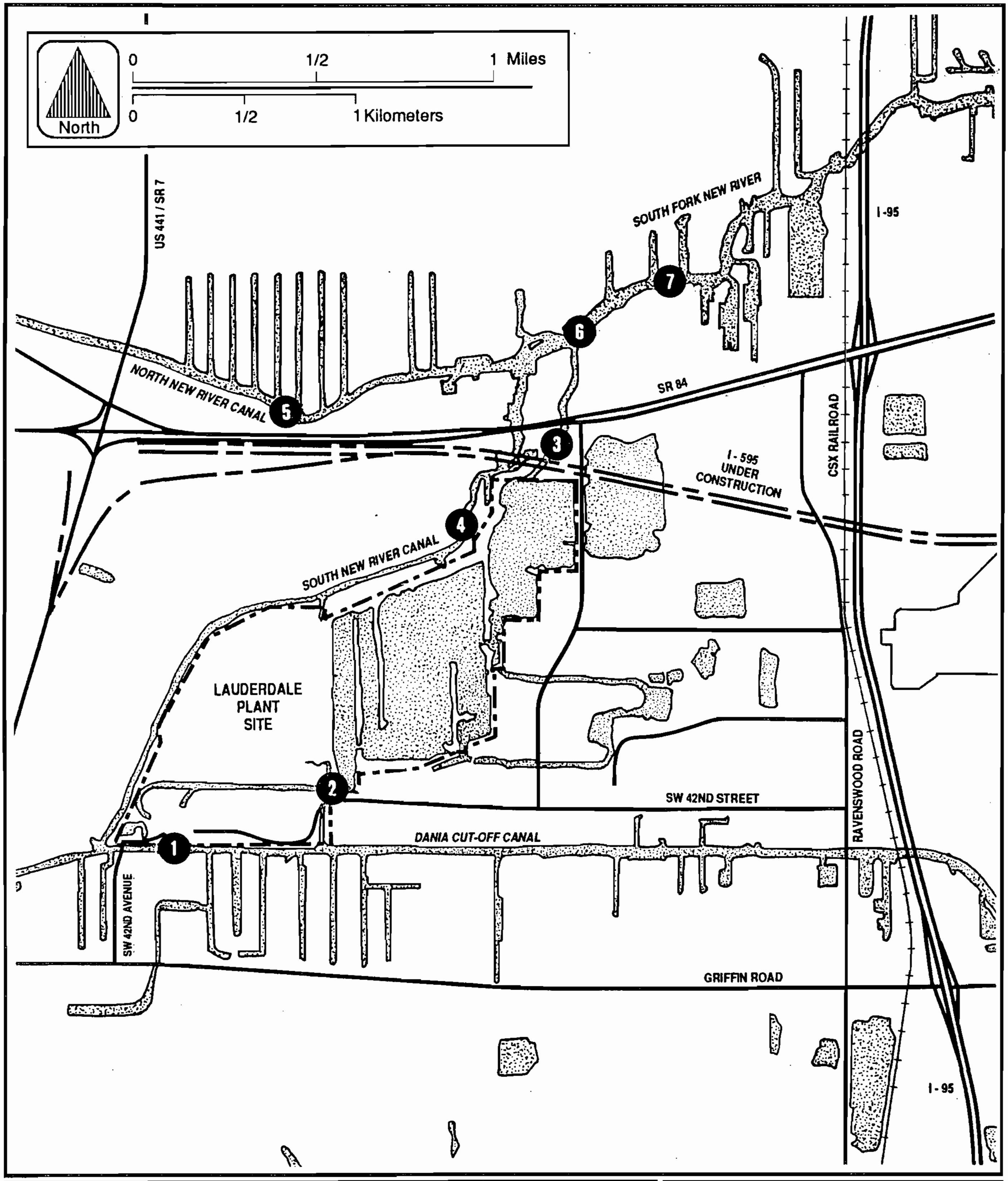

Figure 2.3-23 AQUATIC ECOLOGY SAMPLING STATION LOCATIONS

Lauderdale Repowering Project

FPL

environment. Components of the 1974-1975 program addressed the following potential impacts:

1. Impingement of fish and invertebrates on the traveling screens;
2. Entrainment of fish (juveniles, eggs, and larvae), invertebrates, and plankton through the condenser cooling system; and
3. Effects of thermal discharge on fish, benthic macroinvertebrates, and plankton.

Impingement during 1974-1975 did not appear to have a significant effect on indigenous fish and shellfish populations. Materials collected on traveling screens at Units 4 and 5 were sampled thirty-four times; sampling was conducted during all seasons and at frequencies of up to twice per month. The average sample collected over these 24-hour sampling periods contained 16 fish and 29 invertebrates with a combined weight of about 1 pound. Principal species collected were mojarras, anchovies, silversides, and mud crabs.

Entrainment effects on fish and invertebrates were evaluated in samples collected at the condenser discharge. About 89 percent of the fish entrained were gobies or anchovies; of these, 56 percent survived passage through the condensers. Ichthyoplankton (fish eggs and larvae) also appeared to be dominated by gobies. The majority of entrained invertebrates were crab larvae. ABI (1976) reported that entrainment has little effect on sport or commercial fish species or invertebrate communities.

The 1974-1975 program indicated that thermal discharge from the Lauderdale Plant did not result in significant adverse impacts to fish, benthic macroinvertebrates, phytoplankton, or zooplankton. No statistically significant differences were noted between populations in the discharge vicinity and populations in nearby areas beyond the thermal influence of condenser discharge.

In March 1987, ABI conducted a survey of benthic invertebrates at three stations in the discharge vicinity (ABI, 1987). The three stations sampled had previously been sampled in 1974-1975. One station was located on the cooling canal/pond system and represented an area continuously exposed to discharge. A second station was located on the South Fork New River, an area marginally influenced by the plant's discharge. A third station, located on the South New River Canal, served as a control site.

Although some changes in community structure between 1975 and 1987 were noted, these changes were felt to reflect primarily the high level of residential, commercial, and industrial waterfront development in the vicinity of the Lauderdale Plant site and the naturally variable salinity regime. Data did not suggest effects attributable to thermal discharge.

AQUATIC STUDY AREA DESCRIPTION

Aquatic systems in the vicinity of the Lauderdale Plant site and sampling station locations are shown in Figure 2.3-23. The Dania Cut-Off Canal runs along the south side of the plant and is the source of cooling water for the plant. The canal is relatively steep sided with little littoral zone. The northern canal bank is vegetated primarily by Australian pine (Casuarina equisetifolia). Additional plants occurring along the northern canal bank include Brazilian pepper (Schinus terebinthifolius), pond apple (Annona glabra), and giant reed (Phragmites australis). A residential canal community occupies the southern side of the Dania Cut-Off Canal. Both banks of this canal are largely bulkheaded. Depths in this canal in the vicinity of the site rarely exceed 2 meters (m) (7 ft).

The Dania Cut-Off Canal shoreline, along the plant site, is vegetated by Australian pine, Brazilian pepper, occasional pond apple, occasional giant reed, and a limited amount of sawgrass (Cladium jamaicense) and leather fern (Acrostichum danaeifolium). The shallow subtidal area consists of limestone rock and sand and supports a sparse algal growth.

Directly across the South New River Canal from the plant site, an upland area has been disturbed by recent construction activities associated with SBCRRP. The shoreline of this disturbed area consists of a riprap berm that protects a wetland mitigation area from erosion.

The major portion of the South New River Canal south of Station 4 is straight with steep, high banks. A narrow shore and intertidal zone is dominated by Brazilian pepper, with occasional pond apples. At Station 4, the western shore of the canal supports a pond apple swamp, with leather fern along the shoreline. The east side of the canal consists of a narrow littoral zone colonized by pond apple. A few red mangroves (Rhizophora mangle) were observed just north of Station 4 and south of the I-595 bridge. From the bridge to the South Fork New River, the system has been developed as a marina/boat yard. Depths along the South New River Canal south of I-595 are generally 2 m (7 ft) or less. Bottom sediments include limestone rock and rubble, silt, sand, and organic detritus.

The southern side of the North New River Canal, in the vicinity of sampling Station 5, has steep, high banks colonized by Brazilian pepper. The north side of this area has been developed as residential property, with dead end canals, and is entirely bulkheaded. The water depth is approximately 3 m (9 ft), and the bottom substrate consists of a rocky to shelly sand with numerous snags and pockets of organic debris.

The South Fork New River has experienced extensive residential and commercial development and has been altered by finger-fill canals, bulkheads, and docks. The southern shore of the river west of Station 6 is occupied by large marinas and associated upland boatyards. East of Station 6, and just west of Station 7, the Secret Woods Nature Center lies along the southern shore of the river and the land remains in a relatively undisturbed state. Vegetation along the shoreline of the nature center is predominantly pond apple. Additional plants along this shoreline include leather fern, white mangrove (Laguncularia racemosa), and red mangrove. Mangrove species are slowly invading the natural freshwater wetlands in this area, and are indicative of increasing salinity in the area (Broward County Commission, n.d.). The littoral area along the nature center shoreline consists of barren sand or peat substrate overlain by a thin veneer of sand. The lower intertidal area is barren sand which appears green due to an abundance of episammic microalgae.

Subtidal substrates of the South Fork New River range from hard bottom, to sand, to mud. Depths within the study area were only found to exceed 3 m (10 ft) in the vicinity of Station 6, where depths of 5 m (16 ft) were recorded.

During the summer monitoring survey conducted in August 1988, small, sparse patches of submerged vegetation (Sagittaria sp.) were observed in shallow subtidal waters south of the I-595 bridge (near Station 4) and at the entrance to Hurricane Harbor (near Station 6). Despite intensive efforts to locate submerged vegetation, none was observed on subsequent monitoring surveys. Submerged macrophytes of the genus Sagittaria are tolerant of a wide range of environmental conditions and are primarily found in fresh to brackish waters. The grassbeds observed in August were apparently ephemeral, established during the period of temporarily reduced salinities which extended through the August 1988 survey period.

FISH (ADULTS)

The waters surrounding the Lauderdale Plant support an assemblage of fish typical of estuarine waters including true estuarine forms and species which, while predominantly associated with either freshwater or marine systems, are tolerant of a wide range of salinities. Fish taxa recorded from the study area on seasonal surveys are listed in Table 2.3-17. Fish collected from each station on each quarterly survey are listed in Appendix 10.5.4. Fishes common to the Lauderdale Plant site vicinity include crested goby (Lophogobius cyprinoides), spotfin mojarra (Eucinostomus argenteus), striped mojarra (Eugerres plumieri), yellowfin mojarra (Gerres cinereus), striped mullet (Mugil cephalus), Atlantic needlefish

Table 2.3-17. Fish Collected or Observed on Seasonal Surveys in the Vicinity of the Lauderdale Plant Site

Scientific Name	Common Name	August	November	February	May
Anchoa hepsetus	Striped anchovy	O	O	X	O
Anchoa spp.	Anchovies	O	O	O	X
Archosargus probatocephalus	Sheepshead	O	O	X	O
Arius felis	Sea catfish	O	X	X	X
Bairdiella chrysura	Silver perch	O	O	X	O
Caranx hippos	Crevalle jack	X	O	O	X
Centropomus undecimalis	Snook	O	X	X	X
Cichlidae spp.	Cichlids	X	X	X	X
Clupeidae sp.	Clupeids	O	O	O	X
Cyprinodontidae sp.	Killifish	O	O	X	O
Diapterus rhombeus	Caitipa mojarra	X	O	O	O
Elops saurus	Ladyfish	O	O	O	X
Etheostoma sp.	Darter	X	O	O	O
Eucinostomus argenteus	Spotfin mojarra	X	O	X	X
Eucinostomus gula	Silver jenny	X	O	O	O
Eugerres plumieri	Striped mojarra	X	X	X	O
Gambusia affinis	Mosquitofish	X	O	O	O
Gerres cinereus	Yellowfin mojarra	O	X	X	X
Gerridae spp.	Mojarras	O	O	X	X
Gobiidae spp.	Gobies	O	O	O	X
Lagodon rhomboides	Pinfish	O	O	O	X
Leiostomus xanthurus	Spot	O	O	O	X
Lophogobius cyprinoides	Crested goby	X	X	X	X
Monacanthidae sp.	Filefish	O	O	X	O
Mugil cephalus	Striped mullet	X	X	O	X
Mugil curema	White mullet	O	O	X	O
Sphyraena sp.	Barracuda	O	O	O	X
Strongylura marina	Atlantic needlefish	X	O	X	X
Syngnathus sp.	Pipefish	O	O	O	X
Trinectes maculatus	Hogchoker	X	O	X	X
Unidentified spp.		O	O	X	O

X = collected or observed.
O = not recorded during survey period.

(Strongylura marina), cichlids (Tilapia spp.), sea catfish (Arius felis), hogchoker (Trinectes maculatus), and snook (Centropomus undecimalis).

The family most commonly represented in collections was Gerridae; the mojarras. Members of this family were also commonly taken from the study area in sampling conducted in 1975 by ABI (ABI, 1976). Fishes of the family Gerridae are most frequently found over sand or mud bottoms and often extend into brackish and occasionally fresh water. The Gerridae probably feed on small benthic invertebrates; however, relatively little appears to be known of the life histories or behavior of these fish.

Adult spotfin mojarra and silver jenny (Eucinostomus gula) have been reported to occur in waters ranging from fresh to those with salinities of over 45 ppt (Johnson, 1978). Juveniles of these species have been reported to range from fresh water to salinities of about 30 ppt. The upper thermal limit from which adults of these species have been reported is 36°C (Johnson, 1978).

Crested gobies are common in the mangrove swamps and bays of south Florida. This fish inhabits brackish to fresh waters. The crested goby was the only fish species collected on all quarterly surveys. Crested gobies were collected throughout the study area, mainly in baited minnow traps. Crested gobies were the most common species collected in minnow traps deployed in the study area in 1975 (ABI, 1976).

Atlantic needlefish and mullet were observed throughout the study area. Atlantic needlefish are primarily an inshore, shallow water species, and are reported to travel well up rivers into fresh water. Spawning occurs inshore in bays and estuaries, and may occur in fresh water in Florida. Striped mullet are euryhaline species of commercial importance and have been reported to occur in areas with salinities ranging from 0 to 75 ppt (Collins, 1985).

Fish species of recreational importance that are common in the study area include snook, tarpon (Megalops atlantica), and jack (Carangidae spp.). Snook are listed by the Florida Game and Fresh Water Fish Commission (FGFWFC) as a species of special concern. Snook frequent fresh and brackish waters, are sensitive to cold and do not tolerate temperatures below 15°C (60°F) (Hoese and Moore, 1977). Similar to snook, tarpon and jacks are euryhaline species that commonly occur in fresh and brackish waters. Johnson (1978) reports that adult jacks have been collected from waters ranging from 18 to 33.6°C (64.4 to 92.5°F). Jones et al. (1978) report that the maximum temperature at which tarpon have been encountered is 40°C (104°F).

In August, at Station 3 (under the I-595 overpass), a large number of recreational fishermen were observed making good catches of large striped mojarra. In November, a recreational fisherman was also observed to catch a large snook at the point of discharge of the cooling canal/pond system. The cooling canal/pond system contained substantial numbers of both snook and tarpon. Schools of mullet were also observed within the cooling canal/pond system.

Fish collected in impingement samples from Unit 4 are listed in Table 2.3-18. Few fish were present in samples collected on quarterly surveys. In a total of 96 hours of collection, covering all seasons, only 40 fish were collected from the Unit 4 intake, an average of 10 fish per collection period. This figure agrees well with the average number of fish, 16, collected by ABI from Units 4 and 5 during similar 24-hour sampling periods in 1974-1975.

ICHTHYOPLANKTON (FISH LARVAE AND EGGS)

The taxonomic composition and abundance of fish larvae collected in August and November 1988 and February and May 1989 are presented in Tables 2.3-19 through 2.3-22. Concentrations of larval fish increased throughout the study year, from an average of 57 per 100 cubic meters (m^3) in August to 2,973 per 100 m^3 in May. Larval fish abundance is closely related to the

Table 2.3-18. Organisms Collected on Traveling Screens at the Intake to Lauderdale Unit 4 on Quarterly Surveys

Scientific Name	Common Name	Quarter/Number Collected[a]			
		August	November	February	May
FISH					
Anchoa hepsetus	Striped anchovy	0	0	3	0
Anchoa spp.	Anchovies	0	0	0	16
Bairdiella chrysura	Silver perch	0	0	1	0
Cichlidae spp.	Cichlids	3	2	1	1
Clupeidae sp.	Clupeids	0	0	0	1
Cyprinodontidae sp.	Killifish	0	0	1	0
Eugerres plumieri	Striped mojarra	1	1	1	0
Lophogobius cyprinoides	Crested goby	0	0	0	2
Monocanthidae sp.	Filefish	0	0	1	0
Syngnathus sp.	Pipefish	0	0	0	1
Trinectes maculatus	Hogchoker	1	0	2	1
Unidentified sp.		0	0	1	0
INVERTEBRATES					
Callinectes sapidus	Blue crab	5	1	0	0
Macrobrachium carcinus	River shrimp	1	0	0	0
Penaeus aztecus	Brown shrimp	0	0	0	428
Penaeus duorarum	Pink shrimp	0	8	90	0
Penaeus setiferus	White shrimp	0	0	0	6
Rhithropanopeus harrisii	Mud crab	4	5	3	16
VERTEBRATES					
Pseudemys floridana peninsularis	Peninsular cooter	1	0	0	0
Trionyx ferox	Florida softshell turtle	1	0	0	0

[a]Samples collected over one 24-hour period each quarter.

Table 2.3-19. Larval Fish Collected in the Vicinty of the Lauderdale Plant Site, August 23, 1988 (Page 1 of 2)

Order / Family / Genus species	Concentration (number/100 m^3) Station 1 (Intake)			Station 2 (Discharge Canal)			Station 3 (Pond Discharge)			Mean	Relative
	Morning	Afternoon	Night	Morning	Afternoon	Night	Morning	Afternoon	Night	Number/100 m^3	Abundance (percent)
Elopiformes											
Elopidae (Tarpons)											
Elops saurus	0	0	4	0	0	0	0	0	0	<1	1
Clupeiformes											
Clupeidae (Herrings)											
Harengula sp.	2	12	0	0	0	14	2	8	5	5	9
Brevoortia sp.	4	0	4	0	13	5	0	0	5	3	5
Clupeidae sp.	2	0	0	7	0	5	7	0	0	2	4
Engraulidae (Anchovies)											
Anchoa sp.	12	7	17	4	18	47	4	11	27	16	28
Gobiesofiformes											
Gobiesocidae (Clingfishes)											
Gobiesox strumosus	23	22	4	19	0	14	2	0	0	9	16
Atheriniformes											
Belonidae (Needlefish)											
Strongylura marina	0	0	0	4	0	0	0	0	0	<1	1
Cyprinodontidae (Killifish)											
Fundulus sp.	0	2	0	0	0	0	0	4	0	<1	1
Poeciliidae (Livebearers)											
Gambusia affinis	0	0	4	0	0	0	0	0	0	<1	1
Atherinidae (Silversides)											
Menidia beryllina	2	0	0	0	5	0	0	0	0	<1	1
Gasterosteiformes											
Syngnathidae (Pipefish)											
Syngnathus sp.	0	0	0	0	0	0	0	0	5	<1	1

Table 2.3-19. Larval Fish Collected in the Vicinty of the Lauderdale Plant, August 23, 1988 (Page 2 of 2)

Order / Family / Genus species	Concentration (number/100 m³) Station 1 (Intake) Morning	Afternoon	Night	Station 2 (Discharge Canal) Morning	Afternoon	Night	Station 3 (Pond Discharge) Morning	Afternoon	Night	Mean Number/100 m³	Relative Abundance (percent)
Perciformes											
Gerridae (Mojarras)											
Eucinostomus sp.	2	0	0	0	0	0	0	0	0	<1	1
Gobiidae (Gobies)											
Microgobius sp.	0	27	9	4	0	28	2	0	0	8	14
Bathygobius soporator	6	5	26	0	3	19	0	0	5	7	13
Gobiidae sp.	0	0	0	0	0	0	4	4	0	<1	2
Soleidae (Soles)											
Achirus lineatus	0	0	0	0	0	0	0	0	5	<1	1
Cichlidae (Cichlids)											
Tilapia sp.	4	0	0	0	0	0	0	0	0	<1	1
Total Number of Taxa	9	6	7	5	4	7	6	4	6	17	
Total Number/100 m³	57	75	68	38	39	132	21	27	52	57	

Table 2.3-20. Larval Fish Collected in the Vicinty of the Lauderdale Plant Site, November 28 and 29, 1988

Order Family Genus species	Concentration (number/100 m³) Station 1 (Intake) Morning	 Afternoon	 Night	 Station 2 (Discharge Canal) Morning	 Afternoon	 Night	 Station 3 (Pond Discharge) Morning	 Afternoon	 Night	Mean Number/100 m³	Relative Abundance (percent)
Clupeiformes											
Engraulidae (Anchovies)											
Anchoa mitchilli	0	8	71	0	0	127	0	0	22	25	12
Anchoa sp.	18	49	39	2	0	9	40	61	45	29	14
Atheriniformes											
Atherinidae (Silversides)											
Menidia beryllina	3	5	4	0	0	0	0	0	0	1	<1
Gasterosteiformes											
Syngnathidae (Pipefish)											
Syngnathus sp.	3	3	7	0	0	0	0	0	2	2	1
Perciformes											
Blenniidae (Blennies)											
Hypleurochilus sp.	0	3	0	4	0	0	0	0	2	1	<1
Gobiidae (Gobies)											
Lophogobius cyprinoides	33	132	270	37	30	94	15	12	60	76	36
Gobiosoma sp. cf bosci	3	16	224	16	7	133	7	20	62	54	25
Gobiidae sp.	27	8	85	10	2	30	22	0	42	25	12
Microdesmidae (Wormfish)											
Microdesmus longipinnis	6	0	0	2	0	0	0	0	0	<1	<1
Total Number of Taxa	7	8	7	6	3	5	4	3	7	9	
Total Number/100 m³	93	224	700	71	39	393	84	93	235	214	

Table 2.3-21. Larval Fish Collected in the Vicinty of the Lauderdale Plant Site, February 27 and 28, 1989

Order Family Genus species	Concentration (number/100 m^3) Station 1 (Intake) Morning	 Afternoon	 Night	 Station 2 (Discharge Canal) Morning	 Afternoon	 Night	 Station 3 (Pond Discharge) Morning	 Afternoon	 Night	Mean Number/100 m^3	Relative Abundance (percent)
Clupeiformes											
Engraulidae (Anchovies)											
Anchoa mitchilli	0	0	130	17	0	0	0	0	69	24	4
Anchoa sp.	0	57	70	0	70	0	22	18	41	31	5
Perciformes											
Blenniidae (Blennies)											
Hypleurochilus sp.	0	13	30	17	23	0	11	6	0	11	2
Hypsoblennius sp.											
Blenniidae sp.	0	6	0	0	0	24	0	0	0	3	<1
Gobiidae (Gobies)	0	0	10	0	0	0	0	0	0	1	<1
Gobiosoma sp. cf. *bosci*	880	353	1,770	292	326	1,000	209	90	83	556	83
Gobiosoma sp.	53	0	110	0	23	95	0	24	62	41	6
Total Number of Taxa	2	4	6	3	4	3	3	4	4	7	
Total Number/100 m^3	933	429	2,120	326	442	1,119	242	138	255	667	

Table 2.3-22. Larval Fish Collected in the Vicinty of the Lauderdale Plant Site, May 30 and 31, 1989

Order Family Genus species	Concentration (number/100 m^3) Station 1 (Intake) Morning	 Afternoon	 Night	 Station 2 (Discharge Canal) Morning	 Afternoon	 Night	 Station 3 (Pond Discharge) Morning	 Afternoon	 Night	Mean Number/100 m^3	Relative Abundance (percent)
Clupeiformes											
Clupeidae (Herrings)											
Brevoortia sp.	122	10	112	65	0	180	0	0	16	56	2
Engraulidae (Anchovies)											
Anchoa mitchilli	8	0	36	0	0	0	0	0	32	8	<1
Anchoa sp.	0	7	10	0	0	20	0	0	32	8	<1
Atheriniformes											
Cyprinodontidae (Killifish)											
Fundulus sp. cf similis	0	0	15	0	0	0	0	0	16	3	<1
Atherinidae (Silversides)											
Menidia beryllina	0	20	107	0	15	20	0	0	0	18	1
Gasterosteiformes											
Syngnathidae (Pipefish)											
Syngnathus sp. cf floridae	0	0	15	0	15	20	0	0	0	6	<1
Perciformes											
Blenniidae (Blennies)											
Hypleurochilus sp.	97	34	36	22	75	40	21	37	32	44	1
Hypsoblennius sp.	0	0	5	0	0	20	0	0	0	3	<1
Gobiidae (Gobies)											
Bathygobius soporator	219	14	219	43	15	100	10	0	143	85	3
Gobiosoma sp. cf bosci	535	20	918	174	104	580	42	0	175	283	10
Lophogobius cyprinoides	6,075	252	4,442	4,123	1,118	4,020	749	130	1,224	2,459	83
Total Number of Taxa	6	7	11	5	6	9	4	2	8	11	
Total Number/100 m^3	7,056	357	5,915	4,427	1,342	5,000	822	167	1,670	2,973	

biology of the relatively few species that dominated the ichthyoplankton assemblage.

The family Gobiidae accounted for 29 percent of the larvae collected in August, 73 percent in November, 89 percent in February, and 93 percent in May. Several species contributed to the relative importance of this family in larval collections. Microgobius sp. and Bathygobius soporator were the most abundant gobies in August, Lophogobius cyprinoides was abundant in November and May, and Gobiosoma sp. cf. bosci was dominant in February.

Anchovies were common components of the larval fish collections and were the most abundant taxa collected in August. Larval anchovies were present in similar concentrations throughout the year.

Gobies and anchovies were also the most abundant larval fish collected in 1974 and 1975 in the vicinity of the Lauderdale Plant site (ABI, 1976). Studies conducted at that time indicated that 72 percent of goby larvae and 8 percent of anchovy larvae survive condenser passage.

Few changes in the overall composition of the larval fish assemblage were noted between Station 1 (intake canal) and Station 2 (plant discharge canal). Lowest concentrations were generally found at Station 3. Highest larval fish concentrations generally occurred at night.

Results of the analysis of fish eggs contained in ichthyoplankton samples are presented in Tables 2.3-23 through 2.3-26. Fish eggs were present in similar concentrations throughout the year. Percoid eggs accounted for 94 percent of all eggs collected in summer samples, whereas only anchovy eggs occurred in fall, winter, and spring samples. Fish egg concentrations were lowest at Station 3 in the summer, fall, and winter and highest at this location in the spring.

Table 2.3-23. Fish Eggs Collected in the Vicinity of the Lauderdale Plant Site, August 23, 1988

Order Family Genus species	Concentration (number/100 m^3) Station 1 (Intake) Morning	 Afternoon	 Night	 Station 2 (Discharge Canal) Morning	 Afternoon	 Night	 Station 3 (Pond Discharge) Morning	 Afternoon	 Night	Mean Number/100 m^3	Relative Abundance (percent)
Clupeiformes											
Engraulidae (Anchovies)											
Anchoa sp.	0	0	65	0	0	107	0	0	9	20	5
Atheriniformes											
Atherinidae (Silversides)											
Menidia beryllina[a]	12	0	0	0	0	0	0	0	0	1	<1
Perciformes	6	15	1,492	0	5	1,195	0	0	393	345	94
Total Number/100 m^3	18	15	1,557	0	5	1,302	0	0	402	366	

[a]Sampling artifact; *M. beryllina* attach their eggs to aquatic vegetation; eggs were probably attached to detritus in sample.

Table 2.3-24. Fish Eggs Collected in the Vicinity of the Lauderdale Plant Ste, November 28 and 29, 1988

Order Family Genus species	Concentration (number/100 m^3) Station 1 (Intake) Morning	 Afternoon	 Night	 Station 2 (Discharge Canal) Morning	 Afternoon	 Night	 Station 3 (Pond Discharge) Morning	 Afternoon	 Night	Mean Number/100 m^3	Relative Abundance (percent)
Clupeiformes											
Engraulidae (Anchovies)											
Anchoa sp.	721	386	1,534	367	154	985	288	73	536	560	100
Total Number/100 m^3	721	386	1,534	367	154	985	288	73	536	560	

Table 2.3-25. Fish Eggs Collected in the Vicinty of the Lauderdale Plant Site, February 27 and 28, 1989

Order Family Genus species	Concentration (number/100 m^3)									Mean Number/100 m^3	Relative Abundance (percent)
	Station 1 (Intake)			Station 2 (Discharge Canal)			Station 3 (Pond Discharge)				
	Morning	Afternoon	Night	Morning	Afternoon	Night	Morning	Afternoon	Night		
Clupeiformes											
Engraulidae (Anchovies)											
Anchoa sp.	1,823	214	180	654	163	143	594	48	62	431	100
Total Number/100 m^3	1,823	214	180	654	163	143	594	48	62	431	

Table 2.3-26. Fish Eggs Collected in the Vicinty of the Lauderdale Plant Site, May 30 and 31, 1989

Order Family Genus species	Concentration (number/100 m^3) Station 1 (Intake) Morning	Station 1 (Intake) Afternoon	Station 1 (Intake) Night	Station 2 (Discharge Canal) Morning	Station 2 (Discharge Canal) Afternoon	Station 2 (Discharge Canal) Night	Station 3 (Pond Discharge) Morning	Station 3 (Pond Discharge) Afternoon	Station 3 (Pond Discharge) Night	Mean Number/100 m^3	Relative Abundance (percent)
Clupeiformes											
Engraulidae (Anchovies)											
Anchoa sp.	778	68	0	304	89	0	946	352	0	282	100
Total Number/100 m^3	778	68	0	304	89	0	946	352	0	282	

EPIBENTHIC INVERTEBRATES

Epibenthic invertebrates collected from the study area during quarterly surveys are listed in Table 2.3-27. Epibenthos recorded from each station on each seasonal survey are given in Appendix 10.5.4. Species common to the area include mud crabs (Rhithropanopeus harrisii), river shrimp (Macrobrachium carcinus), blue crabs (Callinectes sapidus), olive nerite snails (Neritina reclivata), grass shrimp (Palaemonetes pugio), brown shrimp (Penaeus aztecus), white shrimp (Penaeus setiferus), pink shrimp (Penaeus duorarum), and wharf crabs (Sesarma cinereum).

Mud crabs were collected throughout the study area. This estuarine crab is common in tidal waters ranging from fresh to salinities of 20 ppt. It occurs intertidally and subtidally in mud banks and grass beds, on pilings and oyster bars, and among shells and rocks. Mud crabs were a common component of 1975 collections in the study area (ABI, 1976).

Olive nerite snails and wharf crabs were collected by hand at Station 2. Neritina were collected in August and wharf crabs in November, though both species undoubtedly occur in suitable habitats within the study area throughout the year. Both species are euryhaline.

River shrimp were collected, primarily on the North New River Canal. This species was collected in baited fish traps in both August and November. The absence of this species from February and May collections is likely related to increased salinity. ABI (1976) also reported collecting river shrimp from fish traps deployed in the study area.

Grass shrimp were collected by hand at the shoreline near Station 2. This small estuarine shrimp is commonly found in littoral grass beds at salinities ranging from 10 to 20 ppt (Heard, 1982).

Species of commercial importance which were collected included blue crabs, brown shrimp, pink shrimp, and white shrimp. Blue crabs are euryhaline, tolerant of a wide range of environmental conditions and are present in the

Table 2.3-27. Epibenthic Invertebrates Collected or Observed on Seasonal Surveys in the Vicinity of the Lauderdale Plant Site

Scientific Name	Common Name	August	November	February	May
Callinectes sapidus	Blue crab	X	X	X	X
Macrobrachium carcinus	River shrimp	X	X	0	0
Neritina reclivata	Olive nerite snail	X	0	0	0
Palaemonetes pugio	Grass shrimp	X	0	0	0
Penaeus aztecus	Brown shrimp	0	0	0	X
Penaeus duorarum	Pink shrimp	0	X	X	0
Penaeus setiferus	White shrimp	0	0	0	X
Rhithropanopeus harrisii	Mud crab	X	X	X	X
Sesarma cinerium	Wharf crab	X	X	X	X

Note: X = collected or observed.
0 = not recorded during survey period

study area throughout the year. Although thermal tolerance is dependent upon a broad range of environmental and physiological factors, growth has been reported to occur at temperatures between 13 and 34°C (55.4 and 93.2°F) (Perry and McIlwain, 1986).

Pink shrimp were collected from the study area in November and February, whereas brown shrimp and white shrimp were present in May. The pink shrimp occurs in estuaries and coastal marine waters, predominantly over sand, shell, or coral mud (Bielsa et al., 1983). Brown shrimp prefer muddy substrate and vegetation, whereas white shrimp range over both sand and mud (Lassuy, 1983; Minello and Zimmerman, 1985). Pink shrimp have been collected from waters ranging from 10° to 35.5°C (50 to 95.9°F) (Bielsa et al., 1983). Brown shrimp are tolerant of temperatures ranging from 4.4 to 35°C (40° to 95°F), although growth and survival are reduced above 32.2°C (90°F) (Lassuy, 1983).

Table 2.3-18 lists the invertebrate species that were collected from the Unit 4 traveling screens on quarterly surveys. Few invertebrates were impinged. More than 90 percent of the organisms impinged were shrimp. Shrimp impingement was seasonal, with pink shrimp occurring in winter and brown shrimp predominating in spring.

BENTHIC MACROINVERTEBRATES

The benthic macroinvertebrate community of the study area is composed of organisms of both freshwater and marine origins. Benthic invertebrates were sampled from Stations 2 through 7 on a quarterly basis [August 1988 (summer), November 1988 (fall), February 1989 (winter), and May 1989 (spring)]. Results of analyses of samples collected from each station during each sampling period are given in Appendix 10.5.4. The majority of benthic macroinvertebrate species collected are common to areas of fluctuating salinities near the freshwater/saltwater boundary. Taxonomic groups which were well represented in collections included polychaetes, oligochaetes, molluscs, amphipods, and midge larvae (chironomids).

Benthic invertebrate taxa collected from stations in the study area are listed in Table 2.3-28. A total of 70 benthic taxa was recorded during the 1988-1989 monitoring period. Numbers of distinct taxa recorded from seasonal surveys ranged from 29 in August, to 30 in November, to 38 in February, to 33 in May.

In August the most abundant species in the study area were the oligochaete Limnodrilus hoffmeisteri and the false mussel Mytilopsis leucophaeta. L. hoffmeisteri is known for its tolerance to a wide variety of environmental conditions, including brackish waters. M. leucophaeta has previously been reported to be a dominant component of the study area's benthic community throughout the year (ABI, 1976; ABI, 1987). In November, L. hoffmeisteri was again the dominant organism in the Lauderdale Plant site vicinity. Densities of M. leucophaeta decreased from August levels, whereas densities of polychaete worms increased. In February, the polychaete Streblospio benedicti was the most abundant organism in the study area, although M. leucophaeta was locally dominant at Station 6 on the South Fork New River. In May, the benthic fauna of the study area was dominated by the amphipods Grandidierella bonneroides, Gitanopsis sp. A, and Corophium spp. S. benedicti was also common, although at lower densities than in the winter quarter.

The composition of the benthic community reflects the increase in salinities that occurred between the August and November surveys and was sustained throughout the remainder of the study period. Following is a brief discussion of conditions and results for each station.

Station 2 was located near the point where the condenser output flows into the cooling canal/pond system. Substrates at this station were variable over a short distance. The substrate sampled during August, 1988 consisted predominantly of peat which was noticeably heated. Only two organisms were collected, the phantom midge (Chaoborus sp.) and M. leucophaeta. The unfavorable substrate and high temperature probably excluded most animals from this particular location. In November, February, and May, the

Table 2.3-28. Benthic Macroinvertebrates Collected in the Vicinity of the Lauderdale Plant Site, August 1988 through May 1989 (Page 1 of 4)

Phylum Class Order Genus species (LPIL)	August 1988	November 1988	February 1989	May 1989
Porifera				
Porifera spp.	X	X		
Platyhelminthes				
Platyhelminthes spp.		X		X
Turbellaria				
Turbellaria spp.			X	
Cnidaria				
Anthozoa				
Anthozoa spp.				X
Hydrozoa				
Hydrozoa spp.		X		X
Chaetognatha				
Chaetognatha spp.			X	
Nemertea				
Nemertea spp.		X	X	X
Annelida				
Polychaeta				
Boccardiella sp.	X			
Capitellidae spp.			X	X
Capitomastus aciculatus			X	X
Eteone heteropoda			X	X
Glycera spp.			X	
Leitoscoloplos				X
Laeoneris culveri	X	X	X	X
Neanthes succinea	X	X		
Nereida spp.	X	X	X	
Serpulidae spp.				
Stenoninereis martini		X	X	
Streblospio benedicti	X	X	X	X

Table 2.3-28. Benthic Macroinvertebrates Collected in the Vicinity of the Lauderdale Plant Site, August 1988 through May 1989 (Page 2 of 4)

Phylum Class Order Genus species (LPIL)	August 1988	November 1988	February 1989	May 1989
Annelida (cont.)				
Oligochaeta				
Limnodrilus hoffmeisteri	X			
Nadidae sp.	X			
Oligochaeta spp.	X	X		X
Mollusca				
Pelecypoda				
Mytilopsis leucophaeta	X	X	X	X
Tagelus plebius			X	X
Tagelus spp.			X	
Gastropoda				
Nudibranchia spp.			X	
Arthropoda				
Crustacea				
Cladocera				
Cladocera spp.	X			
Cirripedia				
Balanus amphitrite	X	X	X	X
Cumacea				
Cyclaspis varians		X	X	X
Cumacea spp.			X	
Oxyurostylis smithi			X	
Tanaidacea				
Hargeria rapax	X			X
Tanaidae sp.				X
Mysidacea				
Bowmaniella dissimilis		X	X	X
Mysidopsis bigelowi		X	X	X
Mysidopsis bahia			X	X
Mysidopsis sp.		X		
Isopoda				
Cirolana gracilis	X	X	X	
Cyathura polita	X	X	X	X
Edotea sp.	X			X
Isopoda spp.				

Table 2.3-28. Benthic Macroinvertebrates Collected in the Vicinity of the the Lauderdale Plant Site, August 1988 through May 1989 (Page 3 of 4)

Phylum Class Order Genus species (LPIL)	August 1988	November 1988	February 1989	May 1989
Arthropoda (cont.)				
Crustacea (cont.)				
Amphipoda				
Aoridae spp.		X	X	
Caprellidae spp.			X	
Cerapus tubularis				X
Corophium spp.	X	X	X	X
Gitanopsis sp.A		X	X	X
Grandidierella banneroides				X
Melita nitida	X		X	X
Decapoda				
Callinectes sapidus	X	X	X	
Eurypanopeus depressus				X
Macrobrachium carcinus	X	X		
Palaeomonetes pugio				
Panaeus duorarum		X	X	
Rhithropanopeus harrisii	X	X	X	X
Sesarma cinereum		X		
Megalopa larvae			X	
Zoea larvae			X	X
Insecta				
Unidentified spp.				
Collembola				
Collembola sp.	X			
Chaoboridae				
Chaoborus sp.	X		X	

Table 2.3-28. Benthic Macroinvertebrates Collected in the Vicinity of the Lauderdale Plant Site, August 1988 through May 1989 (Page 4 of 4)

Phylum Class Order Genus species (LPIL)	August 1988	November 1988	February 1989	May 1989
Arthropoda (cont.)				
Insecta (cont.)				
Chironomidae				
Chironomus attenuatus		X		
Chironomidae spp.	X		X	X
Chironomidae sp. A	X			
Chironomidae sp. B		X		
Chironomidae sp. C		X		
Cryptochironomus sp.	X		X	
Paratanytarsis sp.	X			
Polypedilum spp.	X	X	X	X
Tanytarsis sp.	X			
Echinodermata				
Holothurioidea				
Holothurioidea sp.				X

Note: LPIL = lowest practical identification level.

substrate sampled consisted of a shelly, fine sand. This change in substrate was probably responsible for the observed increase in number of taxa collected, densities, and species diversity. The oligochaete, L. hoffmeisteri, numerically dominated the November collection; however, the majority of the taxa collected were estuarine species. Estuarine species were also predominant in February and May collections. The polychaete S. benedicti was the dominant organism at this station in February, and the amphipod G. bonneroides was the numerical dominant in May.

Station 3 was located at the upstream (south) end of the canal connecting the cooling canal/pond system to the South Fork New River. Currents at this station were swift, and the substrate consisted of limestone rock rubble and coarse sands. This high-energy environment is reflected by this station's benthic community, which is notably distinct from that of the other stations sampled. Organisms characteristic of Station 3 include mud crabs (Rhithropanopeus harrisii), M. leucophaeta, barnacles (Balanus amphitrite), amphipods (Gitanopsis sp. A and Melita nitida), sponges, and hydrozoans. The taxa at Station 3 were predominantly estuarine organisms. This station was numerically dominated by M. leucophaeta in August, Gitanopsis sp. A in November and May, and M. nitida in February. Gitanopsis sp. A collected from this station included several size classes and gravid females and were representative of a reproductive population. The coarse rocky substrate at this station is particularly favorable for M. leucophaeta, as this small bivalve colonizes crevices, holes, and empty barnacles.

Station 4 was located in the South New River Canal. The substrate at this station consisted of a mixture of sand, shell, and detritus. The benthic community at this station was equally represented by freshwater and marine organisms in August; the numerically dominant organisms were the polychaete (Laeonereis culveri), oligochaete (L. hoffmeisteri), and chironomid (Polypedilum spp.). In November, overall benthic invertebrate densities, number of taxa, and diversities declined. Four of five taxa collected in

November were characteristic of fresh waters; the dominant organism was the chironomid (Polypedilum sp.). In February, dominance shifted to estuarine forms. The estuarine polychaete S. benedicti was the most abundant organism in collections from this station in February, although the brackish water mussel M. leucophaeta was also common. In May, estuarine organisms were predominant; the benthic assemblage was dominated by the amphipods Corophium spp. and G. bonneroides and the polychaete S. benedicti.

Station 5 was located upstream of the discharge from the cooling canal/pond system, near the downstream end of the North New River Canal. The bottom substrate at this station was relatively hard, and consisted of shells, sand, and detritus. The taxa represented in August were predominantly freshwater forms, whereas those in November, February, and May were predominantly estuarine. L. hoffmeisteri was the numerical dominant at this station in both August and November, and S. benedicti was dominant in February and May. Diversity and overall invertebrate density varied little between sampling periods.

Station 6 is located in the South Fork New River near the point of discharge from the cooling canal/pond system and at the entrance to the Hurricane Harbor Marina. The bottom substrate was highly organic consisting of mud and detritus. The taxa collected in August were a mixture of freshwater and marine forms. M. leucophaeta was the numerical dominant, followed by L. hoffmeisteri. M. leucophaeta collected at Station 6 were all small, indicating a recent set. In November, L. hoffmeisteri was the only benthic invertebrate species collected, in low numbers, from Station 6. M. leucophaeta was the numerical dominant in February, whereas Corophium spp. and S. benedicti were the most abundant benthic macroinvertebrates in May.

Station 7 was located on the South Fork New River, approximately 2,000 ft (610 m) east (downstream) of Station 6. The substrate at this station ranged from limerock rubble near the channel center to muddy sand in the nearshore area. This station was dominated by freshwater forms, chironomids and oligochaetes, in August and by estuarine forms during the remainder of the study year. Polychaete worms were the most abundant taxa in November (L. culveri) and February (S. benedicti), and the mollusc Tagelus plebius was the numerical dominant in May.

Quantitative parameters were used to support the characterization of benthic community structure. Results of analyses of benthic macroinvertebrate density, number of taxa, and Shannon-Weaver diversity are summarized by station and month of collection in Table 2.3-29. Macroinvertebrate densities and the number of taxa represented varied widely, both between stations and between collection periods. In general, densities and species richness were lowest in summer and fall and highest in winter and spring. These trends are common in benthic communities and are typically related to the increased dissolved oxygen levels present in the winter and spring in southeastern aquatic systems. Study area waters were fresh in August, with salinities of less than 1 ppt. The salinity of bottom waters was higher during subsequent sampling periods, ranging from 10.7 to 11.6 ppt in November, 3.2 to 18.3 ppt in February, and 7.0 to 9.7 ppt in May. Increased and sustained salinities allowed the establishment of estuarine organisms and was an additional factor contributing to the increased richness of taxa in the winter and spring.

Benthic invertebrate densities and the number of taxa represented in samples did not reveal any between-station differences attributable to the operation of the Lauderdale Plant. Organism abundance and taxa richness were apparently related to substrate type, habitat diversity, and salinity.

Diversity values were calculated for the benthos collected from each station on each quarterly survey using the Shannon-Weaver Index. This index is based both on the richness of taxa and on the distribution of individuals among taxa. High values (above 3) are generally associated with relatively stable environments with little stress, and low values (below 1) are characteristic of stressed environments (EPA, 1973).

Table 2.3-29. Summary of Benthic Macroinvertebrate Descriptive Parameters (Density, Number of Taxa, and Shannon-Weaver Diversity) for Stations Sampled in the Lauderdale Plant Site Vicinity, August 1988 through May 1989

Parameter	Station					
Month	2	3	4	5	6	7
Density (number/m^2)						
August	29	2,598	689	2,397	1,177	431
November	316	4,593	158	2,541	57	2,526
February	5,583	1,277	4,162	5,196	3,215	1,823
May	904	6,660	2,756	3,000	4,392	3,502
Number of Taxa						
August	2	8	8	7	10	8
November	8	10	5	9	1	12
February	17	11	19	9	17	15
May	11	15	15	13	17	17
Shannon-Weaver Diversity						
August	1.00	2.42	2.25	1.23	2.11	2.49
November	2.46	2.25	1.67	1.70	0	1.77
February	1.67	2.74	2.56	1.65	1.67	2.63
May	2.20	1.74	2.74	1.92	3.11	2.42

Diversities at stations in the Lauderdale Plant site vicinity varied widely, between 0 and 3.11, and exhibited no definitive trends. Both the lowest and highest diversities occurred at Station 6, located where the cooling canal/pond discharge enters the South Fork New River. Results obtained from this station are believed to reflect the variable character of the substrate at this location. Most diversities were moderate, falling between 1 and 3.

Data from the 1988-1989 monitoring year were compared with data collected from the study area in 1975 and 1987 (ABI, 1976; ABI, 1987). In terms of taxonomic composition, M. leucophaeta, although an important component of the 1988-1989 benthic collections, did not achieve the degree of dominance exhibited in the earlier studies. The compositions of the 1987 and 1988-1989 collections were more similar to one another than to the 1975 collection. This is to be expected considering the significant degree of recent and ongoing anthropogenic disturbance in the area.

Table 2.3-30 presents benthic community descriptive parameters for the three stations common to the 1975, 1987, and 1988-1989 study periods. In general, the 1987 and 1988-1989 collections reflect an apparent increase in benthic invertebrate density and taxa richness from 1975 levels. This apparent trend may be related to the increase in salinities in the vicinity of the Lauderdale Plant site. Diversities were variable but comparable for all three sampling periods. No effects of plant operation are indicated in any of the databases, and over the past 13 years no trends associated with long-term discharge effects are apparent.

AQUATIC REPTILES AND AMPHIBIANS

Several species of aquatic reptiles and amphibians occur in and around the Lauderdale Plant site. Two species of turtle, both juveniles, were collected in impingement samples at Unit No. 4. These were a Florida softshell turtle (Trionyx ferox) and a peninsular cooter (Pseudemys floridana peninsularis). One individual of each was collected in debris

Table 2.3-30. Comparison of Benthic Community Characteristics from Studies Conducted in 1975, 1987, and 1988-1989 in the Lauderdale Plant Site Vicinity

Study Period	Parameter and Station								
	Density (number/m²)			Number of Taxa			Shannon-Weaver Diversity		
	3	4	6	3	4	6	3	4	6
1975									
Spring	7,612	1,414	759	13	12	12	1.65	2.49	2.74
Summer	1,328	190	129	6	7	4	1.63	2.61	1.89
Fall	1,784	793	1,681	5	7	9	0.44	1.73	1.48
Winter	474	1,009	1,207	8	11	9	1.66	2.57	2.50
1987									
Spring	35,848	155	2,368	19	7	22	0.67	2.64	3.06
1988-1989									
Spring	6,660	2,756	4,392	15	15	17	1.74	2.74	3.11
Summer	2,598	689	1,177	8	8	10	2.42	2.25	2.11
Fall	4,593	158	57	10	5	1	2.25	1.67	0
Winter	1,277	4,162	3,215	11	19	17	2.74	2.56	1.67

Note: Station designations differed between studies. Station numbers given are those established for the current, 1988-1989, study period.

Sources: ABI, 1976.
ABI, 1987.

from the traveling screen. These species also were collected in impingement samples in 1975 (ABI, 1976).

AQUATIC MAMMALS

No aquatic mammals were observed in the study area during quarterly surveys. Mammals that are expected to frequent area waters include bottlenose dolphins (Tursiops truncatus) and the West Indian manatee (Trichechus manatus).

TERRESTRIAL SYSTEMS

Flora--The vegetation of the Lauderdale Plant site and vicinity are described in Section 2.3.5 and mapped in Figure 2.3-21. Few rare, threatened, or endangered species occur on the site which has a long history of disturbance, is vegetated by second-growth communities, and heavily invaded by exotics. None of the Special Plant species documented as occurring in Broward County by the Florida Natural Areas Inventory (FNAI) would be expected in habitats like those on the site. (Most of these species are found in old-growth tropical hammock, scrub, or dune communities.)

Only one plant species listed by either FNAI, the Florida Department of Agriculture (FDA), or the U.S. Fish and Wildlife Service (USFWS) was observed during field surveys. Leather ferns (Acrostichum spp.) were found scattered in low-lying areas on the site. A particularly dense stand was noted in the eastern part of the site under the transmission lines just north of the discharge canal. It was not determined whether these were golden leather fern (Acrostichum aureum), listed as endangered by FDA, or the very similar giant leather fern (A. danaeifolium), which FDA lists as threatened. Leather ferns are common in south Florida wetland habitats. They are considered threatened due to loss of these habitats.

Royal palms (Roystonea spp.), listed as endangered by FDA and under review by USFWS, and coconut palms (Cocos nucifera) listed as threatened by FDA, occur on the site, but the specimens present originated from landscape plants rather than from native vegetation (refer to Section 2.3.5).

There are two important areas of natural vegetation near the site. Pond Apple Slough, a proposed Broward County park (previously known as Ann Kolb Park), encompasses the wetland area north of the cooling canal/pond system between the South New River Canal and I-595. The vegetation of this area is shown in Figure 2.3-21. Secret Woods Nature Center is a Broward County regional park located between State Road 84 and the South Fork New River approximately 1 mile northeast of the site. This 37-acre environmental education facility includes cypress/red maple, pond apple/mangrove, and laurel oak hammock communities, all of which have been stressed by hydrologic changes and heavily invaded by exotics. There are also a number of environmental mitigation areas where native vegetation is being restored. None of these are expected to be significantly affected by the repowering project.

<u>Fauna</u>--The wildlife habitats on the Lauderdale Plant site and the surrounding area include the ruderal or developed areas of the plant and the roads and dredging operations, the disturbed wetlands between the ruderal areas and the canals, and the open water habitats of the cooling canal/pond system.

The developed areas around the power block provide minimal wildlife habitat. Shrubs, grasses, weeds, and trees in this area provide foraging and breeding areas for songbirds common to urban areas, as well as small rodents, snakes, and butterflies. All species which utilize these developed areas are adapted to human-disturbed areas.

The canal berms, spoil areas, and other areas of disturbed high ground on and adjacent to the site provide habitat for the same species as the developed areas, as well as species such as the raccoon, opossum, skunk, rabbit, squirrel, and gray fox. The smaller mammals suggest the potential for occasional use of these areas by hawks.

The low-lying areas and SSB/EP ponds on the site provide habitat for several species of wildlife. Wading birds including little blue herons, tricolored herons, and white ibis have been observed in the cooling system. Burrows of the mangrove tree crab (Aratus pisonii) are common throughout the wetland habitats. The open water areas, i.e., canals and ponds (see Aquatic Ecology section), provide habitat for manatees, alligators, and caimans.

Based on vegetation and wildlife surveys, the vertebrates listed in Table 2.3-31 are known to occur or are likely to occur in the area.

ENDANGERED, THREATENED, AND RARE SPECIES

Table 2.3-32 is a list of vertebrates which are endangered, threatened, rare, or species of special concern which have been sighted or could potentially be found on the site. Five of these species have been observed on site: the manatee (Trichechus manatus latirostris), alligator (Alligator mississippiensis), osprey (Pandion haliaetus), tricolored heron (Egretta tricolor), and little blue heron (Egretta caerulea). No nests of ospreys, tricolored herons or little blue herons were found on the site. These species probably utilize the site only for foraging and roosting.

The manatee is listed as endangered by both USFWS and FGFWFC. Manatees have been reported to congregate in the Lauderdale Plant vicinity during the winter (Reynolds and Wilcox, 1986). Reynolds (1988, 1989) reported maximum sightings of up to 20 manatees in the plant vicinity from aerial surveys conducted in winter of 1987 and 1988. Only 6 manatees were observed during the 1988-1989 survey. All of these animals were seen in the cooling canal/pond system. Resting and feeding were the main behaviors observed. Over the past 12 years, the maximum number of manatees observed in the vicinity of the Lauderdale Plant site on winter overflights has ranged from 6 to 52 (Table 2.3-33). The number of manatees observed at the Lauderdale Plant site is small (4.6 percent of total) compared to the numbers sighted at other FPL plants and areas. During the same period, the maximum number of manatees sighted at the Port Everglades plant ranged

Table 2.3-31. Vertebrates Observed or Potentially Occurring on the Lauderdale Plant Site and/or Surrounding Lands (Page 1 of 2)

Common Name	Scientific Name
MAMMALS	
Norway Rat[a]	Rattus norvegious
Hispid Cotton Rat	Sigmodon hispidus
Eastern Cottontail	Sylvilagus floridanus
Domestic Dog[a]	Canis familiaris
Domestic Cat[a]	Felis catus
Gray Squirrel	Sciurus carolinensis
Raccoon	Procyon lotor
Opossum	Didelphis marsupialis
Striped Skunk	Mephitis mephitis
West Indian Manatee	Trichechus manatus latirostris
Gray Fox	Urocyon cinereoargenteus
BIRDS	
Cattle Egret	Bubulcus ibis
Turkey Vulture	Cathartes aura
Black Vulture	Coragyps atratus
American Kestrel	Falco sparverius
Rock Dove[a]	Columba livia
Mourning Dove	Zenaida macroura
Ground Dove	Columbina passerina
Killdeer	Charadrius vociferus
Meadowlark	Sternella magna
Redwinged Blackbird	Agelaius phoeniceus
Common Grackle	Quiscalus quiscula
Northern Mockingbird	Mimus polyglottos
Blue-gray Gnatcatcher	Polioptila caerulea
Eastern Phoebe	Sayornis phoebe
Smooth-billed Ani	Crotophaga ani
House Sparrow[a]	Passer domesticus
Song Sparrow	Melospiza melodia
Palm Warbler	Dendroica palmarum
Cardinal	Cardinalis cardinalis
Bobwhite Quail	Colinus virginianus
Red-bellied Woodpecker	Melanerpes carolinus
Red-shouldered Hawk	Buteo lineatus
Herring Gull	Larus argentatus
Osprey	Pandion haliaetus
Common Moorhen	Gallinula chloropus
Yellow-rumped Warbler	Dendroica coronata
White Ibis	Eudocimus albus
Red-tailed Hawk	Buteo jamaicensis
Gray Catbird	Dumetella carolinensis
Little Blue Heron	Egretta caerulea

Table 2.3-31. Vertebrates Observed on or Potentially Occurring on the Lauderdale Plant Site and/or Surrounding Lands (Page 2 of 2)

Common Name	Scientific Name
BIRDS (Continued)	
Spotted Sandpiper	Actitis macularia
Snipe	Gallinago gallinago
Blue jay	Cyanocitta cristata
Great Blue Heron	Ardea herodias
Green-backed Heron	Butorides striatus
Yellow-crowned Night Heron	Nycticorax violaceus
Anhinga	Anhinga anhinga
Nighthawk	Chordeiles spp.
REPTILES	
Spectacled Caiman[a]	Caiman crocodilus
American Alligator	Alligator mississippiensis
Striped Mud Turtle	Kinosternon bauri
Peninsula Cooter	Pseudemys floridana peninsularis
Florida Softshell Turtle	Trionxy ferox
Six-lined Racerunner	Cnemidophorus sexlineatus
Skink	Eumeces sp.
Corn Snake	Elaphe guttata guttata
Everglades Rat Snake	Elaphe obsoleta rossalleni
Peninsula Ribbon Snake	Thamnophis sauritus sackeni
Black Racer	Coluber constrictor
Brown Anole[a]	Anolis sagrei
Green Iguana[a]	Iguana iguana
AMPHIBIANS	
Eastern Spadefoot Toad	Scaphiopus holbrookii holbrookii
Giant Toad[a]	Bufo marinus
Cuban Tree Frog[a]	Osteopilus septentrionalis

[a]Exotic species

Table 2.3-32. Vertebrates Observed On or Near the Lauderdale Plant Site and Considered To Be Endangered, Threatened, Rare, or Species of Special Concern

Common Name	Scientific Name	USFWS 1988	FGFWFC 1988
	MAMMALS		
West Indian Manatee	Trichechus manatus latirostris	E	E
	BIRDS		
Little Blue Heron	Egretta caerulea		SSC
Tricolored Heron	Egretta tricolor		SSC
American Kestrel	Falco sparverius[a]	UR2	T
	REPTILES		
American Alligator	Alligator mississippiensis	T(S/A)	SSC

[a]Only F. sparverius paulus, the southeastern American kestrel, is listed. It is virtually indistinguishable from F. sparverius sparverius, the eastern American kestrel. The birds observed on the site were not identifed to subspecies.

Note:
E = Endangered species.
SSC = Species of special concern.
T = Threatened species.
T(S/A) = Threatened due to similarity of appearance.
UR2 = Under review for listing but substantial evidence of biological vulnerability and/or threat is lacking.

Table 2.3-33. Maximum Number of Manatees Sighted at the Lauderdale Plant Site--1977-1989

Survey Year	Maximum No. Sighted
1977-78	36
1978-79	27
1979-80	36
1980-81	52
1981-82	19
1982-83	16
1983-84	11
1984-85	29
1985-86	30
1986-87	16
1987-88	20
1988-89	6
TOTAL	298[a]

[a]Represents 4.6 percent of manatee sightings at five FPL plants and Hobe Sound during the observation period.

Source: Reynolds, 1989.

from 35 to 276. The periodic operational schedule of the Lauderdale plant is suggested as the reason for the low numbers (Reynolds and Wilcox, 1986).

Manatees have been observed in the cooling system in each of the 12 years of the ongoing annual FPL aerial surveys. The manatees use the canals and the pond, with their relatively warm water temperatures, as thermal refuges during winter. In the winter of 1987-1988 survey, manatees were seen at the site on each of eight days in which winter manatee surveys were conducted. The number of manatees sighted ranged from 2 to 20. Calves represented 6.4 percent of the animals observed. In the 1988-1989 survey, the number of manatees sighted ranged from 2 to 6. This low abundance is attributed to an extremely mild winter and the resultant lack of use of thermal refuge such as power plant discharge canals. The locations at which manatees were seen are shown in Figure 2.3-24.

Manatees are found in coastal saltwater, estuaries, rivers, streams, lagoons, and lakes. Their present range within the United States is largely confined to peninsular Florida and the coast of Georgia. Turbidity seems to have no effect on manatees, as they are found in very clear and in extremely muddy waters. Manatees are herbivorous, subsisting almost entirely on submerged vegetation. They normally feed for 6 to 8 hours per day. Manatees have a gestation period of approximately 12 to 13 months and give birth to one calf every 3 to 5 years. This slow reproduction, combined with mortality from boats, threatens survival of the species. The minimum water temperature tolerable to manatees varies with activity. Husar (1977) and Allsopp (1961) suggested that minimum water temperature tolerated by manatees was 21°C (70°F), Squros (1966) believed it to be lower near 16 to 18°C (61 to 64°F), and Hartmann (1971) recorded animals in 15°C (59°F) water moving to warmer regions of Crystal River. Groups are formed when manatees seek warm-water areas during winter. During cold weather, some manatees rest throughout the day. Resting is the activity most often recorded in winter surveys of manatees at the Lauderdale Plant site. When gathered into wintering groups, manatees are particularly susceptible to harassment by humans. Problems associated with boating near

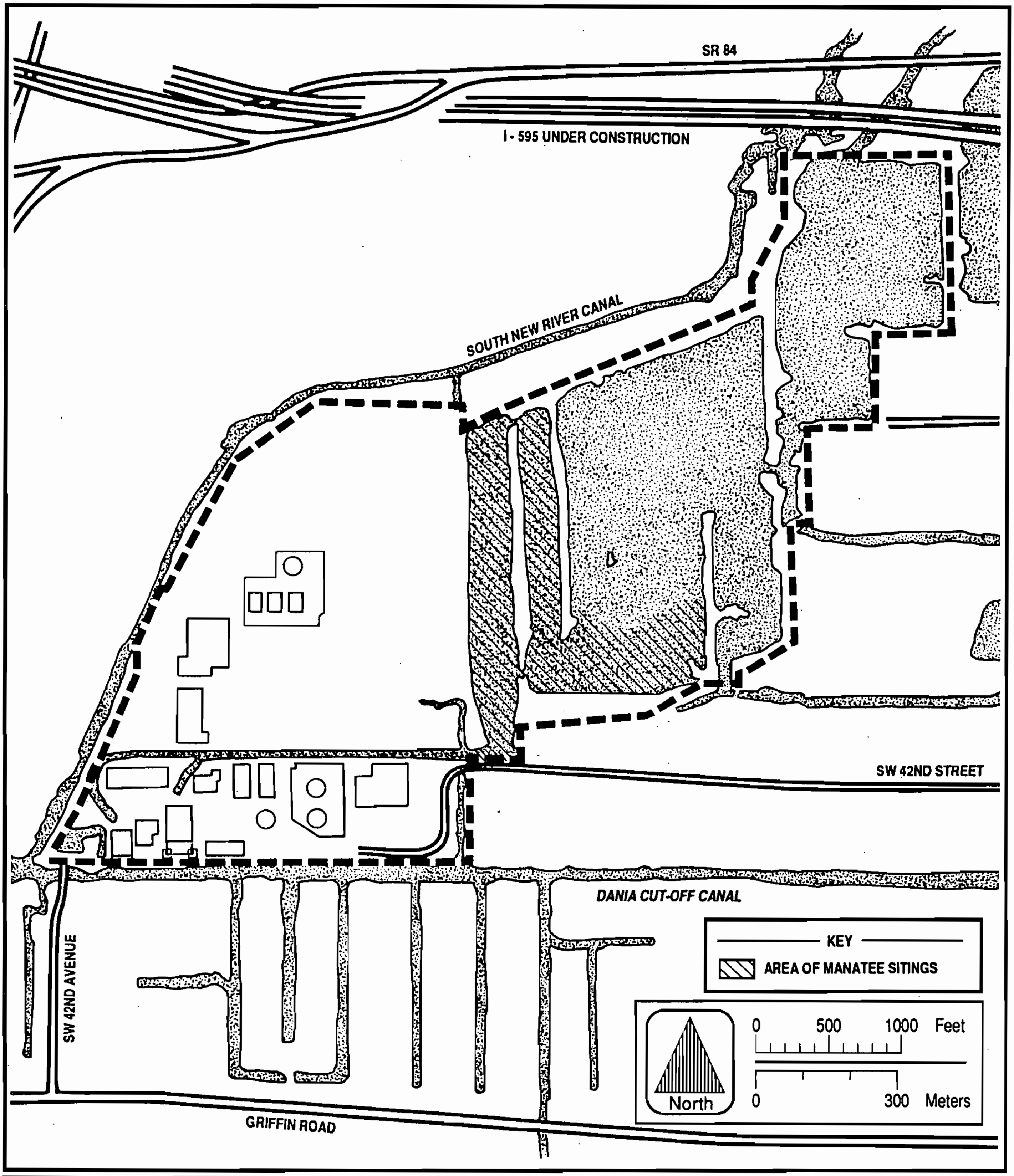

Figure 2.3-24 MANATEE SIGHTING LOCATIONS NEAR THE LAUDERDALE PLANT DURING THE 1988-1989 SURVEY

SOURCE: REYNOLDS, 1989.

Lauderdale Repowering Project

FPL

these wintering groups have led FDNR to declare some areas as no-entry zones.

In November, an alligator (Alligator mississippiensis) was observed in the plant discharge canal, near Station 2. Alligators and spectacled caimans (Caiman crocodilus) were repeatedly observed in the cooling pond and Pond Apple Slough during the crocodile survey. Alligators are listed by FGFWFC as species of special concern and are listed as threatened by USFWS due to their similarity of appearance to other crocodilians. The caiman is not a state or federally listed species. Giant toads (Bufo marirus) and Cuban tree frogs (Osteopilus septentrionalis) were also observed during crocodile surveys.

Florida crocodiles are listed as endangered by the Florida Game and Freshwater Fish Commission (FGFWFC) and by the U.S. Fish and Wildlife Service (USFWS). They are presently fairly restricted to southern Dade and Monroe counties. Crocodiles have been reported to occur in Broward County since 1919 (Mazzotti, 1983), and have been observed there continually but infrequently since the early 1960s. Broward County sightings have been reported in the West Lake area, near the Lauderdale Plant cooling canal/pond system, and in the South Fork New River near the intersection of SR 84 and 441. In 1986, an unconfirmed sighting was made in Pond Apple Slough.

Crocodiles normally occur in coastal mangrove swamps, brackish and saltwater bays, brackish creeks, and abandoned coastal canals. Primary nesting sites are banks of coastal creeks or canals, or at the edge of hardwood thickets on small sand beaches. Female crocodiles often use the same nest mounds for several consecutive years. Nests vary in size, with eggs buried below ground level or in mounds of sand or soil up to 2 ft high and 20 ft in diameter. The primary food of adult crocodiles is fish. Smaller crocodiles feed upon a wide variety of aquatic invertebrates. Little is known of the range of individuals, but there is probably a fair amount of wandering by adults during nonbreeding seasons.

Systematic surveys of South Fork New River Canal, Pond Apple Slough, Dania Cut-Off Canal, the Lauderdale Plant cooling system and off-site ponds since 1986 have found no evidence of crocodile presence on or near the site. Only alligators and caimans were observed. No nesting by crocodiles even in prime nesting sites (e.g., sandy berms of the cooling pond) was observed. Appendix 10.5.4 presents the results of surveys since 1986.

2.3.6.2 Pre-Existing Stresses

AQUATIC SYSTEMS

Aquatic systems in the vicinity of the Lauderdale Plant site are subjected to stress from numerous sources. Pre-existing stresses include:

1. Channelization and dredging,
2. Water/flood management operations,
3. Bulkheading,
4. Residential development,
5. Industrial/commercial development,
6. Marinas and boatyards,
7. Highway construction and operation, and
8. Power plant operation (since the 1920s).

Waterways in the study area have been created by and subjected to extensive channelization and bulkheading. This activity has limited the extent of littoral zones and associated communities which, in natural systems, serve to physically and biologically filter influent surface waters, serve as sites of nutrient uptake and regeneration, and provide habitat, nursery, and feeding areas for a wide variety of aquatic organisms.

The character of area waters is largely affected by water control structures operated by the SFWMD. The salinity of waters in the study area is dependent upon rainfall and runoff, water management activities, and tidal incursion. The site lies about 5 miles west of the Intracoastal Waterway, which is contiguous with the Atlantic Ocean. A general increase in the salinity of study area waters has been reported (Broward County Commission, n.d.).

The surface waters adjacent to the site vicinity are located in an extensively developed area and receive runoff and discharge from residential, industrial, and commercial sources. Finger canal systems are located along the Dania Cut-Off Canal, North New River Canal, and South Fork New River. Finger canal systems provide for high density waterfront development and have been associated with water quality degradation. Industrial and commercial sites in the area also contribute contaminants, through runoff, to local waters.

Marinas, boatyards, and boat service docks are located on the Dania Cut-Off Canal west of the Lauderdale Plant site, on the South New River Canal north of the I-595 bridge, along the canal receiving cooling canal/pond discharge between SR 84 and the South Fork New River, and along the North New River Canal and South Fork New River. These facilities alter both the physical and chemical quality of area waters. Impacts are related to maintenance dredging, scouring, painting, fueling, vessel maintenance, and construction. Vessel traffic is generally moderate to heavy throughout the area.

During the period of study, intense roadway construction activities occurred in the northern portion of the study area. These activities, associated with I-595 construction, have contributed contaminants via runoff and construction debris to waters in the area.

TERRESTRIAL SYSTEMS

The site's native soils (predominantly Okeelanta Muck and Lauderhill Muck) and nearby vegetation remnants suggest that this land was once a cypress swamp, but field surveys suggest that none of the original vegetation remains. The plants now growing are representative of second-growth that has become established on lands that have been cleared, graded, filled, drained, and/or otherwise drastically altered.

The area in the vicinity of the Lauderdale Plant site is already so heavily impacted by various side-effects of urbanization that it is difficult to isolate vegetation responses to specific stresses. The current decline of cypress (Taxodium spp.) along the North and South New River Canals, which is attributed to saltwater intrusion (Burch, personal communication, 1988), is probably just an obvious example of generally subtle ongoing processes of depauperization of the native plant communities. The profusion of exotic species in this area is certainly at least partially due to the vacant niches created as stressed native species lose vigor and are out-competed by more resilient exotics.

During the field survey, red maples (Acer rubrum) located on-site showed signs of stress, such as dead branches and discolored foliage. This was most obvious in the line of trees just east of the SSB/EP ponds, where several trees about 30 ft tall appeared to have died within the past year and others exhibited many dead branches. Much of the foliage was already a dark burgundy red, even though the maples in north Florida had just begun to change color. Elsewhere on the site and to the northeast at the Secret Woods Nature Center, maples also had dark leaves and dead branches. In sheltered locations, some were putting out relatively vigorous growth near the base. The Lauderdale Plant site is near the species' southern limit and maples generally do not grow well in this region (D. Burch, personal communication, 1988). It has been suggested that the 1988 fall drought could also have affected the trees. When checked in February 1989, some branches still showed signs of stress, but others were leafing out vigorously.

Near the stressed maples, woman's tongue trees (Albizia lebbeck) had chlorotic foliage and some (but not all) Brazilian peppers had silvery grey discolorations between the midribs on the older leaves. These species showed lesser signs of stress elsewhere on the site.

Because of urbanization, the wildlife habitats of the site area (primarily wetlands) are invaded by exotic species and altered from their normal structure and function (see Section 2.3.5). These pre-existing stresses have reduced the quality and diversity of wildlife normally associated with such habitats. Domestic animals such as the dog and cat use these areas as well as the Norway rat (_Rattus norvegicus_), rock dove (_Columba livia_), house sparrow (_Passer domesticus_), caiman (_Caiman crocodilus_), giant toad (_Bufo marinus_), Cuban tree frog (_Osteopilus septentrionalis_), green iguana (_Iguana iguana_), and other introduced species.

2.3.6.3 Measurement Programs

AQUATIC ECOLOGY

Aquatic ecological investigations were designed to: (1) characterize aquatic biological systems in the vicinity of the Lauderdale Plant, and (2) provide information relevant to assessing potential impacts of the Lauderdale Repowering Project. Quarterly field investigations were conducted during the periods of August 22 through 26, 1988 (summer); November 28 through December 1, 1988 (fall); February 27 through March 2, 1989 (winter); and May 30 through June 1, 1989 (spring). The locations of aquatic ecology sampling stations are shown in Figure 2.3-23.

Sampling was conducted to assess potential impacts resulting from impingement/entrainment and discharge. Organisms collected on the condenser intake screens and ichthyoplankton (fish eggs, larvae, and juveniles and eggs) were sampled to assess impingement/entrainment effects. Fish and benthic macroinvertebrates were sampled to aid in the assessment of discharge effects. Table 2.3-34 identifies components of the aquatic system sampled at each station. Results of this sampling program and supplemental observational and water quality data were used to characterize aquatic communities of the study area.

Organisms impinged on intake screens at Station 1 (Unit 4) were collected over a 24-hour period of plant operation each quarter. All organisms (fish and epibenthic fauna) removed from the traveling screens and retained in the Unit No. 4 collection cage (0.5-inch aperture) were identified and enumerated. To the extent possible, organisms were identified in the field. Organisms of uncertain identity were preserved in a solution of 10 percent buffered formalin and analyzed upon return to the laboratory.

Table 2.3-34. Aquatic Ecological Sampling Conducted at Stations in the Vicinity of the Lauderdale Plant Site

Station No.	Location	Sample Type	Sampling Frequency
1	Unit 4 Intake; Dania Cut-Off Canal	Intake Screen Wash (fish and epibenthic fauna)	Quarterly
		Ichthyoplankton	Quarterly
		Supplemental Water Quality	Quarterly
2	Discharge Canal Between Plant and Cooling System	Ichthyoplankton	Quarterly
		Fish/Epibenthos (traps)	Quarterly
		Benthic Macroinvertebrates	Quarterly
		Supplemental Water Quality	Quarterly
3	Canal Between Cooling System and South Fork New River	Ichthyoplankton	Quarterly
		Fish/Epibenthos (traps)	Quarterly
		Benthic Macroinvertebrates	Quarterly
		Supplemental Water Quality	Quarterly
4	South New River Canal	Fish/Epibenthos (traps, cast net, gill net)	Quarterly
		Benthic Macroinvertebrates	Quarterly
		Supplemental Water Quality	Quarterly
5	Upstream, North New River Canal	Fish/Epibenthos (traps)	Quarterly
		Benthic Macroinvertebrates	Quarterly
		Supplemental Water Quality	Quarterly
6	Downstream, South Fork New River	Fish/Epibenthos (traps, cast net, gill net)	Quarterly
		Benthic Macroinvertebrates	Quarterly
		Supplemental Water Quality	Quarterly
7	Downstream, South Fork New River	Fish/Epibenthos (traps, cast net)	Quarterly
		Benthic Macroinvertebrates	Quarterly
		Supplemental Water Quality	Quarterly

Ichthyoplankton (fish larvae and eggs) were collected at the plant intake and discharge areas to evaluate the effects of entrainment. Each quarter, drift nets (50-centimeter (cm) diameter, 202-micrometers (um) mesh) were deployed at Stations 1, 2, and 3, to collect ichthyoplankton during a 24-hour period of plant operation. Nets were deployed 3 times during the sampling period to allow the assessment of ichthyoplankton entrainment during the morning, afternoon, and at night. Flow through the nets was monitored with a General Oceanics digital flowmeter equipped with a remote meter-display unit (General Oceanics Model 2035 MKIII). Nets at Station 1 were set approximately 0.5 m below the surface and 0.5 m above the bottom and these samples were composited for analysis. Samples at Stations 2 and 3 were collected at mid-depth. The duration of each deployment was determined in the field, based on flow rates and tendency of nets to clog with suspended matter. Upon retrieval, samples were preserved in a 5-percent formalin solution and returned to the laboratory for analysis.

Fish populations were sampled by cast net, gill net, and fish traps. On each survey, two fish traps, one minnow trap (0.25-inch mesh), and one pinfish trap (0.5-inch mesh), were deployed at Stations 2 through 7. Traps were baited with cat food and retrieved after approximately 24 hours. In August and November, fish were also collected by cast net (6-ft diameter, 0.25-inch mesh) at Stations 4 and 6 to aid in characterizing populations in the discharge vicinity. Collections made by cast net resulted in a low catch per unit effort and were highly dependent upon time of day, conditions at the time of sampling (tide, wind, waves, etc.) and relative skill of the sampler. In February and May, cast net collections were discontinued and experimental gill nets were set overnight near Stations 4 and 6. Each experimental gill net is 100-ft long by 6-ft deep and is comprised of five panels with mesh sizes of 0.375-, 0.5-, 0.75-, 1.0-, and 1.5-inch bar measure. To the extent possible, fish collected by trap and net were identified and enumerated in the field. Specimens of uncertain identity were preserved in a solution of 10-percent formalin and returned to the laboratory for analysis; voucher specimens of other specimens were retained.

Benthic macroinvertebrates were collected from Stations 2 through 7 with a 15- by 15-cm petite ponar dredge sampler which samples an area of 225 cm^2. Three replicates were collected at each station and sieved through a U.S. Standard No. 30 Sieve (0.595-millimeter (mm) mesh). Samples were logged, labeled and preserved in a solution of 10 percent buffered formalin to which a dye, rose bengal, had been added to facilitate processing. In the laboratory, samples were re-sieved, rinsed to remove the formalin, hand-sorted, and identified to the lowest practicable taxonomic level. Voucher specimens were represerved in a solution of 70 percent isopropyl alcohol to which glycerin had been added to retard desiccation. Table 2.3-35 provides a summary of aquatic biological sampling and analytical methods.

On each quarterly sampling survey, water quality measurements were made at each of the aquatic ecology sampling stations. At each station water temperature, salinity/conductivity, pH, and dissolved oxygen were measured once in the early morning and once in the late afternoon. Vertical profiles were made at 1-m intervals with a Hydrolab (Model 4041) multiple electrode meter. These results are contained in Appendix 10.5.4.

Qualitative surveys of the Lauderdale Plant vicinity were also conducted each quarter to aid in the characterization of the aquatic environment. Areas surveyed included the Dania Cut-Off Canal, South New River Canal, North New River Canal, South Fork New River, and the cooling canal/pond system. Surveys were conducted to assess existing habitat characteristics (i.e., submerged vegetation, algae, emergent vegetation, mangroves, etc.) and the general quality of the aquatic system.

Surveys of crocodiles have been conducted since 1986 to determine their presences on or near the Lauderdale Plant site. More detailed surveys were conducted in 1988 and 1989. The main study area consisted of all bodies of water within the area bounded by Ravenswood Road on the east, SR 84 on the north, US 441 on the west, and Griffin Road on the south.

Table 2.3-35. Summary of Aquatic Biological Sampling and Analytical Methods

Parameter	Sampling Method	Preservative	Processing Analytical/Methods
Fish and Epibenthic Invertebrates	Intake screen collection cages; 24-hour sample	Formalin	Enumeration (to lowest practical taxon) and identification in the field. Specimens for verification and voucher collection retained.
Ichthyoplankton	50 cm, 202-μm net; representative morning, afternoon, nighttime samples	Formalin	Enumeration and identification of fish larvae and eggs to lowest practical taxon. Voucher collection.
Fish	1. Baited minnow traps, 24-hour sample 2. Cast net; 6-ft diameter, 0.25-inch mesh 3. Experimental gill net (0.375-, 0.5-, 0.75-, 1.0-, and 1.5-inch mesh	Formalin	Enumeration and identification (to lowest practical taxon) in the field. Specimens for verification and voucher collection retained.
Benthic Macroinvertebrates	Petite ponar dredge (15 cm by 15 cm)	Formalin/ rose bengal	Sieved in field through 595-micron mesh. Sorted under dissecting microscope. Enumerated and identified to lowest practical taxon. Voucher collection.
Crocodiles	Diurnal foot surveys Nocturnal boat surveys Aircraft surveys	---	Enumeration and identification in the field.
Manatees	Aircraft surveys	---	Enumeration and identification in the field.

The area includes:

1. The four major creeks and numerous smaller creeks in Pond Apple Slough Park just south of I-595;
2. South Fork New River Canal;
3. Dania Cut-Off Canal (a manmade canal system with steep banks and boat slips);
4. The cooling canal/pond system;
5. Series of ponds on the FPL property bordered by cocoa plums (Chrysobalanus icaco), pond apple (Annona glabra), and Australian pine (Casurinia equisetifolia);
6. Numerous off-site ponds; and
7. West Lake, an off-site mangrove-lined lake west of the Intracoastal Waterway and south of the Dania Cut-Off Canal.

The potential presence of crocodiles in these areas was evaluated by conducting diurnal foot surveys, nocturnal boat surveys, and helicopter surveys. All three methods have been shown to be effective in determining the presence of crocodilians as well as obtaining an index of abundance (Parker and Watson, 1970; Woodward and Marion, 1978; Wood et al., 1985; Bayliss et al., 1986; Bayliss, 1987; Brandt 1989).

Foot surveys were conducted mainly in Pond Apple Slough Park. During these surveys, the presence of any crocodilian, crocodilian sign (tail drags or slides), or other wildlife was noted.

One of the most widely used methods for determining the presence of crocodilians in an area is nighttime eyeshine counts (Chabreck, 1966; Woodward and Marion, 1978. The tapetum of crocodilian eyes shines red to orange/yellow when reflecting light, making crocodilians easy to locate at night. Eyeshine counts are conducted by shining a strong light along the shoreline and counting the number of eyeshines observed. Nocturnal surveys were conducted in this manner in the cooling system area, the South New River Canal, and the Dania Cut-Off Canal (all by canoe with a 5-hp motor) and in the off-site ponds (by vehicle). When an eyeshine was spotted, the animal was approached to obtain a size estimate and a positive species identification (American crocodile, Crocodylus acutus; American alligator, Alligator mississippiensis; or spectacled caiman, Caiman crocodylus). An attempt was made to capture all crocodilians sighted in order to weigh, measure (snout-vent length, total length, and skull length), mark, and release them (crocodiles and alligators) or remove them (caimans). Aerial surveys were conducted of the following areas.

1. The cooling canal/pond system,
2. Pond Apple Slough Park,
3. South Fork New River,
4. Dania Cut-Off Canal,
5. West Lake,
6. The Seminole Indian Reservation between U.S. 441 and the Florida Turnpike, and
7. Numerous off-site ponds.

Surveys were flown in a Robinson 22 helicopter at an altitude of 30 to 50 m and an air speed of <40 knots between 0800 and 1100.

Manatee surveys have been conducted since 1977. Following passage of severe or prolonged cold weather in Florida, aerial surveys were initiated. Surveys were conducted using low-flying aircraft. Cruising altitude and air speed were 152 m (500 ft) and 167 kilometers per hour (km/hr) (90 knots), respectively. During circling of manatee aggregations, slower air speeds and lower altitudes were used to permit most efficient counting. Photographs were taken to verify visual counts using a Nikon FG camera equipped with a 200-mm fixed focal length lens, a data back, and a motor drive.

Aerial surveys were flown on the following dates: December 20, 1987; January 12, 24, and 28, 1988; and February 14, 17, 23, and 28, 1988. Each flight lasted one day. Surveys originated in St. Petersburg, Florida, and focused on five FPL power plants including the Lauderdale Plant. At each power plant, aggregations of manatees were circled until a satisfactory count was obtained or until air traffic controllers insisted that the circling terminate. The following data were recorded.

1. Total number of manatees present;
2. Total number of calves (defined as animals less than half the length of a closely associated animal) present;
3. Distribution of animals;
4. Behavior, including feeding or direction of travel; and
5. Weather and water conditions.

Waters within about 5 miles of each plant (termed the vicinity of each plant) were also observed for manatees.

TERRESTRIAL SYSTEMS

On-site terrestrial ecology studies were performed through examination of aerial photographs followed by field surveys of representative areas of each habitat by a team consisting of two vegetation ecologists and two wildlife ecologists. The primary field effort was conducted November 10-12, 1988, with a supplementary visit February 26, 1989.

Quantitative data were gathered on animal observations; qualitative assessments were deemed more useful in profiling plant communities.

Compass line transects were followed across broad areas of dense vegetation like the sawgrass marsh and Australian pine swamp at the north end of the site. Smaller patches of habitat were surveyed through a systematic approach designed to enable the surveyors to view several representative areas of each vegetation type.

Special effort was made to thoroughly cover any areas suggested as potential sites for construction during repowering. Thus, field surveys were conducted along the gas pipeline to be routed north-south along a dirt road that is located by the western portion of the cooling canal/pond system and continuing from east to west near the northern boundary of the discharge canal.

All plants and animals observed were listed by habitat and location. Plant community structure and composition were recorded and any signs of stressed vegetation were noted. The species compositions and hydrological linkages were evaluated in relation to regulatory implications.

To assess the condition of native vegetation in the surrounding area, overview surveys of the Secret Woods Nature Center and Pond Apple Slough were performed. Vegetation in other adjoining properties was surveyed by driving around the neighborhoods near the site; this vegetation was mostly landscape plants and ruderal in character.

Wildlife surveys were conducted by field biologists on November 11, 1988, and February 26, 1989. Compass line transects were followed across large areas of dense vegetation. Smaller areas were surveyed by systematically wandering through the area, thereby covering the entire area. All observations were recorded in field notebooks and on hand-held cassettes.

2.3.7 Meteorology and Ambient Air Quality

2.3.7.1 Meteorology

Meteorological data collected at existing monitoring stations were used to describe the local and regional climatology representative of the Lauderdale Plant site. The meteorological station located closest to the site which has available complete meteorological data is the primary National Weather Service (NWS) station located at the Miami International Airport. This NWS station is situated approximately 35 kilometers (km) (22 miles) to the south-southwest of the site. The NWS has recorded weather observations for more than 40 years at this site, and these data are the most complete for the region surrounding the proposed project.

Meteorological data are also collected at other sites, such as the Fort Lauderdale-Hollywood International Airport and at a site operated by BCEQCB. However, the measurements made at these stations are not complete for use in air dispersion models (e.g., only 16 hours of observations are made each day), since certain meteorological parameters are not observed (e.g., cloud ceiling and height), or quality assurance and instrument siting criteria do not meet the NWS standards.

To evaluate the potential variability in meteorological conditions that could occur in the project area compared to conditions in Miami, meteorological data collected at the NWS station in West Palm Beach were reviewed and compared to the data observed at the NWS station in Miami. The NWS station in West Palm Beach, located approximately 68 km (43 miles) to the north of the project site, has a complete meteorological database that can be compared to the Miami data for the time period used in this analysis (1982 to 1986). The following sections describe the meteorological data collected by the NWS station in Miami and, where appropriate, compare the data to those collected in West Palm Beach.

TEMPERATURE

The climate in the south Florida area, including the project site, is tropical with a marine influence from the Atlantic Ocean and Biscayne Bay.

Temperature means and extremes for Miami are presented in Table 2.3-36. The mean annual temperature is 76°F, with mean monthly temperatures varying from a maximum of 89°F to a minimum of 59°F. Record extreme temperatures range from a low of 30°F to a record high of 98°F. Although the sun's elevation is nearly zenith during the summertime, temperatures do not exceed 100°F. The reason can be attributed to the high relative humidities with subsequent cloud cover formation and the abundant convective-type precipitation.

For comparison with the Miami data, temperature data for West Palm Beach are presented in Table 2.3-37. Based on these monthly averages, the mean, maximum, and minimum temperatures for West Palm Beach vary by less than 4°F from the Miami temperatures.

RELATIVE HUMIDITY AND PRECIPITATION

Relative humidity, an indication of the amount of moisture in the air at a given temperature, is presented for Miami in Table 2.3-38 for the morning hours of 0100 and 0700 and early afternoon and evening hours of 1300 and 1900. The highest humidities are coincident with the coolest ambient temperatures, which generally occur at 0700 or near dawn. The lowest humidities coincide with the highest ambient temperatures.

Precipitation means and extremes for Miami are also presented in Table 2.3-38. Approximately 76 percent of the annual precipitation falls during the six warmest months, May through October. The mean annual precipitation is 58 inches, but this has varied from as little as 37 inches to over 89 inches in the last 30 years. The majority of rain is in the form of short-lived convective showers.

WIND PATTERNS

The Lauderdale Plant site area lies entirely within the trade wind belt (i.e., below 30°N latitude) resulting in predominant winds from the east. Also, because of the location of the Atlantic Ocean, moderate to strong late afternoon sea breezes occur on days in which strong land heating

Table 2.3-36. Temperature (°F) Means and Extremes Measured at Miami International Airport, Miami, Florida

Month	Temperature Means[a]			Temperature Extremes[b]	
	Mean	Maximum	Minimum	Maximum	Minimum
January	67.1	75.0	59.2	88	30
February	67.8	75.8	59.7	89	32
March	71.7	79.3	64.1	92	32
April	75.3	82.4	68.2	96	46
May	78.5	85.1	71.9	94	53
June	81.0	87.3	74.6	98	60
July	82.5	88.7	76.2	98	69
August	82.8	89.2	76.5	98	68
September	81.8	87.8	75.7	95	68
October	77.9	84.2	71.6	95	51
November	72.8	79.8	65.8	89	39
December	68.5	76.2	60.8	87	33
Annual	75.6	82.6	68.7	98	30

[a]30-year period of record, 1951 to 1980.
[b]43-year period of record, 1943 to 1985.

Source: National Oceanic and Atmospheric Administration (NOAA), 1985.

Table 2.3-37. Temperature (°F) Means and Extremes Measured at Palm Beach International Airport, West Palm Beach, Florida

Month	Temperature Means[a]			Temperature Extremes[b]	
	Mean	Maximum	Minimum	Maximum	Minimum
January	65.2	74.5	55.9	89	27
February	65.8	75.3	56.2	90	32
March	70.1	79.3	60.8	94	30
April	73.8	82.5	65.1	99	45
May	77.6	85.7	69.5	96	53
June	80.4	88.1	72.7	98	61
July	82.0	89.7	74.2	101	66
August	82.5	90.1	74.8	98	65
September	81.3	88.4	74.3	97	66
October	77.3	84.4	70.1	95	46
November	71.6	79.6	63.5	91	36
December	67.0	75.7	58.2	90	30
Annual	74.5	82.8	66.3	101	27

[a]30-year period of record, 1951 to 1980.
[b]49-year period of record, 1937 to 1985.

Source: NOAA, 1985.

Table 2.3-38. Precipitation and Diurnal Relative Humidity Measured at Miami International Airport, Miami, Florida

Month	Precipitation (inches)			Relative Humidity[c] (%) hour (LT)			
	Mean[a]	Maximum[b]	Minimum[b]	0100	0700	1300	1900
January	2.08	6.66	0.04	80	84	59	68
February	2.05	8.07	0.01	79	83	57	66
March	1.89	7.22	0.02	77	82	56	65
April	3.07	17.29	0.05	75	79	55	64
May	6.53	18.54	0.44	79	82	60	69
June	9.15	22.36	1.81	83	85	66	74
July	5.98	13.51	1.77	82	85	63	72
August	7.02	16.88	1.65	83	86	65	74
September	8.07	24.40	2.63	85	88	67	77
October	7.14	21.08	1.25	82	86	64	73
November	2.71	13.15	0.09	81	85	61	71
December	1.86	6.39	0.13	79	83	59	70
Annual	57.55	89.33	37.00	80	84	61	70

[a]30-year period of record, 1951 to 1980.
[b]43-year period of record, 1943 to 1985.
[c]21-year period of record, 1965 to 1985.

Source: NOAA, 1985.

occurs. These sea breezes produce locally onshore winds (i.e., wind with an easterly component) which are superimposed on the frequent easterly trade winds. Annual and seasonal wind roses for the 5-year period from 1982 through 1986 are given in Figures 2.3-25 and 2.3-26 for Miami and in Figures 2.3-27 and 2.3-28 for West Palm Beach. A summary of the average windspeeds for each season and annually, including calm conditions, is presented in Table 2.3-39 for both Miami and West Palm Beach. As indicated in the figures and tables, the predominant wind throughout the year is from the east for both stations.

ATMOSPHERIC STABILITY

Atmospheric stability is a measure of the atmosphere's capability to disperse pollutants. During the daytime, when clear skies and strong solar insolation occur, the atmosphere can disperse pollutants quickly for a relatively short period of time. This condition is characterized as "very unstable" and generally occurs infrequently during the year. During the nighttime, under clear skies and light windspeeds, the atmosphere is characterized as stable, with low potential to disperse pollutants. Under moderate to high windspeeds during day or night, pollutants are dispersed at moderate rates, and the atmosphere is characterized as "neutral". Neutral conditions are generally more prevalent throughout the year than the other stability categories.

The seasonal and annual average occurrences of atmospheric stability classes are shown in Table 2.3-40 for both Miami and West Palm Beach. Frequent and strong sea breezes cause a predominance of neutral and stable air (neutral and stable classes), counteracting the effect of high incidence of sunshine over the land areas. During the summer months in Miami, unstable classes occur nearly 36 percent of the time due to strong solar insolation, while occurring only 14 percent of the time during the winter months. Neutral stability occurs most frequently during the winter months due to the higher windspeeds in this season. Stable stabilities occur nearly uniformly throughout the year in Miami, with a maximum occurrence of approximately 43 percent in the fall. The annual and

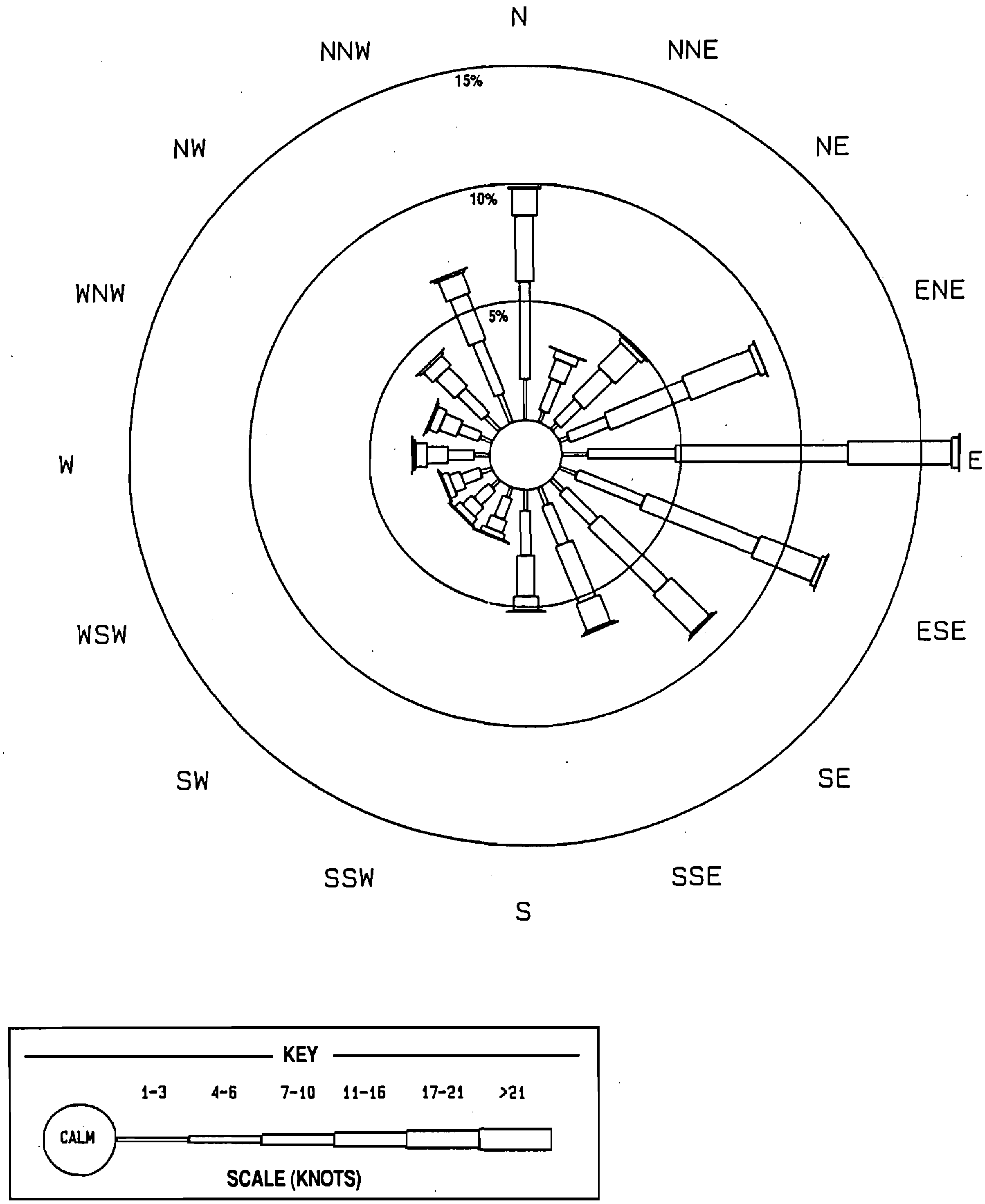

Figure 2.3-25 ANNUAL AVERAGE WIND FREQUENCY DISTRIBUTION, 1982 TO 1986 — NWS STATION, MIAMI, FLORIDA

Lauderdale Repowering Project

FPL

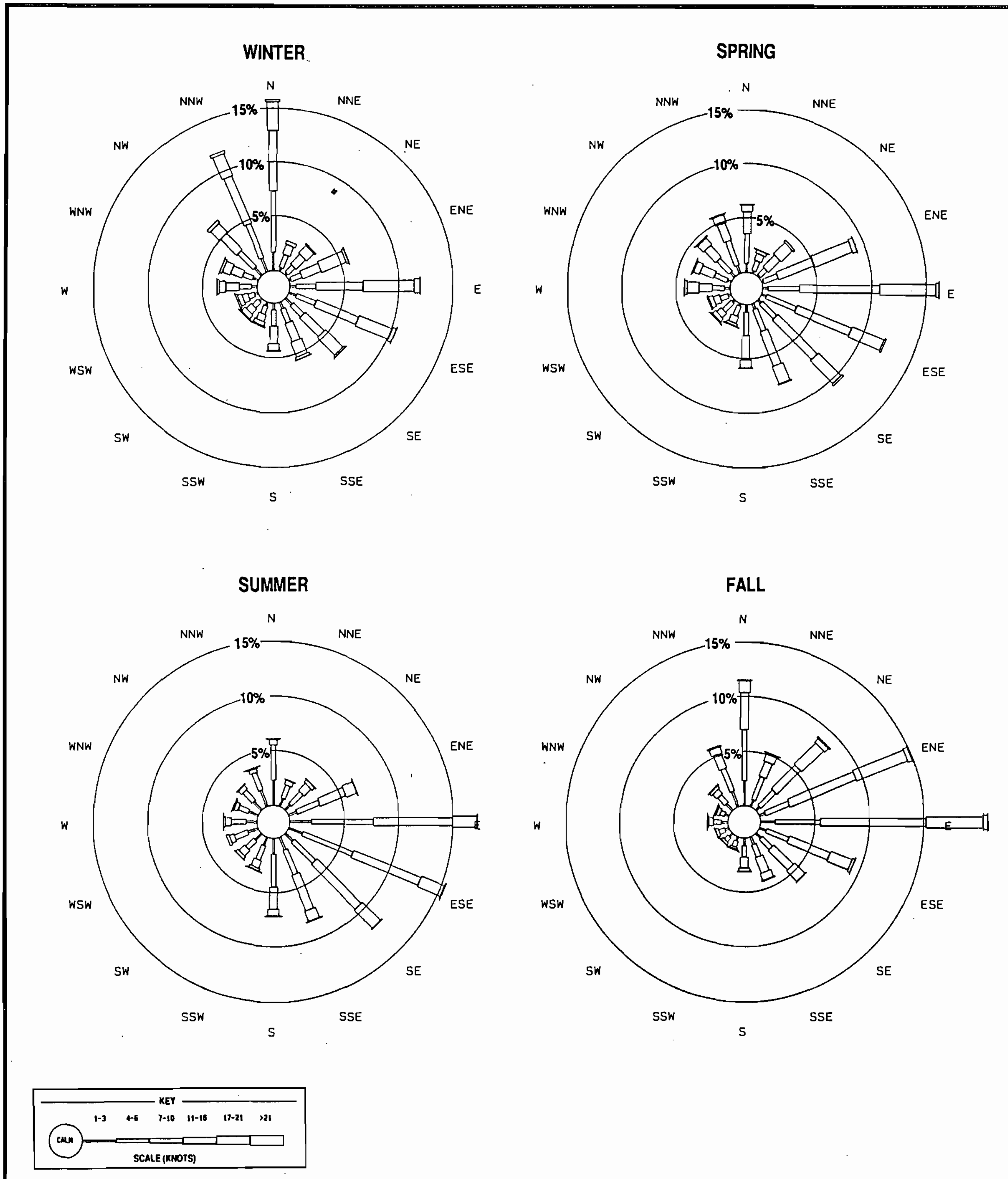

Figure 2.3-26 SEASONAL AVERAGE WIND FREQUENCY DISTRIBUTION, 1982 TO 1986 — NWS STATION, MIAMI, FLORIDA

Lauderdale Repowering Project

FPL

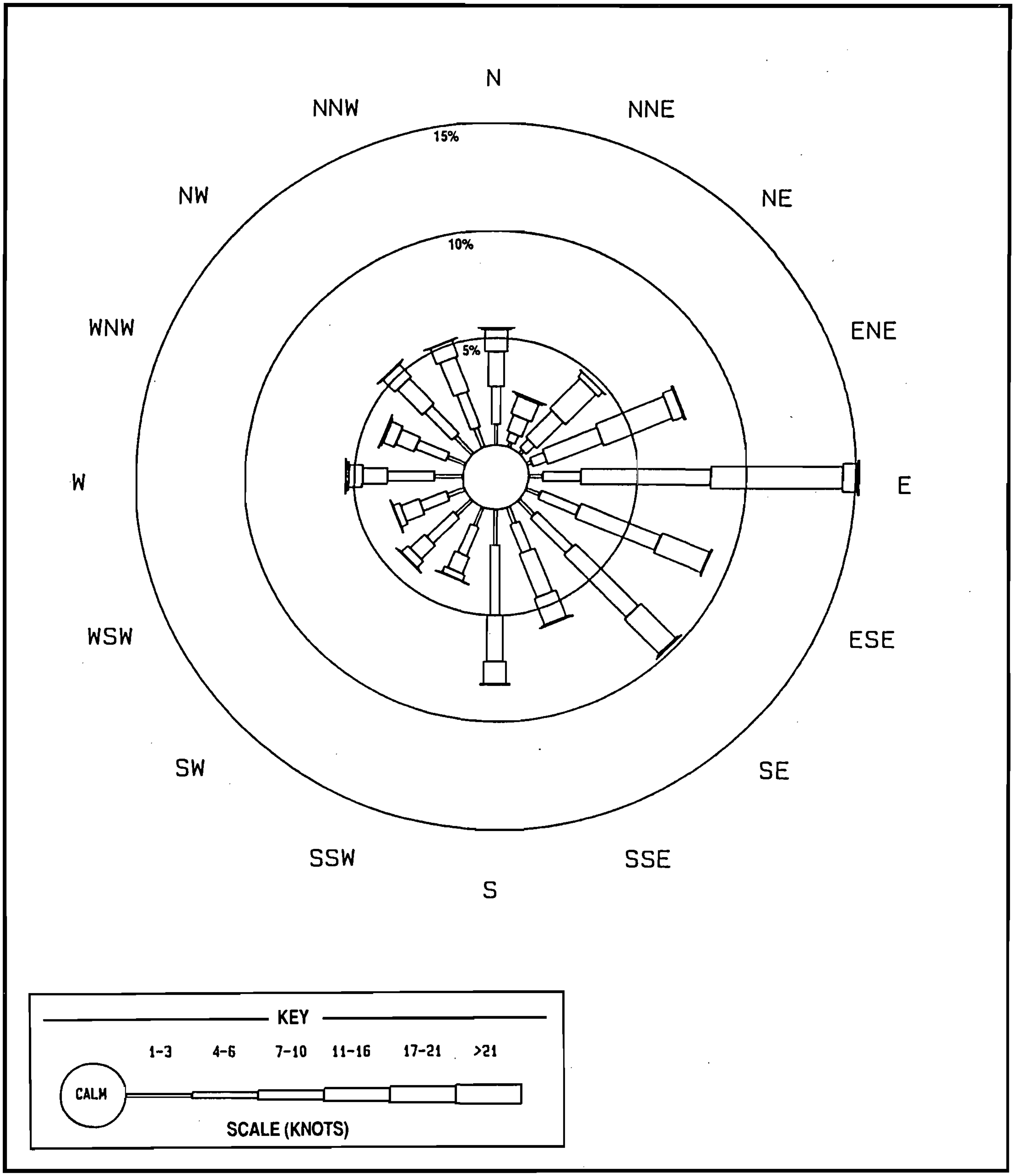

Figure 2.3-27 ANNUAL AVERAGE WIND FREQUENCY DISTRIBUTION, 1982 TO 1986 — NWS STATION, WEST PALM BEACH, FLORIDA

Lauderdale Repowering Project

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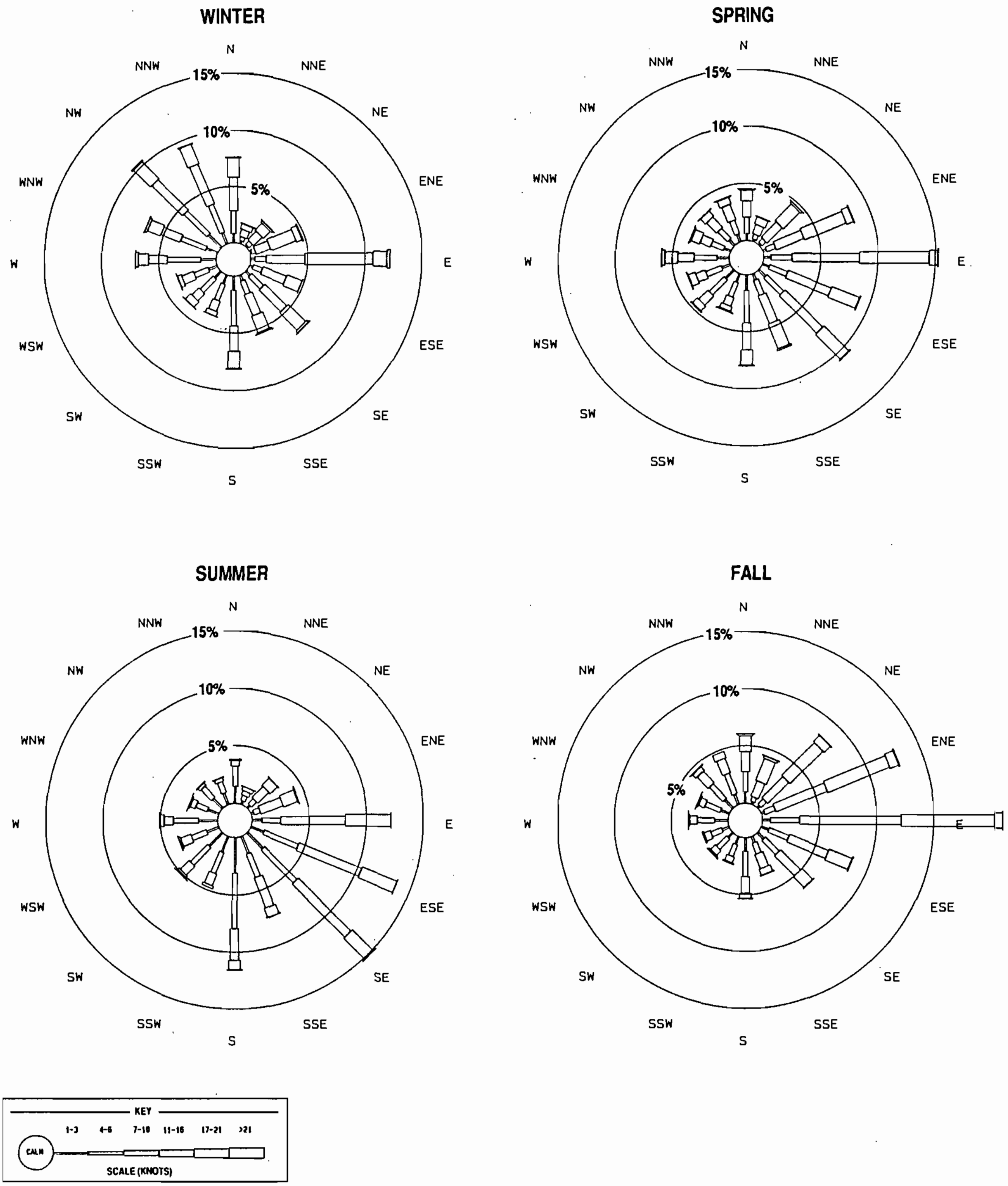

Figure 2.3-28 **SEASONAL AVERAGE WIND FREQUENCY DISTRIBUTION, 1982 TO 1986 — NWS STATION, WEST PALM BEACH, FLORIDA**

Lauderdale Repowering Project

FPL

Table 2.3-39. Wind Direction and Windspeed Measured at Miami and West Palm Beach NWS Stations[a]

Season	Average Windspeed (mph)	Calm[b] (percent)	Prevailing Wind Direction: Direction	Prevailing Wind Direction: Average Windspeed (mph)
Miami				
Winter	9.7	2.2	North	8.7
Spring	9.7	1.4	East	10.7
Summer	7.5	3.4	East	8.4
Fall	9.1	2.7	East	10.2
Annual	9.0	2.4	East	10.1
West Palm Beach				
Winter	9.5	5.3	East	13.8
Spring	9.8	5.4	East	12.0
Summer	7.6	10.0	Southeast	9.2
Fall	9.8	5.4	East	11.7
Annual	9.2	6.6	East	12.0

[a]5-year period of record, 1982 to 1986.
[b]Windspeeds less than approximately 3 miles per hour (mph).

Source: NOAA, 1986.

Table 2.3-40. Occurrences of Atmospheric Stability Classes Determined at Miami and West Palm Beach NWS Stations[a]

Season	Very Unstable	Moderately Unstable	Slightly Unstable	Neutral	Slightly Stable	Moderately Stable
	Occurrence (percent) of Stability Class					
Miami						
Winter	0.0	2.9	10.6	45.9	20.4	20.2
Spring	0.5	6.6	17.7	37.1	18.1	19.9
Summer	1.6	13.2	20.8	21.7	16.1	26.5
Fall	0.3	5.1	13.8	37.9	20.8	22.1
Annual	0.6	7.0	15.8	35.6	18.8	22.2
West Palm Beach						
Winter	0.0	2.7	9.8	49.6	15.9	21.9
Spring	0.4	5.6	16.8	40.9	16.0	20.3
Summer	1.3	10.2	22.4	24.6	14.4	27.0
Fall	0.2	4.2	13.3	45.7	17.6	19.0
Annual	0.5	5.7	15.6	40.2	16.0	22.1

[a]5-year period of record, 1982 to 1986.

Source: NOAA, 1986.

seasonal stability frequencies for West Palm Beach are similar to those for Miami.

MIXING HEIGHTS

The mixing height is a parameter used to define the vertical height to which pollutants can disperse and, therefore, is used in estimating the volume of air in which pollutants are emitted and can be dispersed. In general, the higher the mixing height, the greater the potential for pollutants to be dispersed.

The seasonal and annual average morning and afternoon mixing heights determined using the Holzworth method are listed in Table 2.3-41 for both Miami and West Palm Beach. The highest afternoon mixing heights occur in the spring, and the lowest morning mixing heights occur in winter.

SEVERE STORMS

Thunderstorms are the most frequent of severe storms, occurring an average of 74 days per year in Miami. These storms occur throughout the year, but about 89 percent occur from May through October.

In the 50-mile coastal strip from South Miami to Pompano Beach, there is a 20-percent probability that a tropical storm will pass over the area during any given year. For storms of hurricane strength (i.e., windspeeds exceeding 73 mph), the probability reduces to 1 in 6 (i.e., 16 percent), with a 7-percent chance the winds will be greater than 124 mph (i.e., windspeeds of a great hurricane). Tropical cyclones usually approach Miami during the period from early August through late October.

Statistics compiled by the Severe Local Storms (SELs) branch of the National Severe Storms Forecast Center (Pautz, 1969) show that 25 tornadoes (or waterspouts) were spotted within the 1° latitude by 1° longitude square that includes Miami from 1955 to 1967. This averages approximately two tornadoes per year. The tornado recurrence interval for any specific point location within the 1° square is estimated by the methodology of Thom

Table 2.3-41. Morning and Afternoon Mixing Heights Determined at Miami and West Palm Beach NWS Stations[a]

Season	Mixing Height (m)	
	Morning	Afternoon
Miami		
Winter	788	1,287
Spring	950	1,474
Summer	990	1,368
Fall	976	1,315
Annual	926	1,362
West Palm Beach		
Winter	693	1,205
Spring	873	1,369
Summer	831	1,293
Fall	966	1,213
Annual	841	1,271

[a]5-year period of record, 1982 to 1986.

Source: NOAA, 1986.

(1963) to be 740 years. Therefore, the mean recurrence interval for a tornado striking a point within this square is 740 years. The most common tornado month is June.

2.3.7.2 Ambient Air Quality

AMBIENT AIR STANDARDS

There are two types of ambient air standards that are applicable to the Lauderdale Repowering Project. The first type of standard is referred to as an ambient air quality standard (AAQS). This type of standard establishes a maximum ground level air pollutant concentration which cannot be exceeded by the combination of all emission sources, including natural background sources. AAQS are established by federal and state air pollution control agencies and are specified in terms of averaging times (e.g., annual, 24-hour, 3-hour, etc.).

The second type of standard is referred to as an air quality increment. Air quality increments are set by the Environmental Protection Agency (EPA) and allow a limited amount of air quality degradation above a defined baseline air quality level. These increments are referred to as prevention of significant deterioration (PSD) increments. Both types of ambient air standards are discussed in the following sections.

<u>National and State of Florida AAQS</u>--The existing national and State of Florida AAQS are presented in Table 2.3-42. As indicated, EPA has established primary and secondary national AAQS for six air pollutants. The pollutants for which national AAQS have been set are referred to as the criteria pollutants, because air quality criteria documents have been issued for each. The criteria documents set forth the scientific data and the basis for the AAQS.

The national primary AAQS were promulgated to protect the public health against any known or anticipated adverse effects associated with the presence of pollutants in the ambient air. The national secondary AAQS were set to protect the public welfare against adverse effects, including

Table 2.3-42. Federal and State of Florida AAQS

		AAQS ($\mu g/m^3$)		
Pollutant	Averaging Time	National Primary Standard	National Secondary Standard	State of Florida
Particulate Matter (PM10)	Annual Arithmetic Mean	50	50	50
	24-Hour maximum[a]	150	150	150
Sulfur Dioxide	Annual Arithmetic Mean	80	NA	60
	24-Hour Maximum[b]	365	NA	260
	3-Hour Maximum[b]	NA	1,300	1,300
Carbon Monoxide	8-Hour Maximum[b]	10,000	10,000	10,000
	1-Hour Maximum[b]	40,000	40,000	40,000
Nitrogen Dioxide	Annual Arithmetic Mean	100	100	100
Ozone	1-Hour Maximum[c]	235	235	235
Lead	Calendar Quarter Arithmetic Mean	1.5	1.5	1.5

[a]Achieved when the expected number of exceedances per year is less than 1.
[b]Maximum concentration not to be exceeded more than once per year.
[c]Achieved when the expected number of days per year with concentrations above the standard is less than 1.

Note:
PM10 = Particulate matter with an aerodynamic diameter less than or equal to 10 micrometers (μm).
$\mu g/m^3$ = micrograms per cubic meter.
NA = Not applicable (i.e., no standard exists).

Sources: 40 CFR 50
Chapter 17-2, F.A.C.

effects upon plant and animal life, soils, property, and visibility. The national AAQS apply to areas which meet the definition of ambient air. EPA defines ambient air in 40 CFR 50.1 as "that portion of the atmosphere, external to buildings, to which the general public has access." Under this definition, areas within plant property boundaries that are not accessible by the general public are not considered as ambient air. Implicit in this definition of ambient air is the exclusion of locations at elevated heights above ground to which the public does not have access. Thus, AAQS do not apply at the top of a stack.

The State of Florida has also adopted AAQS for the six air pollutants (Table 2.3-42) for which national AAQS have been set. The Florida AAQS are the same as the national AAQS, except Florida has adopted more stringent standards for sulfur dioxide than the national AAQS.

Florida has not adopted a definition for ambient air. However, past policy of the FDER Bureau of Air Quality Management has been to apply the EPA definition of ambient air, as described previously.

PSD Increments--The 1977 Clean Air Act (CAA) Amendments enacted into law provisions concerning PSD of air quality. The law specified that certain increases in air quality concentrations above the baseline concentration level of sulfur dioxide (SO_2) and particulate matter--total suspended particulates [PM(TSP)] would constitute significant deterioration. The magnitude of the allowable increment depends on the classification of the area in which a new source (or modification) will be located or will have an impact. Congress also directed EPA to evaluate PSD increments for other criteria pollutants and, if appropriate, promulgate PSD increments for such pollutants.

Three classifications were designated based on criteria established in the CAA Amendments. Certain types of areas (international parks, national wilderness areas, and memorial parks larger than 5,000 acres, and national parks larger than 6,000 acres) were designated as Class I areas. All other areas of the country were designated as Class II. PSD increments for Class III areas were defined, but no areas were designated as Class III. However, Congress made provisions in the law to allow the redesignation of Class II areas to Class III areas.

In 1977, EPA promulgated PSD regulations related to the requirements for classifications, increments, and area designations as set forth by Congress. PSD increments were initially set for only SO_2 and PM(TSP). However, in 1988 EPA promulgated final PSD regulations for nitrogen oxides (NO_x) and established PSD increments for nitrogen dioxide (NO_2).

The current federal PSD increments are shown in Table 2.3-43. As shown, Class I increments are the most stringent, allowing the smallest amount of air quality deterioration, while the Class III increments allow the greatest amount of deterioration. FDER has adopted the EPA class designations and allowable PSD increments for PM(TSP) and SO_2 but has not yet adopted the PSD increments for NO_2. On October 5, 1989, EPA proposed PSD increments for PM(10).

The term "baseline concentration" evolves from federal and state PSD regulations and refers to a fictitious concentration level corresponding to a specified baseline date and certain additional baseline sources. By definition in the PSD regulations, baseline concentration means the ambient concentration level which exists in the baseline area at the time of the applicable baseline date. A baseline concentration is determined for each pollutant for which a baseline date is established and includes:

1. The actual emissions representative of sources in existence on the applicable baseline date; and
2. The allowable emissions of major stationary sources which commenced construction before January 6, 1975, for SO_2 and PM(TSP) sources or February 8, 1988, for NO_x sources; but which were not in operation by the applicable baseline date.

Table 2.3-43. Federal and State Allowable PSD Increments

Pollutant	Averaging Time	PSD Increments ($\mu g/m^3$) Class I	Class II	Class III
Particulate Matter (TSP)	Annual Geometric Mean	5	19	37
	24-Hour Maximum[a]	10	37	75
Particulate Matter PM10[b]	Annual Arithmetic Mean	4	17	34
	24-Hour Maximum	8	30	60
Sulfur Dioxide	Annual Arithmetic Mean	2	20	40
	24-Hour Maximum[a]	5	91	182
	3-Hour Maximum[a]	25	512	700
Nitrogen Dioxide[c]	Annual Arithmetic Mean	2.5	25	50

[a]Maximum concentration not to be exceeded more than once per year.
[b]Proposed October 5, 1989.
[c]Federal standard only.

Sources: 40 CFR 52.21
Chapter 17-2, F.A.C.
54 Federal Register (FR) 192, pages 41218-41232.

The following emissions are not included in the baseline concentration and therefore affect PSD increment consumption:

1. Actual emissions from any major stationary source on which construction commenced after January 6, 1975, for SO_2 and PM(TSP) sources and after February 8, 1988, for NO_x sources; and
2. Actual emission increases and decreases at any stationary source occurring after the baseline date.

In reference to the baseline concentration, the baseline date actually includes three different dates:

1. The major source baseline date, which is January 6, 1975, in the cases of SO_2 and PM(TSP) and February 8, 1988, in the case of NO_2.
2. The minor source baseline date, which is the earliest date after the trigger date on which a major stationary source or major modification subject to PSD regulations submits a complete PSD application.
3. The trigger date, which is August 7, 1977, for SO_2 and PM(TSP) and February 8, 1988, for NO_2.

The minor source baseline date for SO_2 and PM(TSP) has been set as December 27, 1977, for the entire state of Florida (Chapter 17-2.450, F.A.C.).

EMISSION SOURCES

The Lauderdale Plant site is located in central Broward County. This area of Broward County is primarily residential, commercial, and light industrial in character, and there are only a few large point sources of air emissions in the county. Adjacent Dade and Palm Beach Counties have similar demographic characteristics.

The Lauderdale Plant site currently consists of two fossil-fuel-fired steam electric generating units, Units 4 and 5, each with a net winter capability of 138 MW and a permitted rating (gross) of 161 MW. These units burn natural gas and/or No. 6 fuel oil. Also located at the site are a total of

24 peaking GT units each with a design rating of 40.5 MW (net winter). These units, which are run intermittently to provide electric power at peak load times, burn natural gas or No. 2 distillate oil.

A source of air emissions in Broward County is the FPL Port Everglades Power Plant. This plant has four fossil-fuel-fired steam electric generating units (Units 1, 2, 3, and 4); Units 1 and 2 have a design rating of 225 MW, and Units 3 and 4 are rated at 402 MW. These units burn natural gas and/or No. 6 fuel oil. The facility also has 12 peaking GT units, each with a design rating of 40.5 MW. The peaking units, which run intermittently to provide power at peak load times, burn natural gas or No. 2 distillate oil.

In order to define other air emission sources which may potentially affect the air quality in the vicinity of the Lauderdale Plant site, an emissions inventory of criteria air pollutants was compiled. Emission source information was obtained from the FDER Air Pollutant Inventory System (APIS) for Dade, Broward, and Palm Beach Counties. Other information, such as county-wide emission inventories, air operating and construction permits, and previous air modeling studies, was also reviewed to supplement the APIS data.

All air emission sources that emit more than 15 tons per year (TPY) of SO_2 and NO_x and that are located within 15 km of the Lauderdale Plant site, as identified through the above investigation, are presented in Table 2.3-44. Source name, location, and emission rates are shown. The emission rates reflect the allowable or maximum emissions from the source in tons per year. The locations of these sources relative to the Lauderdale Plant site are shown in Figure 2.3-29.

Sources located within 15 km of the Lauderdale Plant site include the FPL Port Everglades plant, the SBCRRP facility, and Weekley Asphalt Paving. The SBCRRP facility is a solid waste recycling/energy recovery plant.

Table 2.3-44. Existing SO_2 and NO_x Emission Sources Within 15 km of the Lauderdale Plant Site

APIS Facility Identification Number	Facility	County	UTM Coordinates (km) East	UTM Coordinates (km) North	Relative Location (km) To Proposed Site[a] X	Relative Location (km) To Proposed Site[a] Y	Distance From Proposed Site (km)	Direction From Proposed Site (degrees)	Maximum Allowable Emissions[b] (TPY)
SO_2 Emission Sources:									
50BRO060036	FPL -Port Everglades	Broward	587.4	2885.3	7.1	2.0	7.4	74	76,239
50BRO06????	South Broward County Res. Rec.	Broward	579.6	2883.3	-0.7	0.0	0.7	270	1,318
50BRO060046	Weekley Asphalt Paving	Broward	576.9	2886.1	-3.4	2.8	4.4	310	39
								Total	77,596
NO_x Emission Sources:									
50BRO060036	FPL -Port Everglades	Broward	587.4	2885.3	7.1	2.0	7.4	74	45,570
50BRO06????	South Broward County Res. Rec.	Broward	579.6	2883.3	-0.7	0.0	0.7	270	2,383
50BRO060046	Weekley Asphalt Paving	Broward	576.9	2886.1	-3.4	2.8	4.4	310	313
								Total	48,266

[a]The UTM coordinates of the proposed repowered units are 580.3 km East and 2883.3 km North.
[b]Maximum facility emissions are based on emissions found in APIS, or specific operation permits and PSD applications.

Note: ???? indicates no APIS was provided.

Source: FDER, 1989.

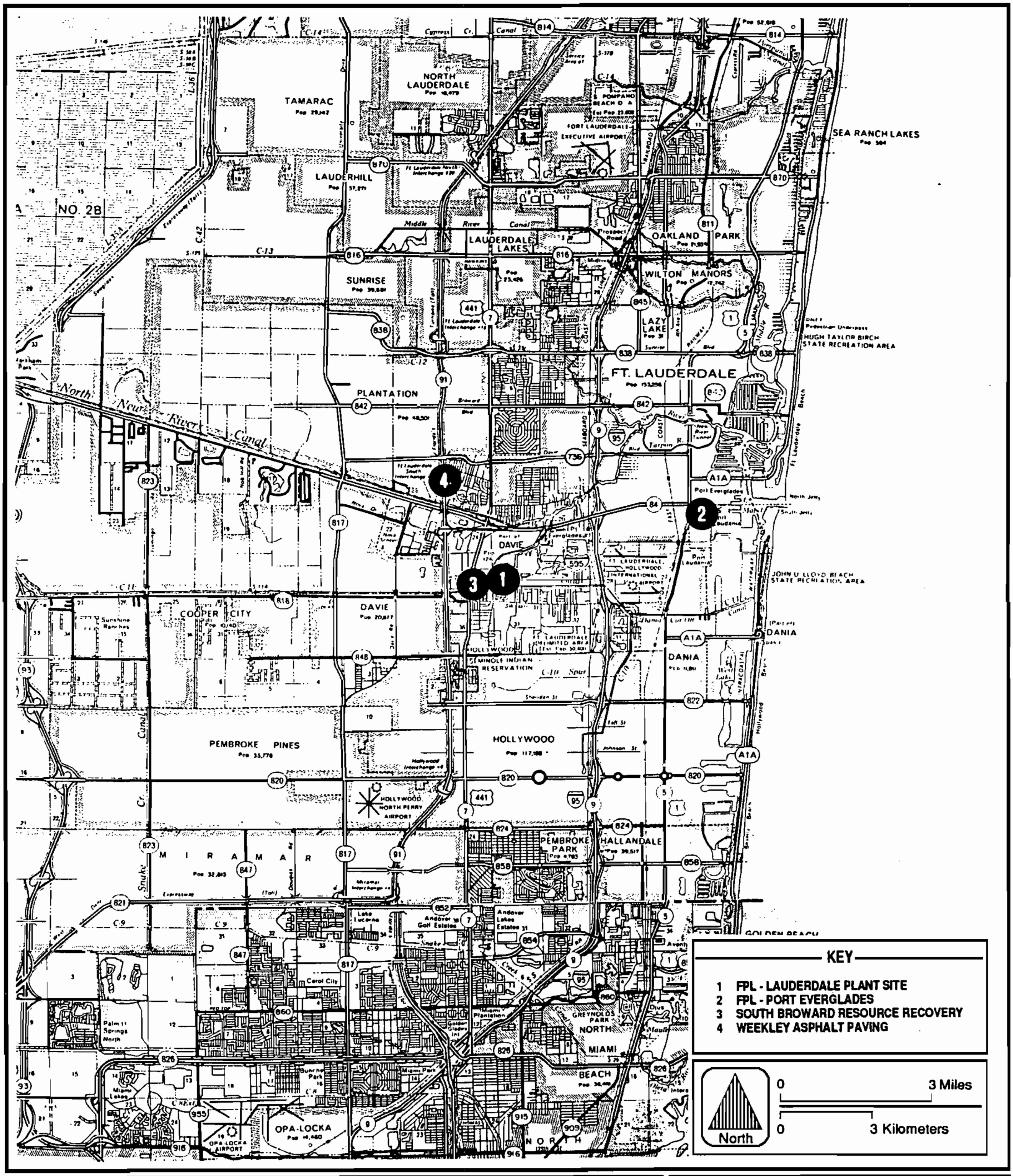

Figure 2.3-29 AIR EMISSION SOURCES LOCATED WITHIN 15 km OF THE LAUDERDALE PLANT SITE

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All air emission sources located from 15 km to 50 km from the Lauderdale Plant site and emitting greater than 100 TPY of SO_2 or NO_x are shown in Table 2.3-45. The locations of these sources relative to the Lauderdale Plant site are shown in Figure 2.3-30. Sources emitting less than 100 TPY and located more than 15 km from the Lauderdale Plant site are not expected to have a significant impact on air quality in the vicinity of the site.

PSD SOURCES

PSD increment-consuming sources in the region surrounding the Lauderdale Plant site were identified through the same sources as the general emission inventory described previously. Identified PSD increment-consuming sources consist of the SBCRRP facility, located within 3 km of the Lauderdale Plant site, the North Broward County resource recovery facility, the Dade County resource recovery facility, and Tarmac Florida, located in Dade County. Locations of these sources are shown in Figures 2.3-29 and 2.3-30.

AREA CLASSIFICATION

Areas of the country with an air pollutant concentration above an AAQS are designated as nonattainment areas. Broward County is designated as attainment for all pollutants except ozone. Both the EPA and the State of Florida have designated Broward County, as well as adjacent Dade County and Palm Beach County, as nonattainment for ozone (40 CFR Part 81, Subpart C; Chapter 17-2.410, F.A.C.).

AMBIENT AIR MONITORING DATA

Requirements--The FDER Instruction Guide For Certification Applications (Form 17-1.211(1)) requires that the source applicant meet the requirements of Chapter 17-2.500(5)(f), F.A.C., which relates to preconstruction air quality monitoring and analysis. This rule requires that any application for a PSD permit must contain an analysis of continuous ambient air quality data in the area affected by the proposed major stationary facility or major modification. For a new major facility, the affected pollutants are those that the facility would potentially emit in significant amounts. For

Table 2.3-45. Existing SO_2 and NO_x Emission Sources Located 15 to 50 km From the Lauderdale Plant Site

APIS Facility Identification Number	Facility	County	UTM Coordinates (km) East	UTM Coordinates (km) North	Relative Location (km) To Proposed Site X	Relative Location (km) To Proposed Site Y	Distance From Proposed Site (km)	Direction From Proposed Site (degrees)	Maximum Allowable Emissions[a] (TPY)	
SO_2 Emission Sources:										
50DAD130003	FPL -Turkey Point[b]	Dade	567.2	2813.2	-13.1	-70.1	71.3	191	36,192	
50DAD130004	General Portland	Dade	551.7	2843.4	-28.6	-39.9	49.1	216	10,546	
50DAD130348	Metro Dade Resource Recovery	Dade	564.3	2857.4	-16.0	-25.9	30.4	212	1,831[c]	
50DAD130020	Tarmac Florida	Dade	562.9	2861.7	-17.4	-21.6	27.7	219	2,792	
50BRO06????	North Broward County Res. Rec.	Broward	583.6	2907.6	3.3	24.3	24.5	8	896	
50DAD130001	FPL -Cutler	Dade	570.4	2834.9	-9.9	-48.4	49.4	192	488	
50BRO060015	East Coast Asphalt	Broward	584.9	2902.2	4.6	18.9	19.5	14	230	
50DAD130015	Rinker Materials	Dade	558.2	2851.3	-22.1	-32.0	38.9	215	218	A
50PMB500015	Boca Raton Hotel and Club, LTD	Palm Beach	592.0	2913.7	11.7	30.4	32.6	21	208	E
50BRO062094	Waste Management	Broward	583.2	2908.0	2.9	24.7	24.9	7	187	
50DAD130483	General Asphalt Portable Plant	Dade	561.5	2853.2	-18.8	-30.1	35.5	212	103	
								Total	54,856	
NO_x Emission Sources:										
50DAD130003	FPL -Turkey Point[b]	Dade	567.2	2813.2	-13.1	-70.1	71.3	191	16,521	
50DAD130001	FPL -Cutler	Dade	570.4	2834.9	-9.9	-48.4	49.4	192	4,796	
50DAD130020	Tarmac Florida	Dade	562.9	2861.7	-17.4	-21.6	27.7	219	4,191	A
50BRO06????	North Broward County Res. Rec.	Broward	583.6	2907.6	3.3	24.3	24.5	8	2,225	
50DAD130014	Rinker Portland	Dade	559.0	2852.2	-21.3	-31.1	37.7	214	702	E
50DAD130004	General Portland	Dade	551.7	2843.4	-28.6	-39.9	49.1	216	616	
50DAD130348	Metro Dade Resource Recovery	Dade	564.3	2857.4	-16.0	-25.9	30.4	212	511	
50BRO062094	Waste Management	Broward	583.2	2908.0	2.9	24.7	24.9	7	236	
50DAD130470	South Florida Cogeneration	Dade	580.5	2850.9	0.2	-32.4	32.4	180	217	
50BRO062081	Ryan Sales and Service	Broward	560.7	2876.5	-19.6	-6.8	20.7	251	200	E
								Total	30,215	

[a]Maximum facility emissions are based on emissions found in APIS, or specific operation permits and PSD applications.
[b]FPL -Turkey Point will be included in the modeling due to its relative emissions and potential impact.
[c]Based on SO_2 source test conducted during January 1983.

Note: E= Emissions rate based on ESTIMATED emission information in APIS, because no information was available on allowable or actual emissions.
A= Emission rate based on ACTUAL emission information in APIS, because no information was available on allowable emissions.

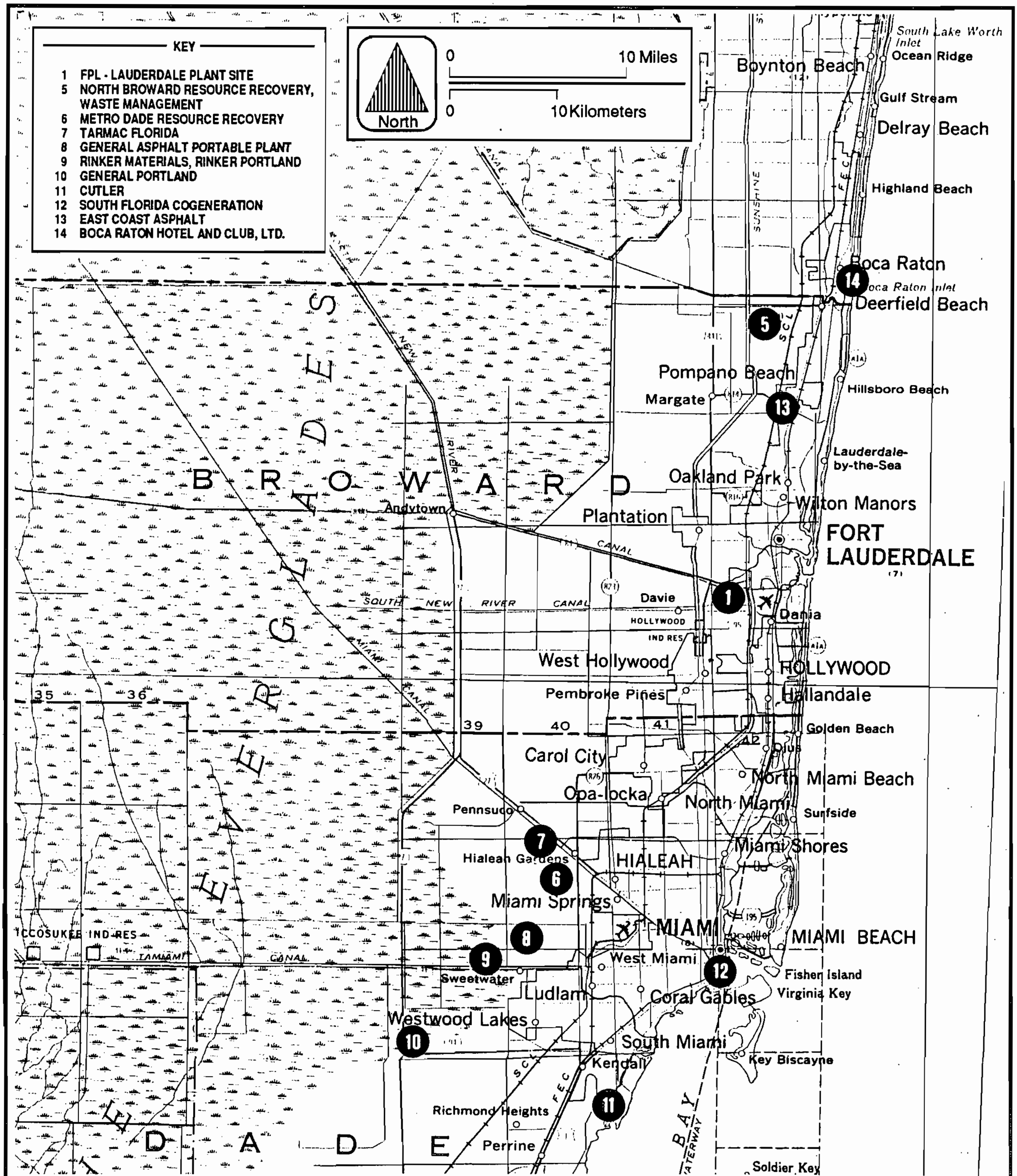

Figure 2.3-30 MAJOR AIR EMISSION SOURCES LOCATED BETWEEN 15km AND 50 km OF THE LAUDERDALE PLANT SITE

Lauderdale Repowering Project

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a major modification, the pollutants are those for which the net emissions increase exceeds the significant emission rate shown in Table 2.3-46.

Ambient air monitoring for a period of up to 1 year is generally appropriate to satisfy the PSD monitoring requirements. A minimum of 4 months of data is required. Acceptable air monitoring methods and quality assurance procedures, as specified in the Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD) (EPA-450/4-87-007), must generally be used to collect the data. Existing data from the vicinity of the proposed source may be utilized if the data meet certain quality assurance requirements; otherwise, additional data may need to be gathered.

The FDER regulations include an exemption in Chapter 17-2.500(3)(e), F.A.C., which excludes or limits the pollutants for which an air quality analysis must be conducted. This exemption states that a proposed major stationary facility or major modification shall be exempt from the monitoring requirements of Chapter 17-2.500(5)(f), F.A.C., with respect to a particular pollutant if:

1. The emissions increase of the pollutant from the facility or modification would cause, in any area, air quality impacts less than the de minimis monitoring concentrations presented in Table 2.3-46; or
2. The ambient concentration of the pollutant in the area that the proposed facility or modification would locate is less than the de minimis monitoring concentration listed in Table 2.3-46; or
3. The pollutant is not listed in Table 2.3-46.

Table 2.3-46. PSD Significant Emission Rates and De Minimis Monitoring Concentrations

Pollutant	Applicable Regulation	Significant Emission Rate (TPY)	De Minimis Monitoring Concentration (µg/m^3)
Sulfur Dioxide	NAAQS, NSPS	40	13, 24-hour
Particulate Matter (TSP)	NAAQS, NSPS	25	10, 24-hour
Particulate Matter (PM10)	NAAQS	15	10, 24-hour
Nitrogen Oxides	NAAQS, NSPS	40	14, Annual
Carbon Monoxide	NAAQS, NSPS	100	575, 8-hour
Volatile Organic Compounds (Ozone)	NAAQS, NSPS	40	100 TPY[a]
Lead	NAAQS	0.6	0.1, 3-month
Sulfuric Acid Mist	NSPS	7	NM
Total Fluorides	NSPS	3	0.25, 24-hour
Total Reduced Sulfur	NSPS	10	10, 1-hour
Reduced Sulfur Compounds	NSPS	10	10, 1-hour
Hydrogen Sulfide	NSPS	10	0.2, 1-hour
Asbestos	NESHAP	0.007	NM
Beryllium	NESHAP	0.0004	0.001, 24-hour
Mercury	NESHAP	0.1	0.25, 24-hour
Vinyl Chloride	NESHAP	1	15, 24-hour
Benzene	NESHAP	0	NM
Radionuclides	NESHAP	0	NM
Inorganic Arsenic	NESHAP	0	NM

[a]Increase in VOC emissions.

Note: Ambient monitoring requirements for subject pollutants may be exempted if the impact of the increase in emissions is below air quality impact de minimis levels.

NAAQS = National Ambient Air Quality Standards.
NESHAP = National Emission Standards for Hazardous Air Pollutants.
NM = No ambient measurement method.
NSPS = New Source Performance Standards.
VOC = Volitile Organic Compounds.

Sources: 40 CFR 52.21.
Chapter 17-2, F.A.C.

The PSD pollutant applicability determination for the Lauderdale Repowering Project shows that the following pollutants must undergo PSD review and, therefore, must undergo a preconstruction ambient monitoring analysis: PM(TSP), PM(10), SO_2, NO_x and CO (refer to Air Permit Application, Appendix 10.1.5). However, the PSD regulations allow an exemption from the preconstruction monitoring requirements if the impacts from the proposed new facility are less than the PSD de minimis monitoring concentrations (Table 2.3-46). A comparison of the de minimis monitoring concentrations and the predicted net increase in impacts due to the repowered Lauderdale units is presented in Table 2.3-47. Sulfur dioxide is the only pollutant for which maximum predicted ground-level impacts are above the respective de minimis monitoring concentration.

Although preconstruction monitoring is required only for SO_2, supplemental air quality data were obtained to support the Air Permit application and Site Certification Application. These supplemental data include data from FPL and FDER (operated by BCEQCB) monitoring stations. Ambient monitoring data for Broward County are available from FDER- and FPL-operated air monitoring stations. Locations of the monitoring sites in the vicinity of the Lauderdale Plant site are shown in Figure 2.3-31. The available data for each pollutant monitored are discussed in the following paragraphs. A more detailed presentation and discussion of the data, as well as quality assurance procedures, are presented in the Air permit application (Appendix 10.1.5).

Particulate Matter--Ambient particulate matter data from monitoring stations located within 15 km of the Lauderdale Plant site for the period 1986 through 1988 are presented in Table 2.3-48. Data are available from six FDER sites, two of which have collocated monitors for quality assurance purposes, and three stations operated by FPL. The FDER and FPL stations are operated according to PSD quality assurance requirements.

Nearly all particulate data collected to date have been for total suspended particulates [PM(TSP)]. In July 1987, EPA changed the national AAQS from a

Table 2.3-47. Comparison of Maximum Predicted Impacts from the Lauderdale Repowering Project and *De Minimis* Monitoring Concentrations

Pollutant	*De Minimis* Monitoring Concentration ($\mu g/m^3$)	Maximum Predicted Impact[a] ($\mu g/m^3$)
Sulfur Dioxide	13, 24-hour	259
Particulate Matter (TSP)	10, 24-hour	3.0
Particulate Matter (PM10)	10, 24-hour	3.0
Nitrogen Oxides	14, Annual	0.9
Carbon Monoxide	575, 8-hour	
Volatile Organic Compounds (Ozone)	100 TPY[b]	99.9 TPY
Lead	0.1, 3-month	0.00032
Total Fluorides	0.25, 24-hour	0.003
Beryllium	0.001, 24-hour	0.0002
Mercury	0.25, 24-hour	0.0003

[a]For the averaging time indicated for the *de minimis* monitoring concentration. Includes creditable emission decreases from Units 4 and 5.
[b]Increases in VOC emissions.

Note: Ambient monitoring requirements for subject pollutants may be exempted if the impact of the increase in emissions is below air quality impact *de minimis* levels.

Sources: 40 CFR 52.21.
Chapter 17-2, F.A.C.

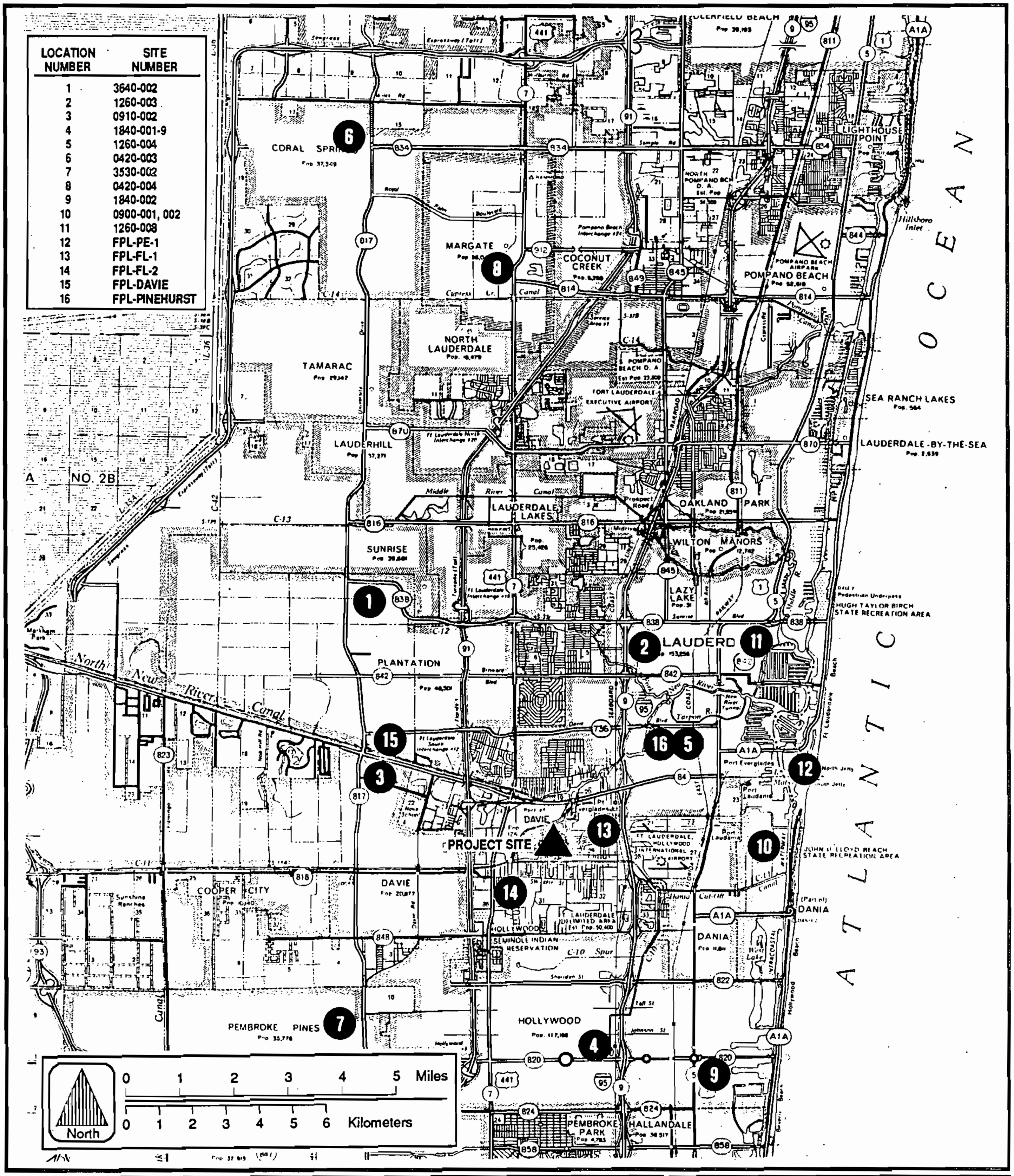

Figure 2.3-31 LOCATIONS OF AMBIENT AIR MONITORING SITES IN THE VICINITY OF THE LAUDERDALE PLANT SITE

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Table 2.3-48. Summary of Ambient Particulate Matter Data, Broward County--1986-1988

Site Number	Site Name/Location	Time Period	No. obs.	PM(TSP) Concentration ($\mu g/m^3$) Max. 24-hr	2nd Max. 24-hr	Arithmetic Mean
0910-002	Davie	1986	56	70	69	31
	UF Ag Research Station	1987	58	100	81	31
		1988	57	198	86	38
1260-003	Fort Lauderdale	1986	58	92	91	56
	2101 NW 6th St.	1987	57	118	115	62
		1988	59	95	92	58
1260-004	Fort Lauderdale	1986	60	85	82	39
	500 SW 14 Ct.	1987	60	101	86	39
		1988	61	59	59	37
1840-001-1	Hollywood	1986	61	90	65	38
	3441 Hollywood Blvd.	1987	59	108	90	42
		1988	59	68	66	39
1840-001-9	Hollywood	1986	59	92	70	39
	3441 Hollywood Blvd.	1987	60	103	85	43
		1988	59	68	66	39
3530-002-1	Pembroke	1986	59	78	64	31
	11251 Taft St.	1987	52	69	64	36
		1988	61	64	56	31
3530-002-9	Pembroke	1986	59	81	65	33
	11251 Taft St.	1987	53	93	66	38
		1988	60	68	61	31
3640-002	Plantation	1986	56	124	84	34
	1200 NW 72	1987	61	104	78	37
		1988	61	57	53	32
FPL FL-1	Fort Lauderdale	1987	50	101	94	54
	SW 39 Street	1988	53	106	104	62
FPL FL-2	Davie	1987	46	106	101	63
	US 441	1988	58	95	90	51
FPL PE-1	Port Everglades	1987	61	99	92	46
	Ocean Dr.	1988	59	71	67	41
FPL Pine-hurst	Fort Lauderdale SW 9th Ave. & 22 St. N.	1989[a]	113	61	58	35
Primary/Secondary AAQS[b]				--	150	50
Florida AAQS[b]				--	150	50

[a]Data cover period July 1988-June 1989 for PM10.
[b]Standards are in terms of particulate matter with an aerodynamic diameter of 10 micrometer (μm) or less.

PM(TSP) standard to a standard based upon PM10 (particulate matter with an aerodynamic diameter less than or equal to 10 μm). Subsequently, FDER adopted the national AAQS. Since PM(TSP) is collected by a method which captures particles up to 60 μm in diameter, PM(TSP) data are always higher in magnitude than the corresponding PM10 data. However, the ratio of PM(TSP) to PM10 in the atmosphere is not constant and is dependent upon a number of factors.

As shown in Table 2.3-48, data from all of the monitoring sites are generally well below AAQS. The second-highest 24-hour concentration measured during any year at any site was 115 $\mu g/m^3$, compared to the AAQS of 150 $\mu g/m^3$. The highest annual mean concentrations measured were at Site 1260-003 (62 $\mu g/m^3$) and FPL sites FL-1 and FL-2 (62 and 63 $\mu g/m^3$, respectively). Although these PM(TSP) values are higher than the PM10 AAQS of 50 $\mu g/m^3$, a study by EPA (1986) shows that these sites would have about a 3-percent probability of exceeding the PM10 annual AAQS based upon observed PM(TSP)/PM10 ratios.

In July 1988, FPL initiated ambient monitoring for PM10 at the Pinehurst site. Sampling was conducted once every third day using three different PM10 samplers. A total of 113 samples were obtained in the period from July 1988 through June 1989. Results of the particulate sampling are summarized below:

Mean concentration:	PM10--24.24 $\mu g/m^3$
	PM(TSP)--35.1 $\mu g/m^3$
Maximum 24-hr concentration:	PM10--58 $\mu g/m^3$
	PM(TSP)--61 $\mu g/m^3$
PM10/PM(TSP) ratios:	Range--0.33 to 1.12
	Mean--0.71

Sulfur Dioxide--Ambient SO_2 data from air monitoring sites located in the vicinity of the Lauderdale Plant site, for the period 1986 through September 1989, are presented in Table 2.3-49. Data are available from four FDER sites (one collocated monitor) and five FPL sites. All data are

Table 2.3-49. Summary of Ambient Sulfur Dioxide Data, Broward County--1986-1988

Site Number	Site Name/Location	Time Period	No. obs.	Sulfur Dioxide Concentration ($\mu g/m^3$) Max. 3-hr	2nd Max. 3-hr	Max. 24-hr	2nd Max. 24-hr	Arithmetic Mean
0910-002	Davie	1986	58	--	--	5	4	3
	UF Ag Research	1987	--	--	--	--	--	
	Station	1988	--	--	--	--	--	
1260-003	Fort Lauderdale	1986	55	--	--	9	8	3
	2101 NW 6th St.	1987	61	--	--	13	13	3
		1988	54	--	--	23	22	4
1260-004-1	Fort Lauderdale	1986	61	--	--	21	8	3
	500 SW 14 Ct.	1987	61	--	--	21	19	3
		1988	60	--	--	23	20	4
1260-004-9	Fort Lauderdale	1986	61	--	--	25	12	3
	500 SW 14 Ct.	1987	60	--	--	21	17	3
		1988	60	--	--	24	20	4
3530-002-1	Pembroke	1986	60	--	--	3	3	2
	11251 Taft St.	1987	--	--	--	--	--	--
		1988	--	--	--	--	--	--
FPL FL-1	Fort Lauderdale	1987	57	--	--	13	3	3
	SW 39 St.	1988	56	--	--	7	7	3
FPL FL-2	Davie	1987	51	--	--	5	4	4
	US 441	1988	47	--	--	12	7	4
FPL PE-1	Port Everglades	1987	53	--	--	10	10	4
	Ocean Dr.	1988	47	--	--	10	5	4
FPL Pine-hurst	Fort Lauderdale SW 9th Ave. & 22nd St. N.	1988[a]	8,339	189	133	42	42	5
FPL Davie	Davie SR 84	1988[a]	8,377	152	138	39	38	4
Federal Primary AAQS				--	--	--	365	80
Federal Secondary AAQS				--	1,300	--	--	--
Florida AAQS				--	1,300	--	260	60

[a]Data cover period October 1988 through September 1989.

collected by the 24-hour bubbler method, except for the FPL Pinehurst and Davie sites, which have continuous monitors. All of the bubbler data are gathered by required quality assurance procedures for bubbler data, while the continuous monitors meet PSD criteria.

As indicated in the table, all recorded SO_2 concentrations are low, and well below the federal and state AAQS. The highest measured 3-hour concentration was 189 $\mu g/m^3$ at the FPL Pinehurst site, and the highest measured 24-hour concentration was 42 $\mu g/m^3$, also measured at the Pinehurst site. These values are well below the AAQS of 1,300 $\mu g/m^3$, 3-hour average, and 260 $\mu g/m^3$, 24-hour average.

The highest recorded annual mean SO_2 concentration at any site was 5 $\mu g/m^3$, recorded at the FPL Pinehurst site. This concentration is well below the AAQS of 60 $\mu g/m^3$ for the annual averaging period.

Nitrogen Dioxide--Available NO_x data from monitoring sites located in the vicinity of the Lauderdale Plant site are presented in Table 2.3-50. Data are available from four FDER sites and four FPL sites and cover the period 1986 through March 1989. All sites are 24-hour bubbler sites, except for the FPL Pinehurst site, which has a continuous monitor. All data have been gathered according to recommended quality assurance techniques for bubbler and continuous monitors.

The highest measured annual mean NO_x concentration was measured at Site 1260-003 in 1986, and was 47 $\mu g/m^3$. This level is roughly one-half the AAQS of 100 $\mu g/m^3$, annual average concentration. An annual average concentration of 26 $\mu g/m^3$ was measured at the FPL Pinehurst site, the only site with a continuous NO_2 monitor.

Carbon Monoxide--Ambient CO data available from three monitoring sites in the vicinity of the Lauderdale Plant site for the period 1986 through 1988 are presented in Table 2.3-51. All of these sites use continuous

Table 2.3-50. Summary of Ambient Nitrogen Dioxide Data, Broward County--1986-1988

Site Number	Site Name/Location	Time Period	No. obs.	Nitrogen Dioxide Concentration ($\mu g/m^3$) Max. 24-hr	2nd Max. 24-hr	Arithmetic Mean
0910-002	Davie	1986	56	57	51	27
	UF Ag Research Station	1987	--	--	--	--
		1988	--	--	--	--
1260-003	Fort Lauderdale	1986	56	108	104	47
	2101 NW 6th St.	1987	61	109	108	46
		1988	56	92	91	43
1260-004-1	Fort Lauderdale	1986	61	76	63	31
	500 SW 14 Ct.	1987	61	81	56	30
		1988	60	72	65	30
1260-004-9	Fort Lauderdale	1986	60	75	63	30
	500 SW 14 Ct.	1987	60	77	66	30
		1988	60	71	70	31
3530-002-1	Pembroke	1986	60	60	60	28
	11251 Taft St.	1987	--	--	--	--
		1988	--	--	--	--
FPL FL-1	Fort Lauderdale	1987	57	68	67	36
	SW 39 St.	1988	56	157	157	42
FPL FL-2	Davie	1987	53	83	81	38
	US 441	1988	54	78	72	35
FPL PE-1	Port Everglades	1987	55	91	58	27
	Ocean Dr.	1988	53	77	72	26
FPL Pine-hurst	Fort Lauderdale SW 9th Ave. & 22 St. N.	1988[a]	7,107	101	100	26
Federal Primary/Secondary AAQS				--	--	100
Florida AAQS			--	--	--	100

[a]Data cover period October 1988 through September 1989.

Table 2.3-51. Summary of Ambient Carbon Monoxide Data, Broward County--1986-1988

Site Number	Site Name/Location	Time Period	No. obs.	Carbon Monoxide Concentration (mg/m^3) Max. 1-hr	2nd Max. 1-hr	Max. 8-hr	2nd Max. 8-hr
1260-003	Fort Lauderdale	1986	7,900	13	12	9	8
	2101 NW 6th St.	1987	8,663	12	12	7	7
		1988	8,560	10	8	6	5
1260-008	Fort Lauderdale	1986	3,535	12	10	7	6
	1770 E. Sunrise	1987	8,542	13	12	7	6
		1988	8,595	8	7	5	5
1840-002	Hollywood	1986	7,790	9	9	9	7
	12701 Plunkett	1987	8,698	7	7	6	5
		1988	8,731	8	6	5	4
Federal Primary/Secondary AAQS				--	40	--	10
Florida AAQS				--	40	--	10

monitors and operated by FDER. All data from the sites are gathered according to required quality assurance procedures.

Measured CO data reflect concentrations well below both the 1-hour and 8-hour AAQS. The second-highest 1-hour concentration measured at any site was 12 milligrams per cubic meter (mg/m^3), while the second-highest 8-hour concentration was 8 mg/m^3.

Ozone-- Ambient ozone data from the period 1986-1988 are available from four sites near the Lauderdale Plant site are shown in Table 2.3-52. All are operated by the FDER and meet minimum quality assurance requirements. As indicated in the table, one site (John Lloyd Park, Dania) recorded three exceedances of the ozone AAQS in 1988. One other site (Nova University, Dania) recorded one exceedance of the AAQS in 1986 and 1987.

2.3.7.3 Measurement Programs

The descriptions of the ambient air quality monitoring network design, rationale for monitoring locations and parameters, description of monitoring sites and sampling equipment were presented in the Air Monitoring Plan submitted to FDER in August 1988. The quality assurance and standard operating procedures used to perform the monitoring are presented in Appendix 10.5.1. The appendix also presents the results of performance audits.

Table 2.3-52. Summary of Ambient Ozone Data, Broward County--1986-1988

Site Number	Site Name/Location	Time Period	No. obs.	Ozone Concentration ($\mu g/m^3$) Max. 1-hr	2nd Max. 1-hr	No. Days Standard Exceeded
0420-003	Coral Springs Fire Station	1986	8,148	215	213	0
		1987	8,553	194	188	0
		1988	8,700	208	198	0
0420-004	N. Lauderdale Water Treatment Plant	1986	8,349	241	223	0
		1987	8,661	186	178	0
		1988	8,520	225	192	0
0900-001	Dania Nova University	1986	7,232	260	200	1
		1987	6,995	249	235	1
		1988	--	--	--	--
0900-002	Dania John Lloyd Park	1986	--	--	--	--
		1987	329	92	86	0
		1988	8,664	315	288	3
Federal Primary/Secondary AAQS[a]			--	235	--	1
Florida AAQS[a]			--	235	--	1

[a]Standard is attained when the number of calendar days with 1-hour concentrations greater than or equal to 235 $\mu g/m^3$ is not greater than 1.

2.3.8 Noise

2.3.8.1 Regulations and Criteria

U.S ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA (1974) has developed indoor and outdoor noise criteria for various land uses as a guide for protecting public health and welfare which are shown in Table 2.3-53. These criteria relate to short-term and day-night average sound pressure levels (SPLs). The L_{eq} is the equivalent constant SPL that would be equal in sound energy to the varying SPL over the same time period. The L_{dn} is the 24-hour average SPL calculated for two daily time periods, i.e., day and night, but has 10 dBA added to nighttime SPL. The equation for L_{dn} is:

$$L_{dn} = 10 \log 1/24 \; [15 \times 10^{(Ld/10)} + 9 \times 10^{(Ln+10)/10)}]$$

where: Ld = day time L_{eq} for the period 0700 to 2200 hours
Ln = nighttime L_{eq} for the period 2200 to 0700 hours.

For residential areas, EPA recommends an outdoor L_{dn} of 55 dBA.

STATE OF FLORIDA

FDER has not promulgated noise regulations. Ambient noise levels and projected impacts, however, must be addressed in the SCA [FDER Form 17-1.211(1)]. Specifically, baseline noise information must be included in Section 2.3.8, and impacts must be addressed in Sections 4.6 and 5.7 of the SCA.

BROWARD COUNTY

Broward County has promulgated a noise ordinance which is codified in Broward County Code (BCC) Article VII Section 27-197 through 27-206. The ordinance requires that the maximum sound level, as measured at the receiving land use, does not exceed the specified limits during more than 50 percent of any measurement period. The measurement period cannot be less than 10 minutes. The maximum permissible sound levels by the receiving land use are as follows:

Table 2.3-53. EPA-Recommended Noise Criteria

		Indoor			Outdoor		
	Measure*	Activity Interference	Hearing Loss Consideration	To Protect Against Both Effects (b)	Activity Interference	Hearing Loss Consideration	To Protect Against Both Effects (b)
Residential With Outside Space and Farm Residences	L_{dn}	45		45	55		55
	L_{eq}(24)		70			70	
Residential With No Outside Space	L_{dn}	45	45				
	L_{eq}(24)		70				
Commercial	L_{eq}(24)	(a)	70	70(c)	(a)	70	70(c)
Inside Transportation	L_{eq}(24)	(a)	70	(a)			
Industrial	L_{eq}(24)(d)	(a)	70	70(c)	(a)	70	70(c)
Hospitals	L_{dn}	45		45	55		55
	L_{eq}(24)	70			70		
Educational	L_{eq}(24)	45		45	55		55
	L_{eq}(24)(d)	70			70		
Recreational Areas	L_{eq}(24)	(a)	70	70(c)	(a)	70	70(c)
Farmland and General Unpopulated Land	L_{eq}(24)				(a)	70	70(c)

*L_{dn} = Day-night average A-weighted equivalent sound level, with a 10-decibel weighting applied to nighttime levels.

L_{eq} (24) = Equivalent A-weighted sound level over 24 hours.

Notes:

a. Since different types of activities appear to be associated with different levels, identification of a maximum level for activity interference may be difficult except in those circumstances where speech communication is a critical activity.
b. Based on lowest level.
c. Based only on hearing loss.
d. An $L_{eq(8)}$ of 75 decibels (dB) may be identified in these situations so long as the exposure over the remaining 16 hours per day is low enough to result in a negligible contribution to the 24-hour average, i.e., greater than an L_{eq} of 60 dB.

Source: EPA, 1974

Land Use Classification Impacted	Sound Level Limit (dBA)	Applicable Times
1. Residential	55	All
2. Recreational or	60	7 a.m. to 10 p.m.
Institutional	55	10 p.m. to 7 a.m.
3. Commercial/Business	65	All
4. Manufacturing, Industrial, or Agricultural	70	All

Additionally, maximum sound levels occurring at any time cannot exceed those levels shown above by:

1. 10 A-weighted decibels (dBA) from 7 a.m. to 10 p.m., and 5 dBA from 10 p.m. to 7 a.m. for zoning classifications 1, 2, and 3 above; and
2. 10 dBA at all times for zoning classification 4 above.

The maximum sound level limits specified above are reduced by 5 dBA for pure tones. Pure tones are defined as the one-third octave band sound pressure level in the band of two contiguous one-third octave band frequencies that exceed the arithmetic average of those frequencies by 5 dBA at a center frequency of 500 Hertz (Hz), by 8 dBA at a center frequency between 160 Hz and 400 Hz, and by 15 dBA at a center frequency less than or equal to 125 Hz.

The maximum permissible sound level is measured in dBA. Decibels are calculated as a logarithmic function of the sound level in air to a reference effective pressure, which is considered the hearing threshold. SPL is defined as:

$$SPL = 20 \log_{10} (Pe/Po) \text{ [decibels]}$$

where: Pe = measured RMS effective pressure of the sound wave
Po = reference effective pressure of 20 micropascals (μPa)

Specific prohibitions and exemptions from the limits are prescribed for certain operations. Any noise disturbance, which is defined as any sound level set forth in the ordinance, is generally prohibited. In addition, certain activities are prohibited from causing a noise disturbance during certain time periods. The listed activities are:

1. Loud speakers--Between 10 p.m. and 7 a.m.;
2. Loading and unloading--Between 7 p.m. and 7 a.m.;
3. Construction and demolition--Between 7 p.m. and 7 a.m.;
4. Power model vehicles--Between 7 p.m. and 7 a.m.;
5. Domestic power tools--Between 8 p.m. and 7 a.m.;
6. Vehicular, motor boat, or aircraft repairs and testing--Between 10 p.m. and 7 a.m.;
7. Explosives, firearms, and similar services--at all times;
8. Air-conditioning and air-handling equipment--at all times except residential land use may exceed maximum permissible sound levels by 5 dBA; and
9. Engines, generators, pumps, motors, and other machinery at all times.

The ordinance specifically exempts certain noise sources or source categories from causing noise disturbances at any time. These exemptions apply to any noise generated by:

1. Motor vehicles operating on a public right-of-way;
2. The unamplified human voice;
3. New products or interstate motor and rail carrier vehicles preempted by the Noise Control Act of 1972 or other applicable federal laws or regulations;
4. Non-stationary farming equipment;
5. Aircraft movement operated in accordance with applicable federal laws or regulations;
6. Routine maintenance of public service utilities;
7. Emergency notification;
8. Non-commercial public speaking and public assembly activities; and

9. Engines, generators, pumps, construction tools, or other equipment used for emergency work.

Measurement of sound pressure levels must be performed using a properly calibrated sound level meter meeting American National Standards Institute (ANSI) specifications for Type II or better equipment.

COMMUNITY NOISE CRITERIA

Several methods have been developed to assess community response and acceptability to noise levels. The more prominent methodologies include the Preferred Speech Interference Level (PSIL), Modified Composite Noise Rating (CNR), Normalized Day-Night Sound Level, Community Noise Equivalent Level (CNEL), Noise Pollution Level (L_{NP}), and Housing and Urban Development (HUD) Criteria and Standards (EEI, 1984). CNR is suggested as the most comprehensive technique for evaluating steady broadband, steady tonal, and short-term noise (EEI, 1984). This recommendation is based on meeting the following criteria:

1. Objective Factors
   a. Level of intruding noise
   b. Spectrum shape of intruding noise
   c. Level of background sound
   d. Spectrum shape of background sound
   e. Audible tonal components
   f. Impulsive noise
   g. Very low frequency noise
   h. Noise level fluctuations
   i. Duration of noise
   j. Time of day
   k. Season of year
2. Subjective Factors
   a. History of previous exposure
   b. Community attitude toward source

3. Other factors
    a. Ease of use
    b. Interpretation

The Modified CNR system uses a series of curves to develop a noise-level ranking based on sound pressure level and frequency as shown in Figure 2.3-32. These rankings are adjusted for background noise according to the curves shown in Figure 2.3-33 and for temporal and seasonal variations, intermittency of noise, noise character, and previous exposure and community attitude by applying the correction factors listed in Table 2.3-54. Corrections either add (+) or subtract (-) from the initial noise-level ranking. The community response is evaluated based upon the expected community reaction to the noise source as shown in Figure 2.3-34. The Modified CNR system was used as an additional technique to evaluate the impacts of the project.

2.3.8.2 Noise Measurements

A noise survey was conducted on March 8 and 9, 1989, at the Lauderdale Plant site. The objectives of the survey were to determine ambient noise levels at the plant's property boundary and nearby receptors and to obtain source noise levels for the plant equipment. These objectives were accomplished by collecting two different types of noise measurement data during the survey:

1. Sound-level measurements at eight locations around the Lauderdale Plant site property boundary and in adjoining residential areas.
2. Octave band analysis of major plant noise sources within the plant boundaries.

The subsections that follow present the equipment, procedures, monitoring locations, and results of the survey. The noise survey did not address any OSHA-regulated workplace noise levels.

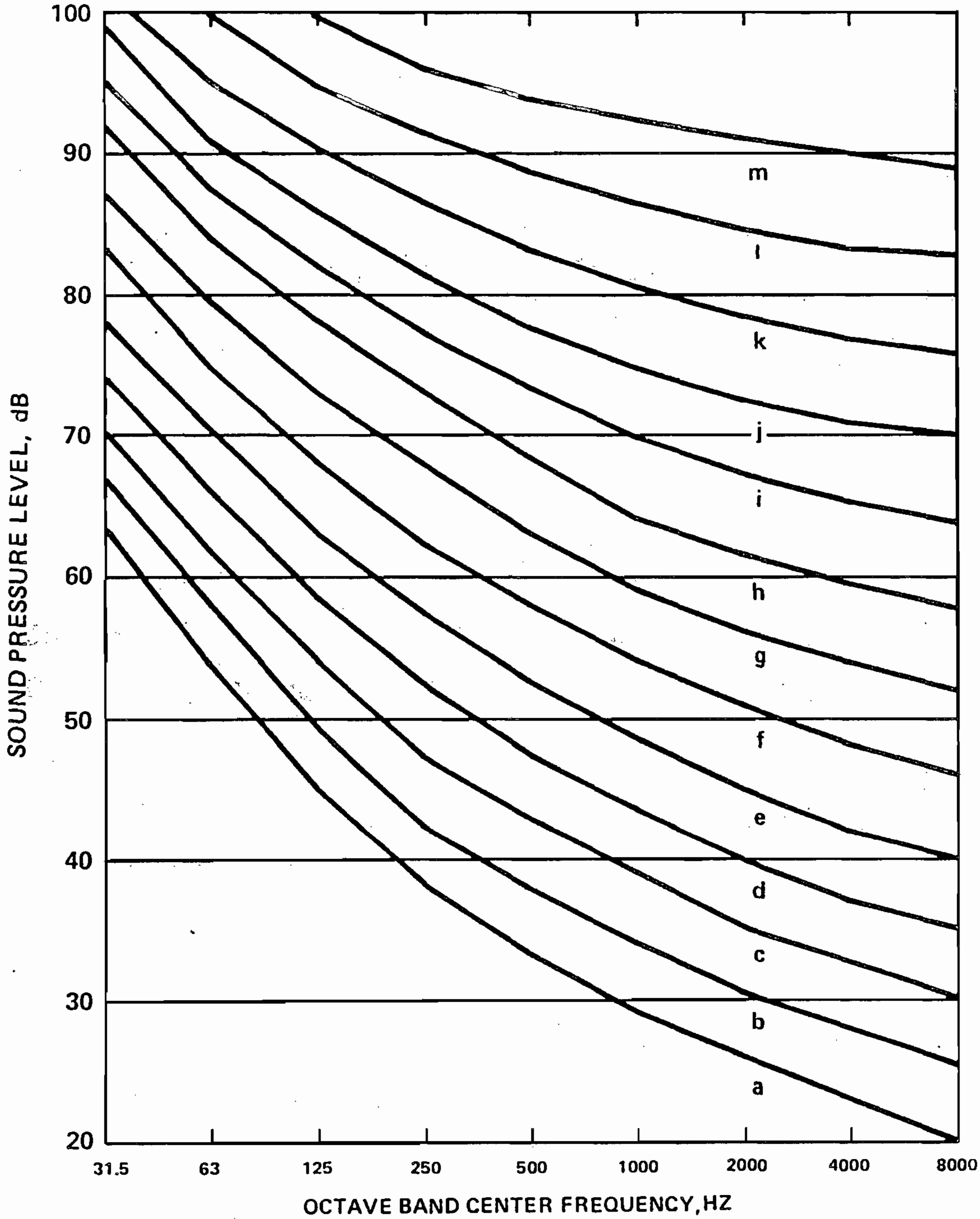

Figure 2.3-32 NOISE LEVEL RANK CURVES FOR MODIFIED CNR SYSTEM

SOURCE: EEI, 1984.

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FPL

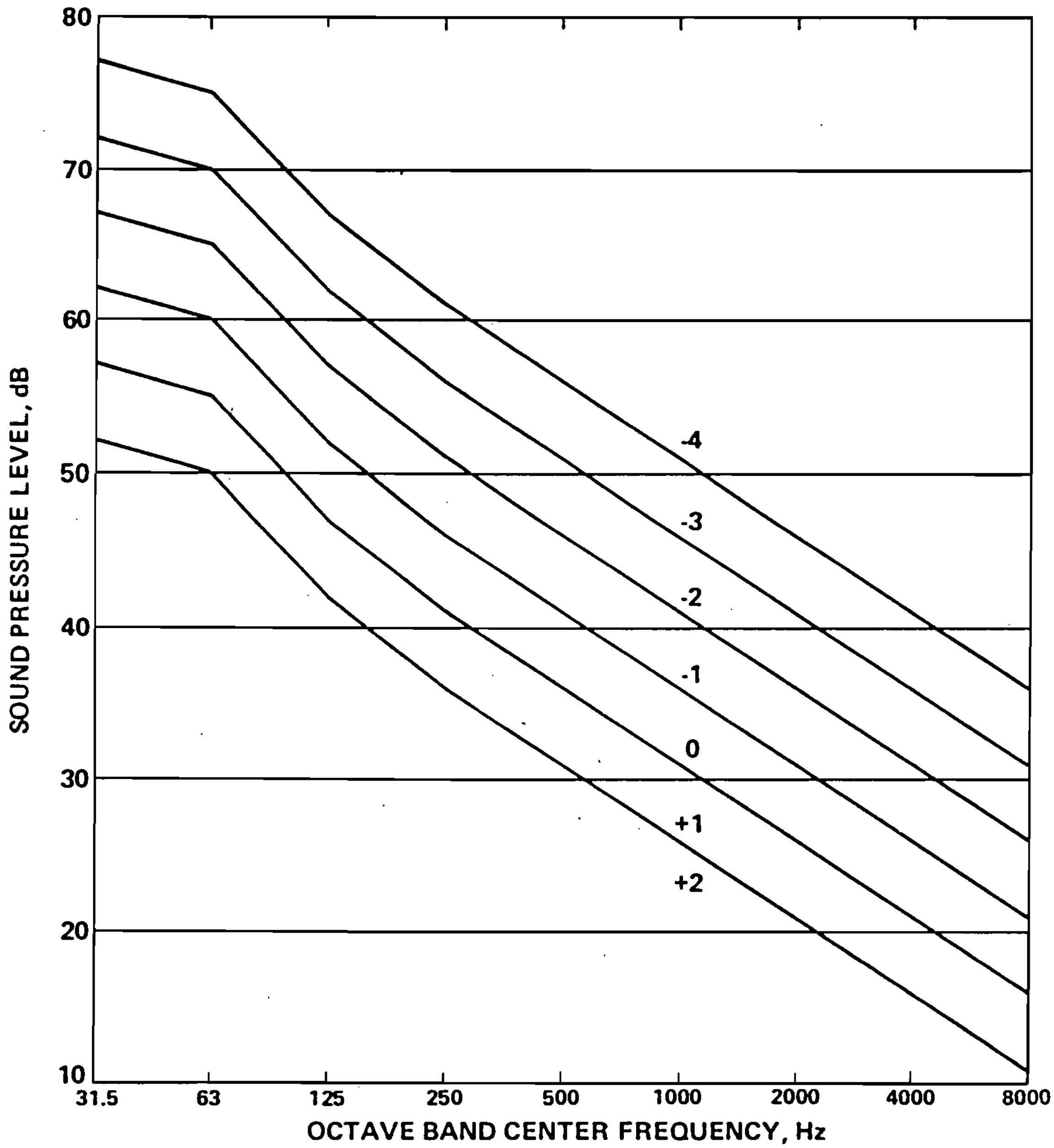

Figure 2.3-33 BACKGROUND NOISE CURVES FOR MODIFIED CNR SYSTEM

SOURCE: EEI, 1984.

Lauderdale Repowering Project

FPL

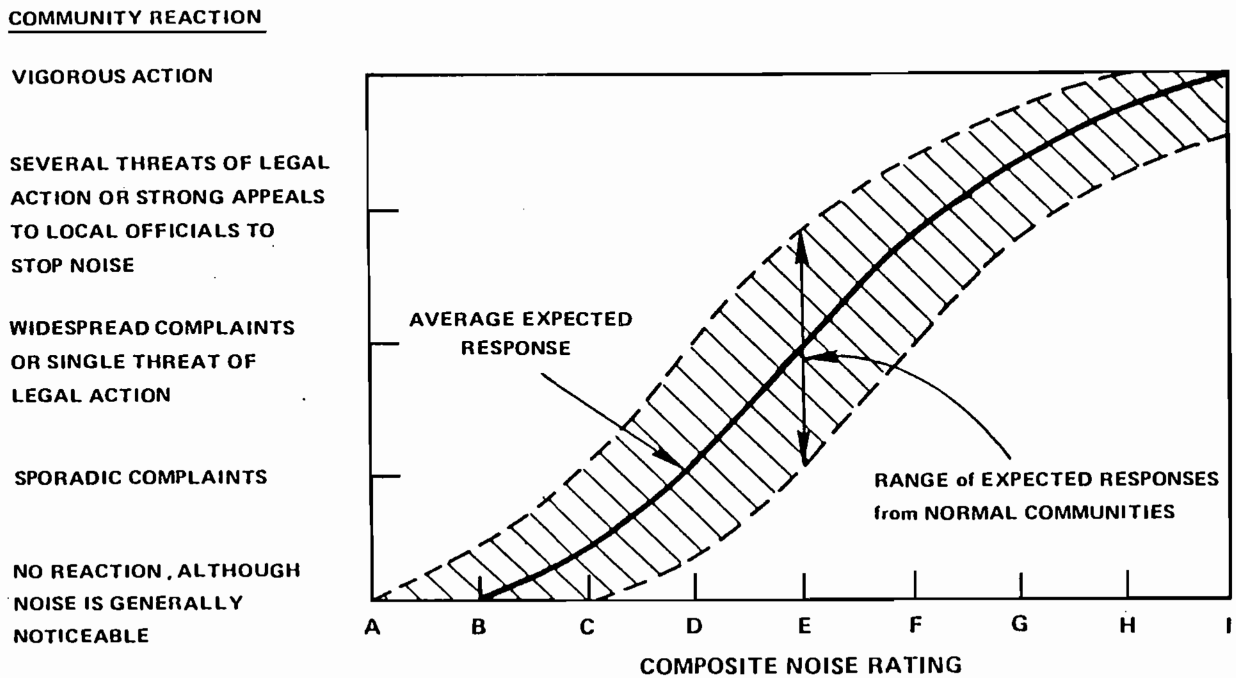

Figure 2.3-34 ESTIMATED COMMUNITY RESPONSE VERSUS COMPOSITE NOISE RATING

SOURCE: EEI, 1984.

Lauderdale Repowering Project

FPL

Table 2.3-54. Correction Factors for Determining the Modified Composite Noise Rating

1.	Correction for temporal and seasonal factors (for full-time plant activity, the total correction here is 0)	
	a. Daytime only	-1
	Nighttime (2200 to 0700 hrs)	0
	b. Winter only	-1
	Summer	0
	c. Intermittency: ratio of source "on" time to reference time period	
	$2 \log \frac{\text{source "on" time}}{\text{reference period}} = n$	
	1.00 - 0.57	0
	0.56 - 0.18	-1
	0.17 - 0.06	-2
	0.05 - 0.018	-3
	0.017 - 0.0057	-4
	0.0056 - 0.0018	-5
2.	Correction for character of noise	
	a. Noise is very low frequency	+1
	b. Noise contains tonal components	+1
	c. Impulsive sound	+1
3.	Correction for previous exposure and community attitude	
	a. No prior exposure or some previous exposure but poor community relations	0
	b. Some previous exposure and good community relations	+1

Source: EEI, 1984

NOISE MONITORING EQUIPMENT

The noise monitoring equipment used during the survey was as follows:

1. Continuous Noise Monitoring Equipment:
   a. Bruel & Kjaer (B&K) Type 2230 Precision Integrating Sound-Level Meter
   b. B&K Type 2639 Microphone Preamplifier
   c. B&K Type 4155 Prepolarized Condenser Microphone
   d. Primeline Model 6723 Two-Pen Portable Strip Chart Recorder
   e. Windscreen, tripod, and various cables
2. Octave-Band Sound-Level Monitoring Equipment
   a. Continuous noise monitoring equipment noted above
   b. B&K Type 1625 One-Third-Octave and Full-Octave Filter Set
3. Sound-Level Meter Calibration Unit
   a. B&K Type 4230 Sound-Level Calibrator (94 dB @ 1,000 Hz)

The B&K Type 2230 sound-level meter complies with Type I - Precision requirements set forth by the American National Standards Institute (ANSI) S1.4 for sound-level meters. The specifications for this equipment are presented in Appendix 10.5.6.

NOISE MEASUREMENT PROCEDURES

Monitoring was conducted using the procedures specified by ANSI. The continuous ambient noise monitoring was performed using fast-response mode to obtain A-weighted sound levels. A windscreen was used since all measurements were taken outside. Random incidence response as specified by ANSI was used for microphone positions. A continuous record of the output data was made on the strip chart during all monitoring. Hourly data were collected at each location and consisted of four noise parameters:

L_{eq}--The sound pressure level averaged over the 1-hour measurement period; this parameter represents the continuous steady sound pressure level which would have the same total acoustic energy as the real fluctuating noise over the same time period.

Maximum--The maximum sound pressure level observed during the 1-hour sampling period.

Minimum--The minimum sound pressure level observed during the 1-hour sampling period.

SEL--The sound exposure level (SEL) is the constant level which, if maintained for a period of 1 second, would have the same acoustic energy as the A-weighted measured noise event.

Monitoring was conducted using the sound-level meter mounted on a tripod at a height of 4 ft abovegrade. An output cable connected the sound-level meter with the strip chart recorder. The strip chart recorder was located away from the sound-level meter so that the time of day and comments could be recorded without disturbing or influencing the sound-level meter during sampling. Field notes were recorded during monitoring and included identifying meteorological conditions and major noise sources.

The B&K Type 2230 sound-level meter and the B&K Type 1625 octave band analyzer, which are designed to be connected and operated as a single unit, were used to measure source noise characteristics. This system setup permitted the measurement and recording of octave band sound pressure levels. Both instrument systems were calibrated at the beginning and at the end of each sampling period using the B&K Type 4230 sound-level calibrator. All calibrations were within 0.1 dBA of the reference sound level.

NOISE MONITORING LOCATIONS AND SCHEDULE

Four noise monitoring sites were located around the southern property boundaries of the Lauderdale Plant site and four monitoring sites were located in the residential area south of the site. The noise monitoring locations are shown on Figure 2.3-35. Sites P1, P2, P3 and P4 were located along the southern boundary of the site. Site A2 was located at 4409 S.W. 35th Street, 0.65 km southeast of the plant. Site A4 was located in Davis Isles south of the plant. Site A7 was located in Hills Mobile Home Park (39th Avenue) directly south of the plant. Site A9 was located at S.W. 42nd Street at the plant gate.

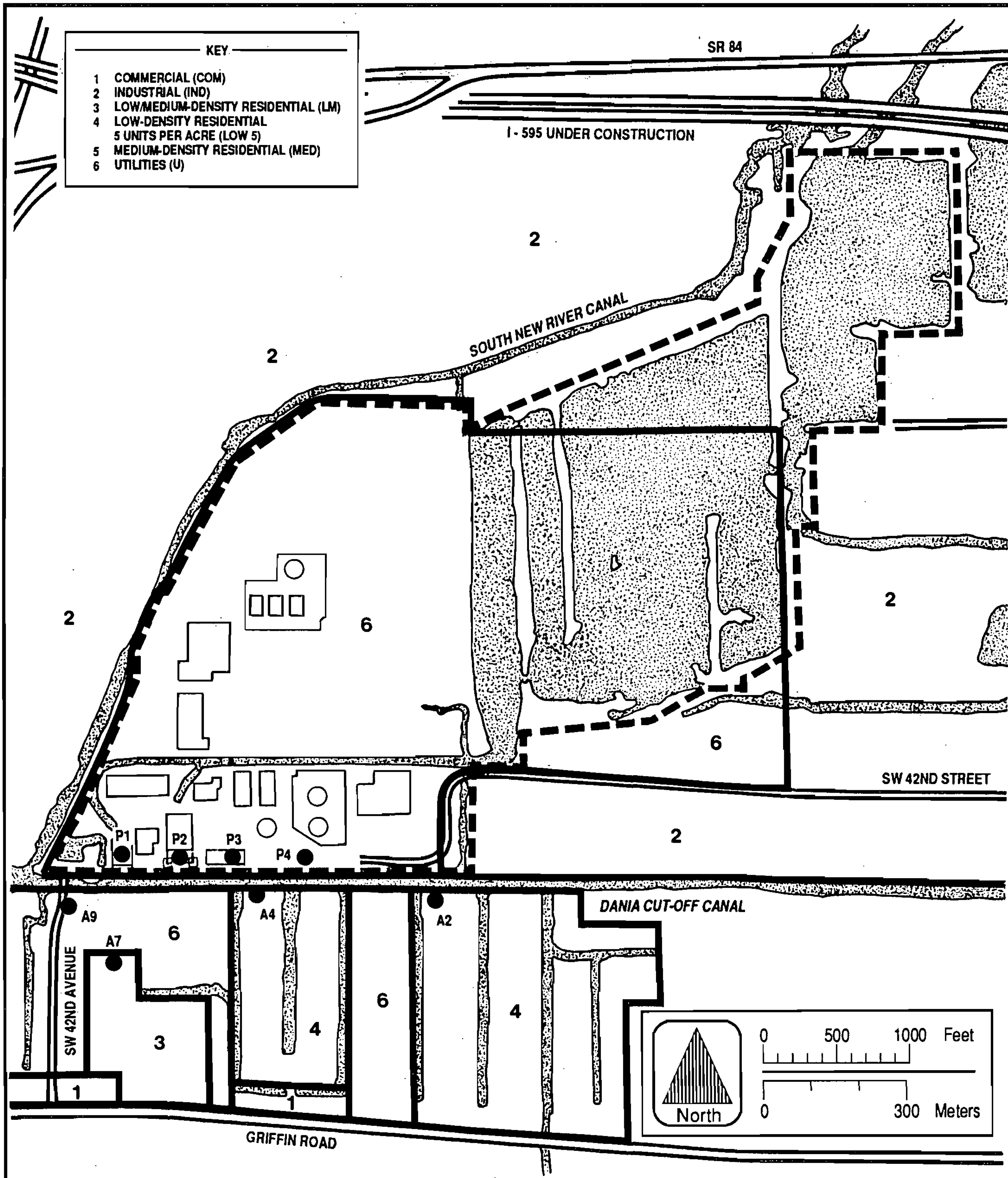

Figure 2.3-35 NOISE MONITORING LOCATIONS AND RECEIVING LAND USE

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FPL

Noise monitoring was conducted to obtain 10-minute readings during daytime (i.e., 7:00 a.m. to 10:00 p.m.), and one nighttime average. Four daytime measurements were taken at sites P1 through P4, and eight daytime measurements were taken at Sites A2, A4, A7 and A9. Nighttime measurements, i.e., after 10:00 p.m., were taken at Sites P2 and P3.

Three noise sources located at the Lauderdale Plant site were identified for octave band analysis. The sources consisted of Unit 4 and several high-voltage transformers. Unit 4 was operating during the noise measurement period. Noise measurements were recorded for a sufficient time to obtain the maximum steady state noise levels from the source.

RESULTS

The results of the ambient sound-level survey are presented in Table 2.3-55. This table presents minimum, maximum L_{eq}, and SEL sound pressure levels, expressed in dBA, observed at the monitoring sites.

Based on a review of the strip charts, the minimum SPL represents the baseline conditions in the vicinity of the plant. These minimum SPLs exclude intermittent and transitory sources such as aircraft, vehicular traffic, birds, and other similar noise sources. These values were used to describe the baseline conditions exclusive of the major sources, i.e., aircraft and vehicles, which are specifically excluded by the Broward County regulations. In Sections 4.6.1 and 5.7, the minimum SPL is referred to as the background SPL.

The maximum SPLs for the on-property monitoring locations ranged from 97.0 dBA at Site P4 during the morning to 58.3 dBA at Site P2 during the night. The maximum SPLs for the residential sites ranged from 92.4 dBA during the afternoon at Site A4 to 70.5 dBA, also at Site A4 during the afternoon.

Table 2.3-55. Noise Monitoring Study Results (Page 1 of 3)

Site	Date	Start Time	Sound Pressure Levels (dBA) Minimum	Maximum	L_{eq}	SEL
P1	3/8/89	1337	57.6	78.6	60.7	88.4
	3/8/89	1353	58.6	89.4	68.4	96.1
	3/8/89	1404	58.0	74.9	60.5	88.2
	3/8/89	1416	57.2	95.2	72.0	99.7
	Background[a]		57.2			
	Maximum			95.2		
	Average L_{eq}				68.0	
	3/8/89	2229	51.4	83.5	64.3	92.0
	3/8/89	2240	49.4	81.4	59.9	87.6
	3/8/89	2251	49.7	90.7	61.7	89.5
	Background[a]		49.4			
	Maximum			90.7		
	Average L_{eq}				62.3	
P2	3/8/89	0930	55.7	67.7	57.9	85.8
	3/8/89	0948	55.7	88.4	67.7	95.4
	3/8/89	0959	56.4	84.1	64.5	92.2
	3/8/89	1010	56.9	87.7	68.2	95.9
	Background[a]		55.7			
	Maximum			88.4		
	Average L_{eq}				66.0	
	3/8/89	2312	46.9	62.7	49.2	76.9
	3/8/89	2350	46.8	58.3	48.5	76.2
	3/9/89	0001	46.5	60.9	49.3	76.9
	Background[a]		46.5			
	Maximum			62.7		
	Average L_{eq}				49.0	

Table 2.3-55. Noise Monitoring Study Results (Page 2 of 3)

Site	Date	Start Time	Sound Pressure Levels (dBA) Minimum	Maximum	L_{eq}	SEL
P3	3/8/89	1033	55.2	67.8	58.4	86.3
	3/8/89	1107	54.2	77.0	60.2	88.0
	3/8/89	1056	55.0	82.7	63.0	90.7
	3/8/89	1118	55.5	87.5	65.2	93.0
	Background[a]		54.2			
	Maximum			87.5		
	Average L_{eq}				62.5	
	3/9/89	0034	46.8	67.2	50.6	78.4
	3/9/89	0045	46.5	64.5	48.9	76.6
	Background[a]		46.5			
	Maximum			67.2		
	Average L_{eq}				49.8	
P4	3/8/89	1141	55.2	89.7	66.0	93.7
	3/8/89	1153	55.0	97.0	76.5	104.3
	3/8/89	1204	55.5	96.6	76.1	103.8
	3/8/89	1215	54.8	94.1	74.2	101.9
	Background[a]		54.8			
	Maximum			97.0		
	Average L_{eq}				74.6	
A2	3/8/89	1842	48.4	89.3	69.0	96.9
	3/8/89	1854	48.9	81.1	62.5	90.2
	3/8/89	1904	48.8	88.9	69.1	96.4
	3/8/89	1915	48.8	89.9	71.5	91.1
	3/9/89	1429	49.7	80.1	60.5	88.2
	3/9/89	1440	49.2	89.7	71.1	99.0
	3/9/89	1450	49.1	74.0	55.3	83.0
	Background[a]		48.4			
	Maximum			89.7		
	Average L_{eq}				68.2	

Table 2.3-55. Noise Monitoring Study Results (Page 3 of 3)

Site	Date	Start Time	Sound Pressure Levels (dBA) Minimum	Maximum	L_{eq}	SEL
A4	3/8/89	1748	51.7	92.4	71.2	98.9
	3/8/89	1758	52.4	87.2	69.2	97.1
	3/8/89	1809	52.6	75.8	58.5	86.0
	3/8/89	1819	52.2	86.1	66.4	94.1
	3/9/89	1117	52.9	70.5	56.8	84.5
	3/9/89	1128	52.8	70.7	58.1	85.8
	3/9/89	1140	51.6	83.5	63.6	91.5
	Background[a]		51.6			
	Maximum			92.4		
	Average L_{eq}				66.3	
A7	3/8/89	1533	53.4	86.2	67.7	95.6
	3/8/89	1546	52.8	82.7	62.6	90.6
	3/8/89	1558	52.5	86.4	63.0	90.8
	3/8/89	1608	53.3	88.4	69.1	96.8
	3/9/89	1207	50.2	73.0	56.6	84.4
	3/9/89	1219	51.0	90.8	66.8	94.6
	3/9/89	1229	51.2	91.3	68.8	96.5
	Background[a]		50.2			
	Maximum			91.3		
	Average L_{eq}				66.4	
A9	3/8/89	1634	51.5	87.5	66.5	94.2
	3/8/89	1645	49.9	77.7	59.8	87.2
	3/8/89	1706	49.0	72.6	53.8	80.5
	3/8/89	1718	49.2	90.8	68.1	95.8
	3/9/89	1030	49.4	70.2	53.2	80.9
	3/9/89	1042	49.9	90.4	57.8	95.9
	3/9/89	1054	48.6	71.0	53.0	80.7
	Background[a]		48.6			
	Maximum			90.8		
	Average L_{eq}				62.7	

[a]Minimum.

The background SPLs, measured at the plant's property line, varied from 46.5 dBA at Sites P2 and P3 during the night to 58.6 dBA at Site P1 during the afternoon. The residential sites' background SPLs ranged from 48.4 dBA at Site A2 to 53.4 dBA at Site A7.

The major contributing sources in the area are aircraft, with minor contributions by boat traffic on the Dania Cut-Off Canal and normal vehicular traffic on and off the plant site. The maximum SPLs at all sites were mainly influenced by aircraft (take-offs and landings) from nearby Fort Lauderdale-Hollywood International Airport during the daytime and early evening. In contrast, late night aircraft traffic was significantly reduced and therefore the nighttime SPLs were also reduced. The nighttime L_{eq} values were more than 10 dBA lower than the daytime L_{eq} values at Sites P2 and P3. The differences between daytime and nighttime L_{eq} values at Site P1 are much less dramatic due to wind-generated noise during both monitoring periods.

Average L_{eq} levels were calculated for each site based on the collected data and were used in the impact analysis and the modified Composite Noise Rating scheme.

The data indicate that the minimum or background SPLs in the residential areas are within the Broward County sound level limit of 55 dBA. Since the Lauderdale Plant was operating during the monitoring period, the results suggest that the noise generated by the plant meets the applicable Broward County standards. Average L_{eq} levels in the residential areas ranged from 62.7 dBA at Site A9 to 68.2 dBA at Site A2. These values are above the Broward County sound level limits but, as previously described, are due to aircraft noise which are exempt from the county's noise limits.

2.3.9 Other Environmental Features

As an existing generating plant in the FPL system, the Lauderdale Plant has ongoing programs of renovation and upgrading existing facilities that will be initiated prior to commencement of construction of the Lauderdale

Repowering Project. In addition, in order to provide a smooth transition from the existing plant to the construction of the repowered units, certain existing facilities will be removed or relocated. These activities will not alter the physical environment or ecology of the site. These renovating and upgrading activities involve changes to the existing transmission, fuel, security, stores, and parking facilities.

To improve system reliability, FPL is currently implementing transmission improvements at the existing 69 kV, 138 kV, and 230 kV substation yards and associated transmission lines. These transmission improvements are:

1. Modification of the 138 and 230 kV facilities on existing property;
2. Retirement of the existing 69 kV substation yard; and
3. Relocation of existing 69 kV, 138 kV, and 230 kV lines and generator terminals and their associated transmission lines.

The in-service date for these improvements is June 1992.

In addition, FPL is currently implementing plans for a transmission interconnection to the SBCRRP facility. The in-service date for this transmission interconnection is scheduled for November 1990.

Florida Gas Transmission Company (FGT) is planning to add a new natural gas line to serve the site. This line will be connected to two natural gas laterals which supply gas to the Port Everglades plant. One of the laterals currently exists, and the second is undergoing Federal Energy Regulatory Commission (FERC) review. Both laterals follow an existing easement along the northern boundary of the Lauderdale Plant site. The new gas line from these laterals will be connected to the Lauderdale Plant and will follow an existing road and end at a pressure-reducing station near the north gas turbines site (see Figure 2.3-36).

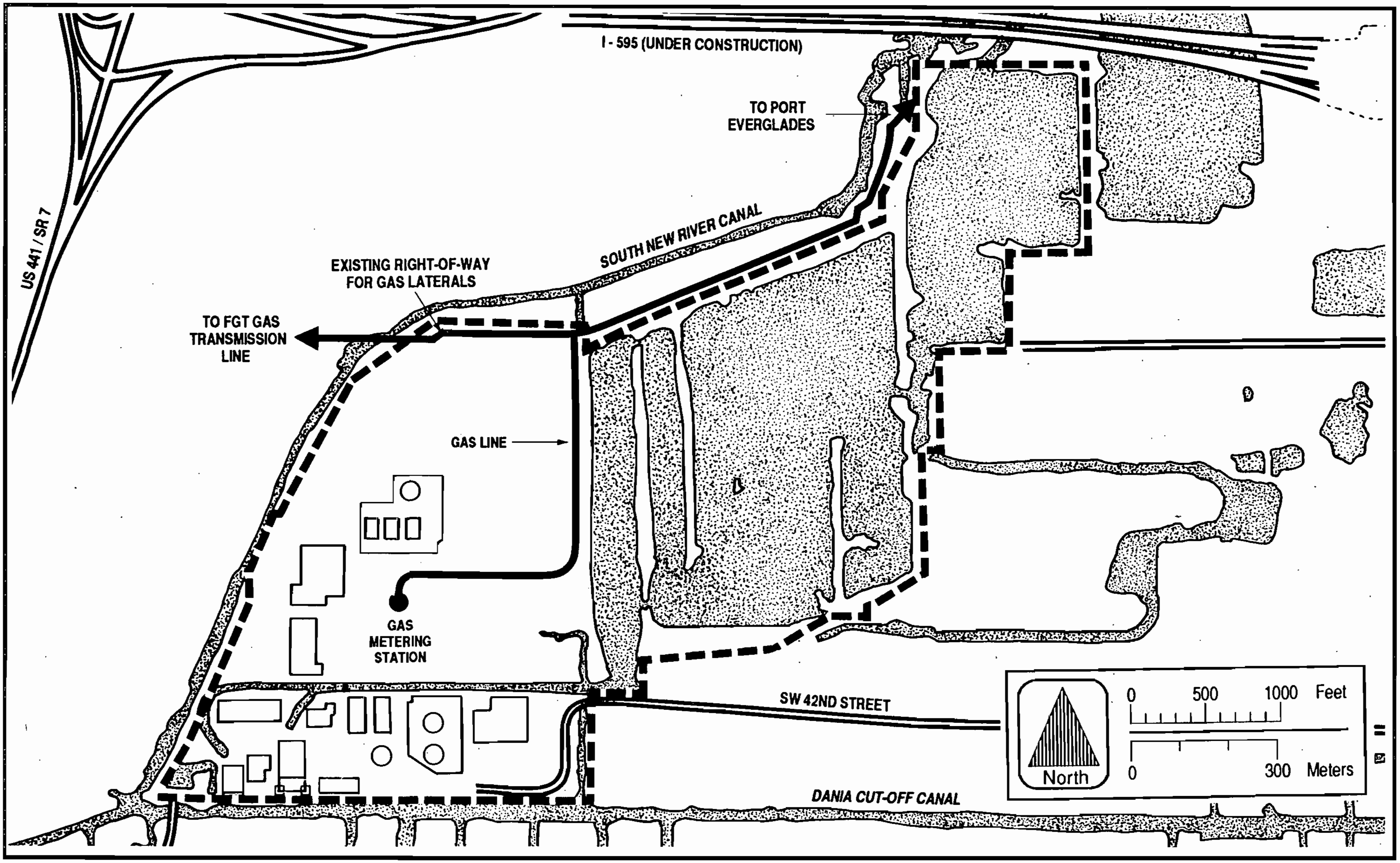

Figure 2.3-36 LOCATION OF GAS LINE

Lauderdale Repowering Project

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The eastern boundary of the Lauderdale Plant site may be fenced. A new stores warehouse will be constructed near the existing south GT site to handle the plant's spare parts storage needs. A new parking lot will be added in an area north of the old intake. The warehouse and parking lot are shown in Figure 2.3-37.

Facilities that will be removed include the No. 4 fuel tank, lunch pavilion, and the east parking lot. The asphalt removed from the east parking lot will be recycled.

The facilities that will be relocated include the natural gas line to the GTs, condensate water line, service air lines, fuel oil (No.2) line to the gas turbine area, service water and air lines, metal cleaning sump, underground gasoline storage tanks, pump and piping, fire system power supply cables and mains, and auxiliary cooling water lines.

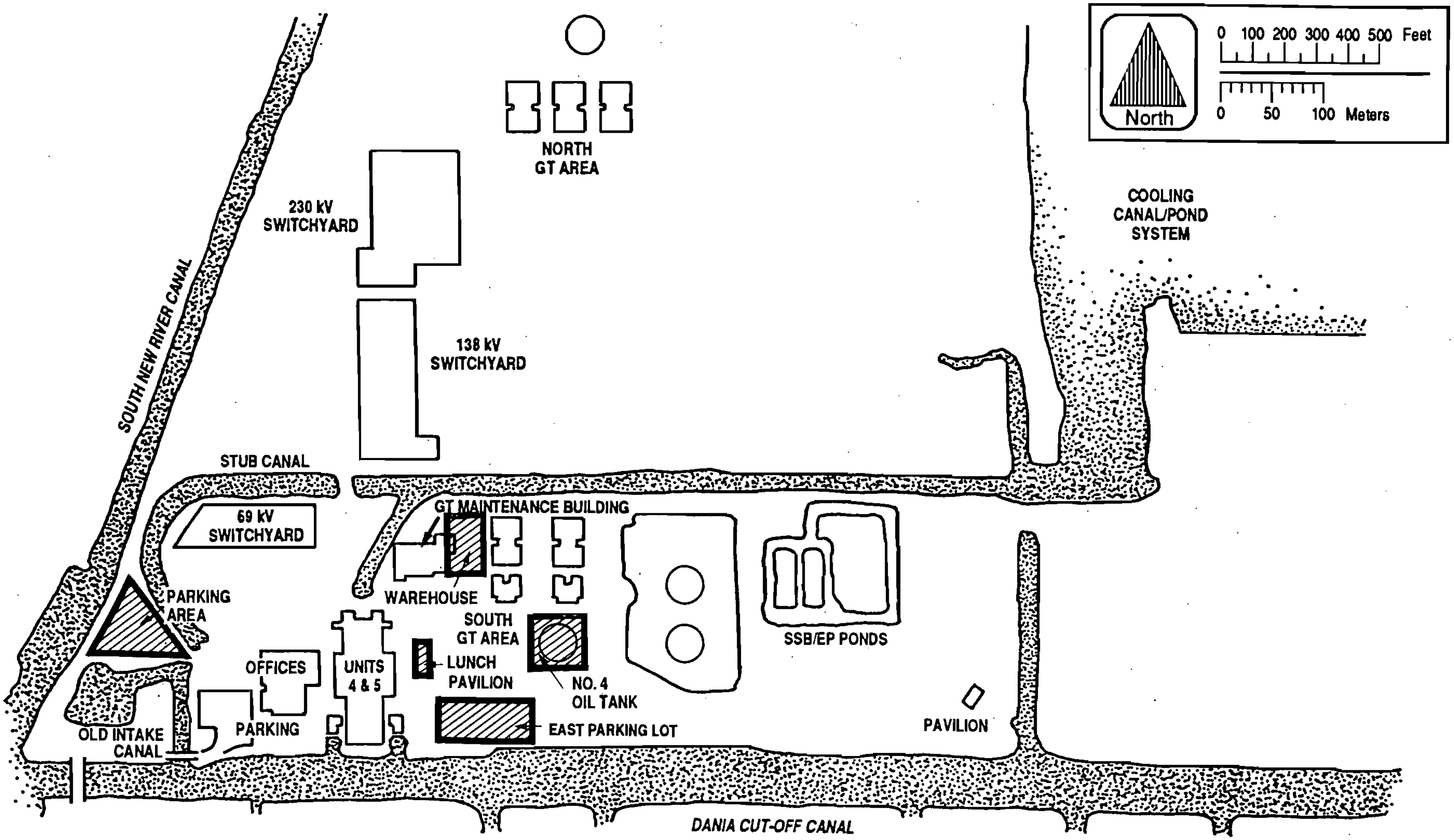

Figure 2.3-37 LOCATIONS OF RENOVATING AND UPGRADING ACTIVITIES

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Lauderdale Repowering Project

Site Certification Application

Chapter 3

The Plant And Directly Associated Facilities

TABLE OF CONTENTS

TABLE OF CONTENTS
(Continued)

TABLE OF CONTENTS
(Continued)

LIST OF TABLES

LIST OF FIGURES

LIST OF FIGURES
(Continued)

3.0 THE PLANT AND DIRECTLY ASSOCIATED FACILITIES

3.1 BACKGROUND

FPL plans to repower Units 4 and 5 of its Lauderdale Power Plant, located near Fort Lauderdale in Broward County. Repowering will increase the net winter generating capacity of the plant from 1,248 MW to approximately 1,932 MW (an increase of 684 MW). This represents an important addition to power generation in southern Florida, an area where power demands are increasing rapidly.

"Repowering" means that some of the existing components or systems from Units 4 and 5 will be retained (such as the electrical generators, steam turbines, condensers, and cooling water system) but that the oil/gas-fired steam generator in each unit will be replaced with CTs and HRSGs. The HRSGs will use the otherwise wasted heat from the CTs. This results in a combined cycle plant which is much more efficient than the existing plant.

Repowering an existing oil- or gas-fired steam electric generating unit is an attractive alternative to building an entirely new plant because repowering is more economical and minimizes environmental impacts. Using the existing Lauderdale Plant site, as opposed to an undeveloped site, offers the following environmental advantages:

1. No new transmission line rights-of-way will be required,
2. Natural gas and light oil line rights-of-way already exist,
3. The existing cooling water system can be utilized,
4. The existing plant land area and infrastructure can be utilized, and
5. New wastewater treatment system will reduce discharges to groundwater.

During repowering, each unit's steam generator and four of the existing feedwater heaters will be replaced by two advanced CTs and associated HRSGs (one per CT). In general, advanced CTs can be distinguished from their traditional counterparts by virtue of their higher power output, higher firing temperatures, advanced internal cooling technologies, improvements in aerodynamic and structural design features involving turbine design, generator design, combustion liner design and compressor design, and, lastly, their usage of combustion technologies which minimize NO_x emissions. The HRSGs will be augmented with the addition of supplementary firing (SF). SF is a relatively easy means of increasing the heat content of the CT exhaust gas using a grid of burner elements positioned perpendicular to the exhaust flow of the CT. Each CT and its associated SF duct burners will exhaust through a single stack located at its associated HRSG.

The CTs and accessories will be placed in an elevated pedestal arrangement inside an enclosure with insulated walls. The enclosure will provide a cost-effective means of noise attenuation at the plant.

Condenser cooling water will continue to be withdrawn from the Dania Cut-Off Canal, flow through the existing open cycle cooling canal/pond system, and discharge to the South Fork New River. Well water from the existing on-site wells will be used as influent for the proposed new water treatment system. Larger open cooling water pumps will be installed in the present intake structures so that water from the Dania Cut-Off Canal can be used for cooling auxiliary plant equipment. This use of surface water will allow a reduction in the usage of groundwater for cooling purposes.

3.2 SITE LAYOUT

The conceptual layout of the Lauderdale Repowering Project area, referred to as the power block area, is shown in Figure 3.2-1. The conceptual design upon which the layout is based includes two advanced CTs for each repowered unit, one SF HRSG for each CT, one stack per HRSG, and a once-through condenser cooling water system. Each set of two CTs and two HRSGs will replace one existing steam generator.

The release point for thermal liquids will remain at the existing circulating water discharge structure, as shown on Figure 3.2-1, and will be essentially at ground level. Similarly, the non-thermal liquid release from the wastewater treatment system will be into the circulating water discharge canal (Figure 3.2-2). A new stormwater release point to the Dania Cut-Off Canal is also shown on Figure 3.2-1. The new release points for air emissions will be the four stacks, as shown on Figure 3.2-1, each 150 ft high, at about elevation 159 ft msl. These stacks will replace the two existing 150-ft tall stacks currently serving Units 4 and 5.

The CTs and accessories will be located in an environmental enclosure with an elevated pedestal arrangement. This enclosure was chosen to provide noise attenuation. This arrangement will also provide maintenance personnel a dry work environment during inclement weather, adequate laydown area and equipment maintenance access, and direct access from the operating floor to the control room.

The enclosure exterior walls will be constructed of insulated metal siding. This type of wall system will enhance aesthetics and still provide adequate noise attenuation to help meet acceptable noise levels at the site boundary. The enclosure will be a steel frame structure with rigid frame roof construction totally enclosing the four advanced CTs which will be located at the operating floor level. Auxiliary equipment is located at the ground level. The building arrangement is shown on Figure 3.2-3.

The enclosure will be approximately 390 ft long, 105 ft wide, and no more than 74 ft high from the ground floor to the top of the roof. It will consist of a ground floor and an operating floor. The height between the ground floor and operating floor will be approximately 24 ft. Laydown areas will be provided at the operating and ground floor levels.

The remaining portions of the power block area include the inlet air filter area (east of the CT building) and the HRSG area (west of the CT area). Although design is not yet final, the expected layout is shown in Figure 3.2-4 (HRSG area) and Figure 3.2-5 (inlet air filter area).

New on-site transmission lines will be added within the existing corridors to connect the CTs (switchyard collector bus areas east of the CTs on Figure 3.2-1) to the existing 138 and 230 kV switchyards (Figure 2.1-5) north of the discharge canal.

The areas affected by the project and included on Figure 3.2-1, and their acreages, are as follows:

Area	Acres
Runoff Pond	0.7
West Construction Laydown Area	0.7
Power Block Area	9.3
Water Treatment Area	1.1

The areas affected by the project and included on Figure 3.2-2, and their acreages, are as follows:

Area	Acres
Equalization Basin	3.0
Wastewater Treatment Area	1.5
Construction Facilities	3.2
East Construction Parking	3.7
East Construction Laydown	4.6

Approximately 3.0 acres of the 4.5 acres included in the equalization basin and in the wastewater treatment area will be utilized for construction parking/laydown before construction of those facilities commences. An additional 0.4 acre will be used only for construction parking/laydown. This 3.4-acre area is designated the central construction parking/laydown area on Figure 3.2-2.

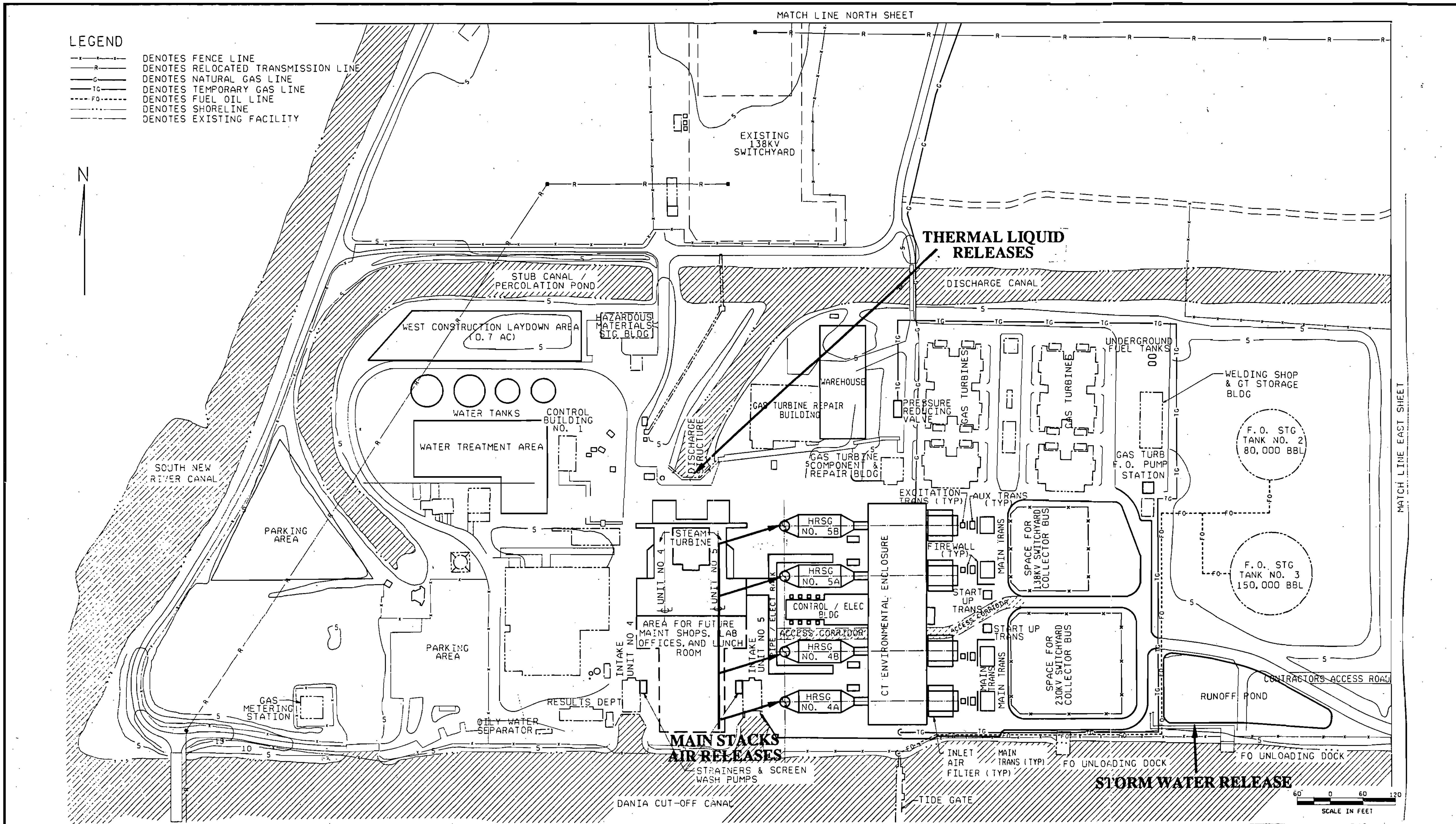

Figure 3.2-1 SITE LAYOUT POWER BLOCK AREA

Lauderdale Repowering Project

FPL

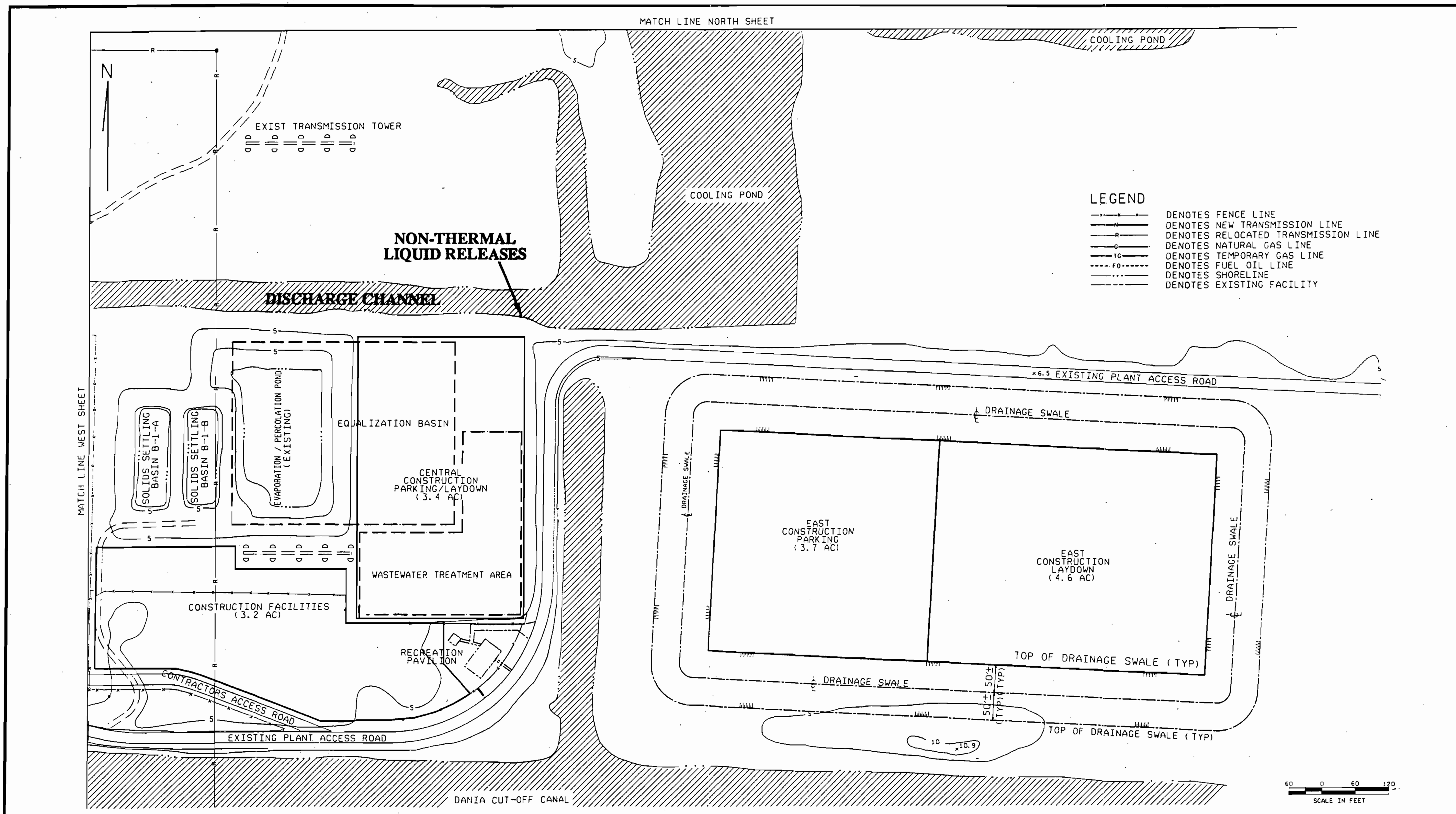

Figure 3.2-2 SITE LAYOUT EASTERN PORTION

Lauderdale Repowering Project

FPL

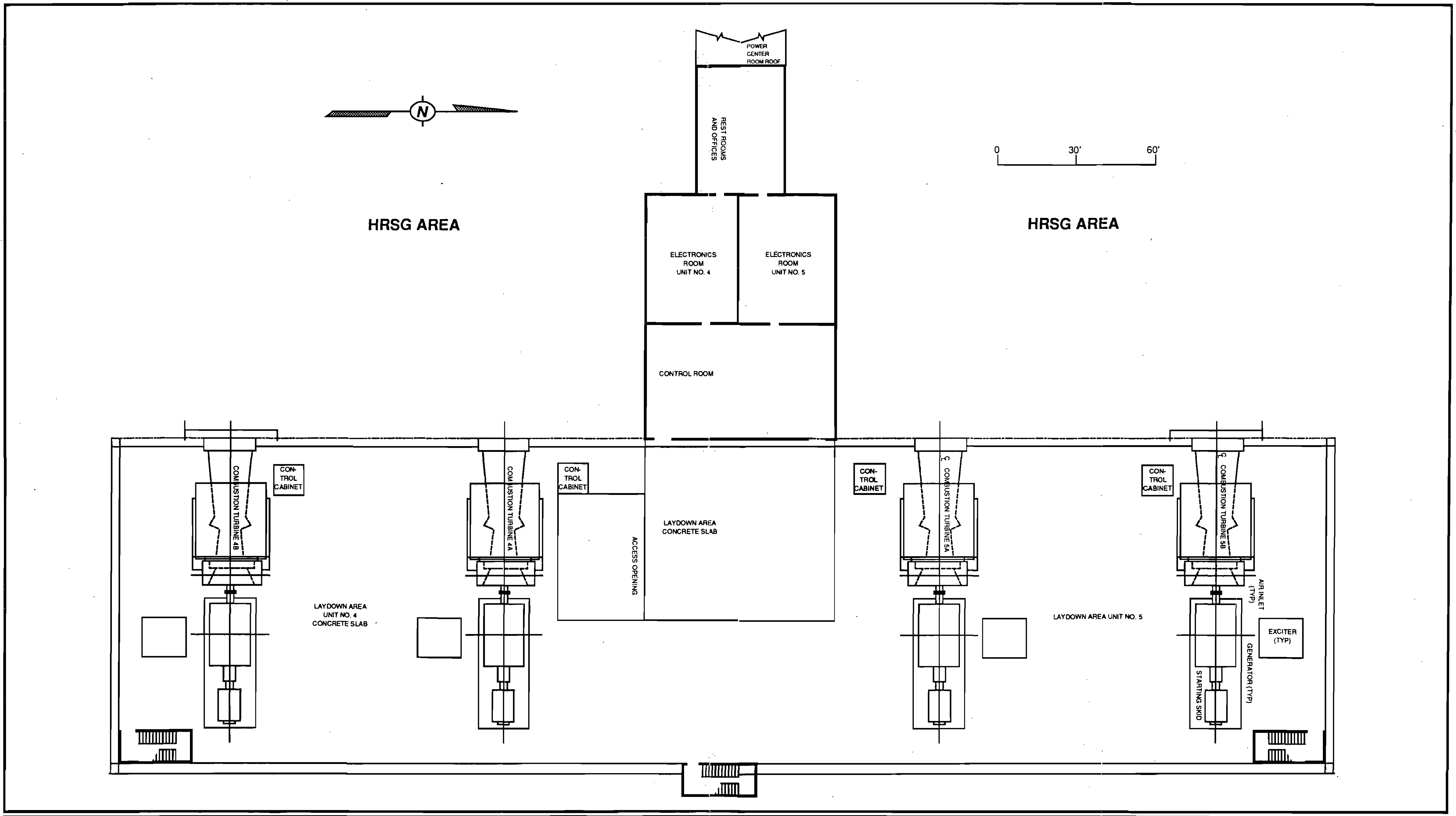

Figure 3.2-3 PLAN VIEW COMBUSTION TURBINE ENVIRONMENTAL ENCLOSURE

Lauderdale Repowering Project

FPL

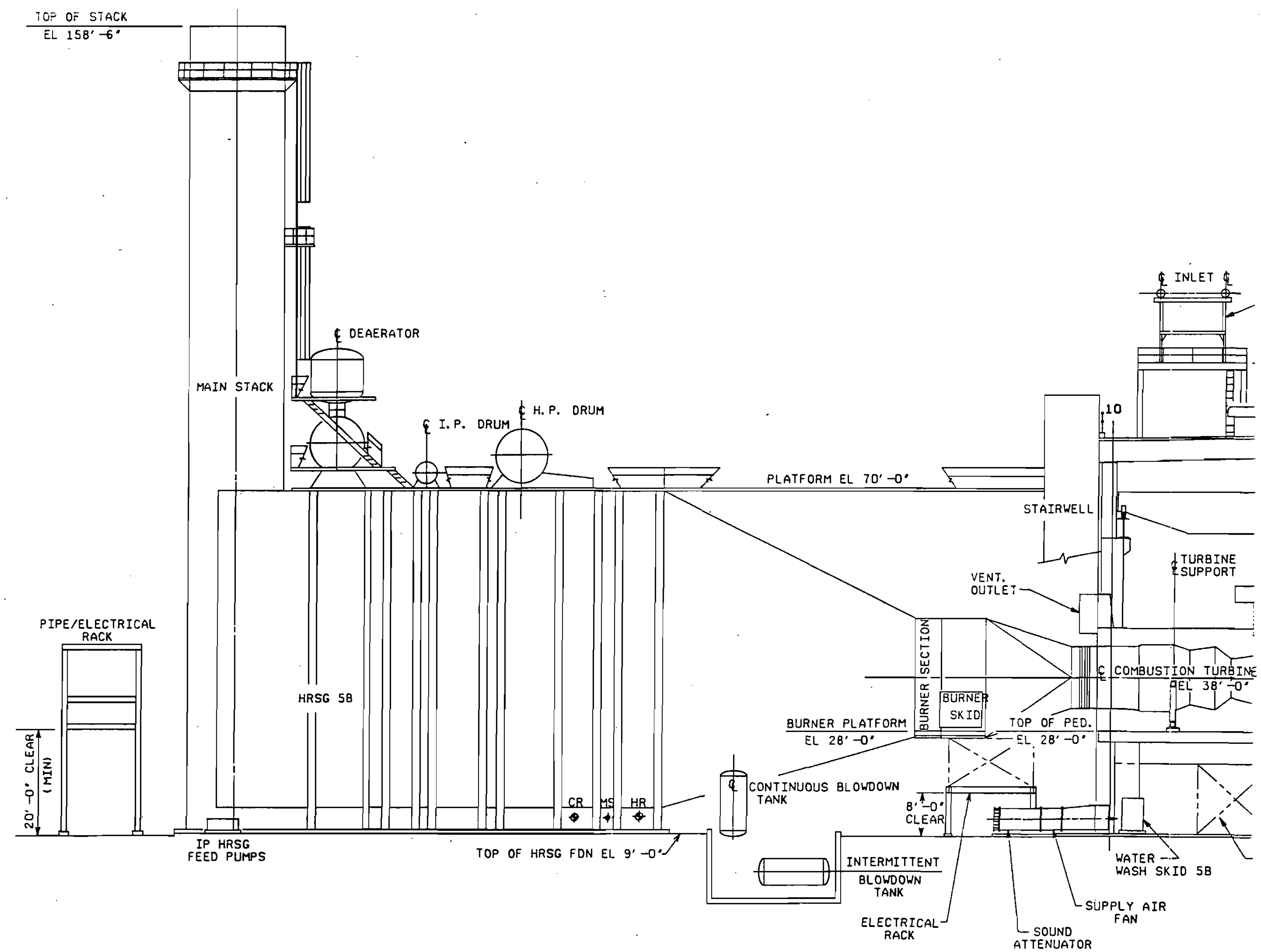

Figure 3.2-4 PROFILE OF HRSG AREA

Lauderdale Repowering Project

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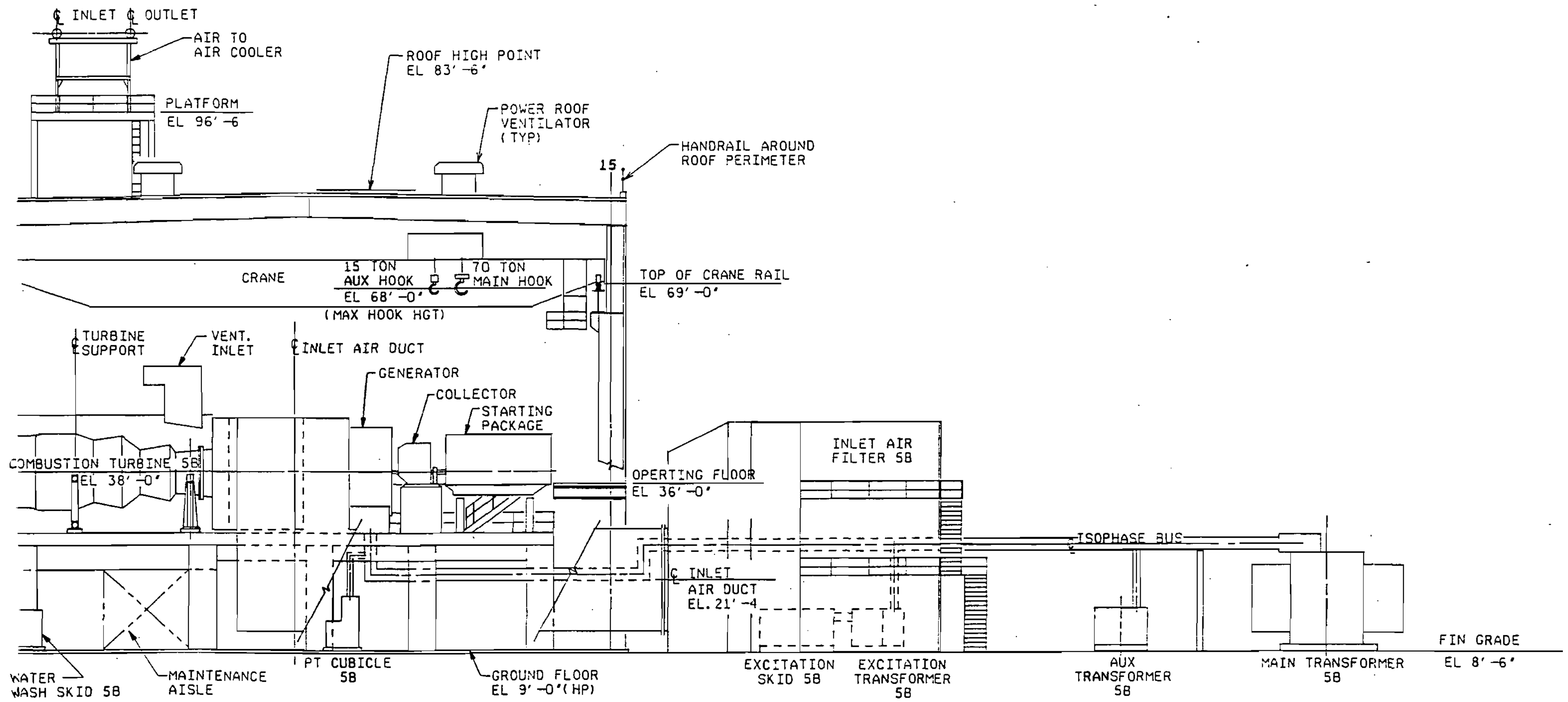

Figure 3.2-5 PROFILE OF INLET AIR FILTER AREA

Lauderdale Repowering Project

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3.3 FUEL

3.3.1 Fuel Types

The primary fuel used will be natural gas. The CTs will have No. 2 distillate fuel oil as an alternate fuel. Startup and operation of the CTs over the full load range will be possible using either fuel. The CTs can be automatically switched to fuel oil in the event that natural gas pressure is lost, and manual switching from one fuel to the other is also possible. The duct burners, which provide supplemental firing within the HRSGs, are designed to burn natural gas.

3.3.2 Quantities

Approximately 7.1 x 10^6 cubic feet per hour (ft^3/hr) of natural gas will be required for operation of the four CTs and duct burners at 100-percent load. Assuming that the plant operates at 100-percent load, the annual gas consumption would be 5.9 x 10^{10} ft^3/yr. Duct burner usage would only account for 0.3 x 10^{10} ft^3/yr of that total.

Approximately 354,000 pounds per hour (lb/hr) of No. 2 distillate fuel oil will be required for use at full load for all four CTs when natural gas is not being utilized.

3.3.3 Transportation

Natural gas will be supplied through a gas supply line from the Florida Gas Transmission Company (FGT) laterals running along the north side of the FPL property to the gas metering station located to the north of the power block area (Figure 3.3-1). The pipeline is 24 inches in diameter, 3,500 ft long, constructed of steel, operates between 300 and 950 pounds per square inch gauge (psig), and follows the route as shown on Figure 3.3-1. A new branch from that line will cross the existing discharge canal and will be routed to the CTs and duct burners as shown on Figure 3.3-2. The No. 2 distillate fuel oil will continue to be supplied by a pipeline from Port Everglades, as shown on Figure 3.3-2. The oil pipeline enters the site from the south, crossing the Dania Cut-Off Canal on the tide gate structure. The tank truck unloading connection will be maintained for possible emergency use.

The barge unloading facility is not presently being used since the Dania Cut-Off Canal is no longer able to accommodate fuel oil barges.

The FGT gas supply lateral into the plant, which enters at the southwest corner of the property, will be capped and left in place for possible future use.

3.3.4 Storage

There are currently two fuel tanks on-site containing No. 6 fuel oil. One of these has a capacity of 150,000 barrels (Tank No. 3) and the other tank has a capacity of 80,000 barrels (Tank No. 2). Both tanks will be converted to hold No. 2 distillate fuel oil for the Lauderdale Repowering Project. Both tanks are surrounded by an earthen dike which would provide containment in the event of an oil release due to tank failure. The design storage volume of the secondary containment includes room for 100 percent of the volume of the largest tank and an additional allowance for precipitation. The locations of the tanks to be used (designated as Tanks No. 2 and 3) are shown on Figure 3.3-2.

A third tank, with a capacity of 75,000 barrels, currently contains No. 2 fuel oil for the existing gas turbines. This tank is located north of the discharge canal as shown on Figure 3.3-1 (designated as Tank No. 5). Piping will be installed so that this tank can serve as a backup source of fuel oil for the CTs. This tank is surrounded by an earthen dike which would provide similar containment to that described for Tanks No. 2 and 3 in the event of an oil release due to tank failure.

3.3.5 Quality

Fuel quality estimates supplied herein are projected based on specifications compiled from ASTM D-396 Table 1 "Detailed Requirements for Fuel Oils," testing performed by the FPL Power Resources Laboratory on No. 2 distillate fuel oil and natural gas received at FPL's power plants, and from vendor information supplied to FPL.

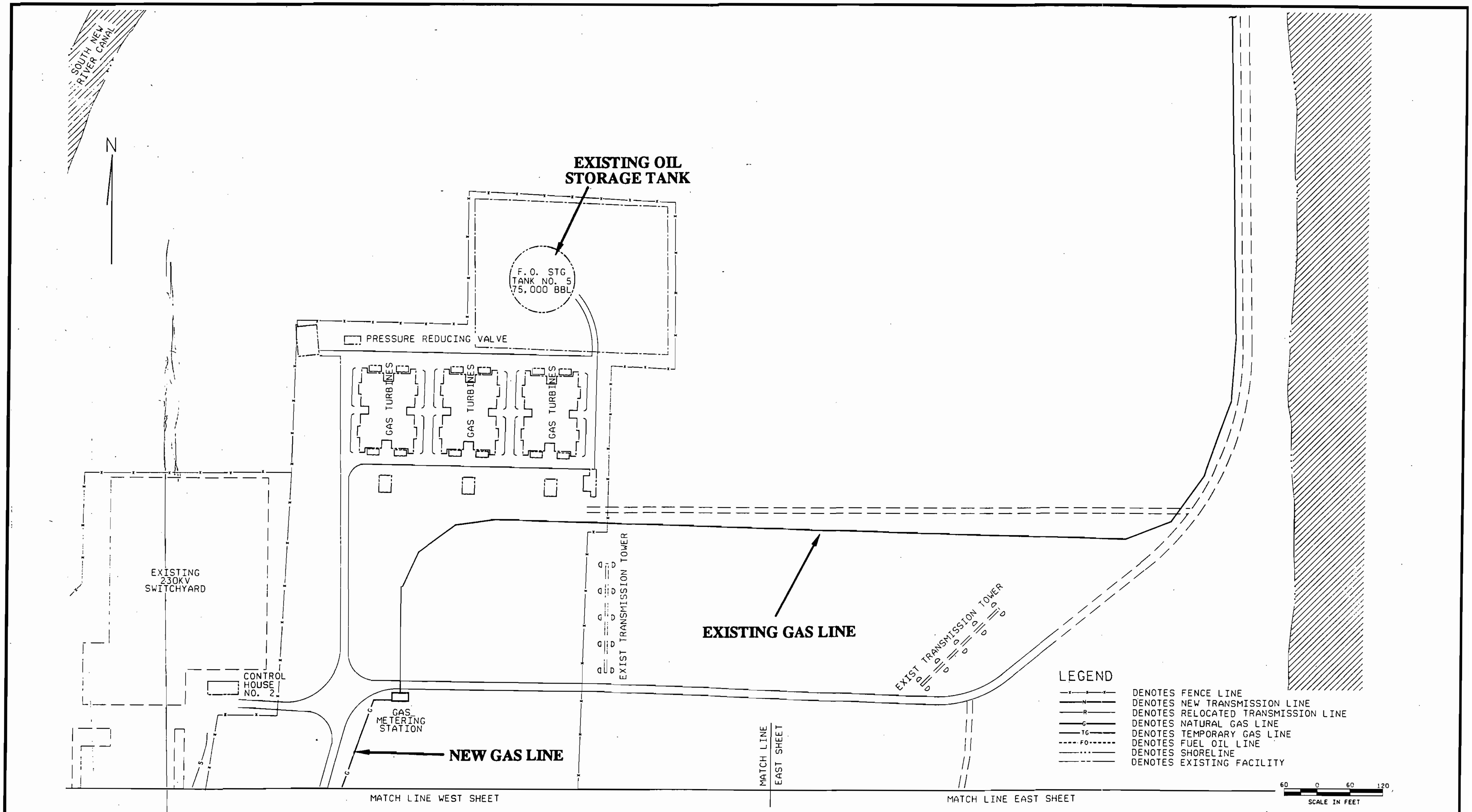

Figure 3.3-1 GAS LINE LOCATION

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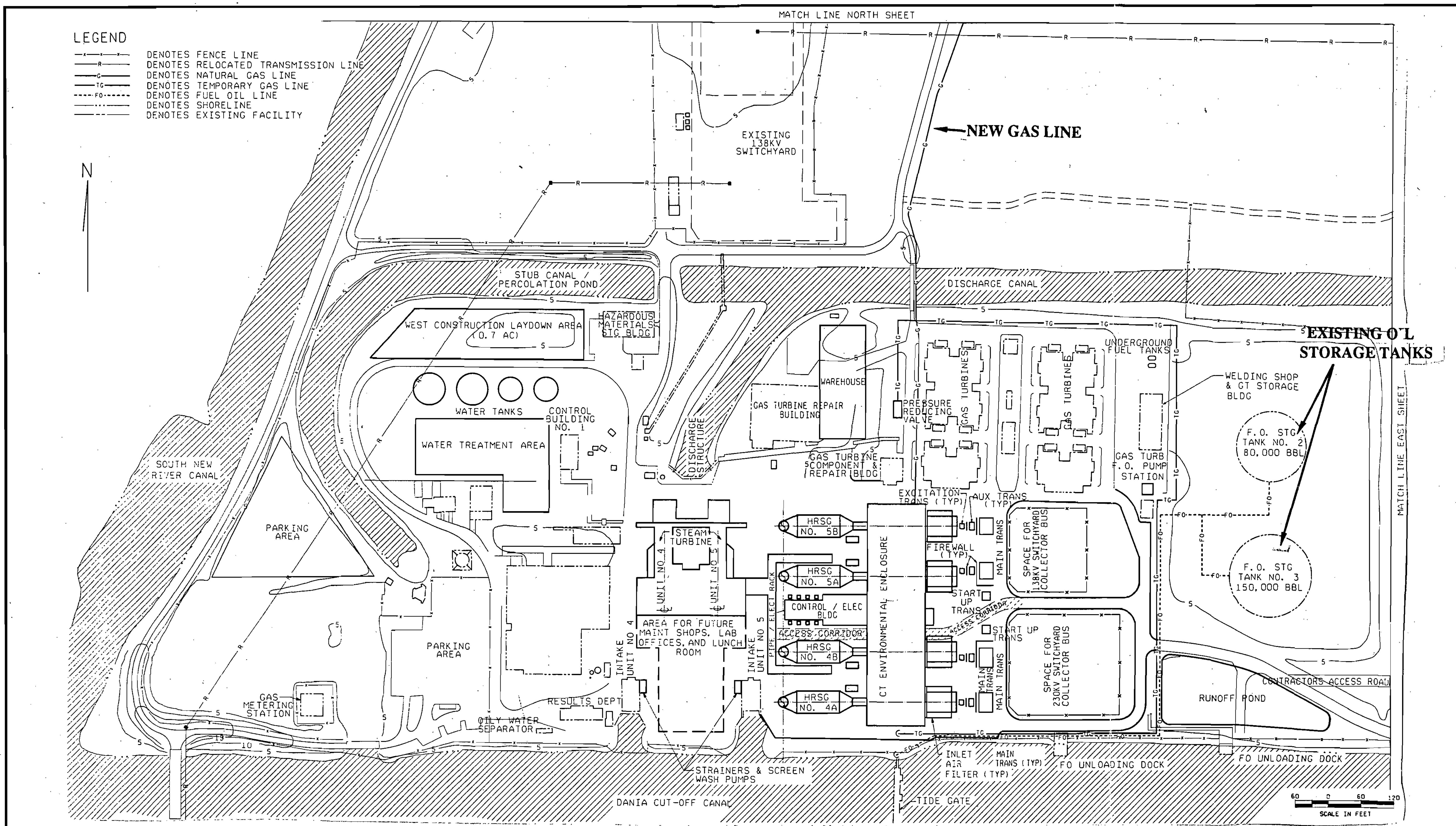

Figure 3.3-2 POWER BLOCK AREA

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Two types of fuel quality analyses have been estimated: an ultimate analysis and a proximate analysis. An ultimate analysis is a gravimetric (i.e., weight-based) breakdown of a fuel to its individual elements--carbon, hydrogen, sulfur, etc. A proximate analysis is a gravimetric breakdown of a fuel to the following components: volatile matter, fixed carbon, moisture, ash, and sulfur.

The results of the estimated analyses are presented in Table 3.3-1 for natural gas and in Table 3.3-2 for No. 2 distillate fuel oil. These analyses provide conservative estimates for fuel quality and assume maximum sulfur contents and minimum heating values.

Table 3.3-1. Estimated Fuel Quality of Natural Gas[a]

Parameter	Gravimetric Breakdown (Percent)
Ultimate Analysis:	
Carbon	73.900
Hydrogen	24.034
Oxygen	1.236
Nitrogen	0.76
Sulfur[b]	0.0007
	100
Proximate Analysis	
Volatile Matter	100.0
Fixed Carbon	0
Moisture[c]	0
Ash	0
Sulfur[b]	0.0007
	100

[a]The heat of combustion of the natural gas is estimated to be at least 950 British thermal units per cubic foot (Btu/ft^3).
[b]Sulfur at 2 grains per 1,000 standard cubic feet (scf).
[c]Actual value is 0.00138 percent.

Table 3.3-2. Estimated Fuel Quality of No. 2 Fuel Oil[a]

Parameter	Gravimetric Breakdown Percent
Ultimate Analysis:	
Carbon	87.0
Hydrogen	12.5
Oxygen	0
Nitrogen	0.02
Sulfur	0.5
	100.0
Proximate Analysis:	
Volatile Matter	99.05
Fixed Carbon	0.35
Moisture	0.05
Ash	0.05
Sulfur	0.50
	100.0

[a]The heat of combustion of the fuel oil is estimated to be at least 19,130 British thermal units per pound (Btu/lb).

3.4 AIR EMISSIONS AND CONTROLS

3.4.1 Air Emissions Types and Sources

3.4.1.1 Sources

Two primary types of new air emissions sources are included in the proposed project at this time; the CTs themselves, and the supplemental firing duct burners within the HRSGs. As described in Section 3.2, there are four actual points of emissions, the four stacks associated with the four HRSGs. Their locations have previously been identified on Figure 3.2-1.

As currently conceived, this project will add no other new air emission sources. There are no bulk material handling systems or cooling towers. There are no bypass stacks for simple cycle operation.

3.4.1.2 Emissions

The repowered units are expected to burn natural gas as the primary fuel, with light oil as an alternate fuel. The maximum air pollutant emission rates for parameters expected to be significant are shown in Table 3.4-1 and reflect conservative assumptions as described in Section 3.3.5. The emissions of particulate matter, sulfur dioxide, nitrogen oxides, and carbon monoxide exceed the PSD significant emission rate thresholds as defined in Chapter 17-2.310, F.A.C. Thus, the project is subject to PSD review for these pollutants. A complete PSD application is presented in Appendix 10.1.5.

3.4.1.3 Unit Retirements

The existing boilers for Units 4 and 5 will be retired upon completion of the Lauderdale Repowering Project. These units presently burn either natural gas or No. 6 fuel oil. A detailed description of the creditable emission decreases to be claimed for their retirement is included in Appendix 10.1.5. Briefly, the maximum existing permitted emission rates compared to the maximum repowering rates are:

Table 3.4-1. Design Assumptions for Lauderdale Repowering Project Units No. 4 and 5[a]

Parameter	Units	Fuel: No. 2 Oil	Fuel: Natural Gas[b]
Design:			
Unit Size	MW (net)	461	480
Net Plant Heat Rate--HHV	Btu/kW-hr	7,347	7,551
Fuel:			
Fuel Use	lb/hr	179,135	162,803
Heat Input	million Btu/hr	863	3,744
Air Emissions:[c]			
Sulfur dioxide	lb/hr	1,740	2.0
Particulate matter[d]	lb/hr	121	32
Nitrogen oxides	lb/hr	863	592
Carbon monoxide	lb/hr	218	205
Volatile organic compounds	lb/hr	17	2.8

[a]Presents the maximum design rate for each repowered unit at 40°F ambient conditions; see Appendix 10.1.5 for more information.
[b]Includes supplemental firing at duct burners.
[c]Based upon 100-percent firing; maximum emissions of SO_2 and NO_x during oil firing occur under ISO conditions; see Appendix 10.1.5 for more information.
[d]Excludes sulfate and sulfite aerosols.

Notes: Btu/kW-hr = British thermal units per kilowatt hour.
HHV = high heating value.

	Existing Permits (TPY)	Repowered Units[a] (TPY)
Particulates[b]	1,445	825
Sulfur Dioxide (SO_2)	15,900	12,232
Nitrogen Oxides (NO_x)	6,640	5,999
Carbon Monoxide (CO)	604	1,659

[a] based on 81.1 percent capacity factor for particulates, SO_2, and NO_x; for CO, 100 percent capacity factor with natural gas firing (see Section 2.0 in Appendix 10.1.5.

[b] does not include sulfate or sulfite aerosols.

3.4.1.4 Emissions Inventory

For emissions inventory purposes, DER Form 17-1.202 (1), "Application to Operate/Construct Air Pollution Source" has been completed and is included in Appendix 10.1.5.

3.4.2 Air Emission Controls

3.4.2.1 Nitrogen Oxides

Nitrogen oxides are formed during the combustion of natural gas or distillate fuel in a combustion turbine. The advanced CTs to be used in the Lauderdale Repowering Project will utilize a combination of high-efficiency burner design and the injection of steam to limit NO_x formation. The burner design includes the use of multiple burners and experimentally designed combustion chamber shapes which, while maximizing fuel utilization, minimize NO_x production. The machines can accommodate steam or water injection, for further NO_x reduction, when burning either oil or gas.

Water or steam injection is the most proven technology for NO_x control on CTs. Water or steam can be injected directly into the combustion zone to reduce the unit's flame temperature, thus limiting the amount of NO_x formed due to atmospheric nitrogen fixation. When firing natural gas, this is accomplished by injection through separate concentric annular spaces in the fuel manifold. On oil, the fuel and water/steam are premixed. Water or steam injection is capable of reducing exhaust gas NO_x concentrations to approximately 42 parts per million by volume (ppmv) when firing gas, and 65 ppmv when firing oil, for advanced CTs [on a dry basis, referenced to 15-percent oxygen (O_2)]. This technology has been used successfully on various types of CTs (both industrial and aircraft derivatives) and has been found to be a reliable and an economical means of controlling NO_x emissions.

Because the CT efficiency is higher with steam injection for NO_x control than with water injection, steam injection has been selected for the Repowering Project.

The other sources of NO_x emissions associated with the project are the supplemental firing systems in the HRSGs (duct burners). These units will be equipped with low NO_x burners which produce approximately one half the NO_x of conventional burners. This type of burner regulates NO_x formation by reducing flame turbulence, delaying fuel-air mixing, and establishing fuel rich zones where combustion initially takes place. This design results in longer, less intense flames, thus limiting flame temperature and reducing NO_x emissions. NO_x emissions from the duct burners are estimated to be about 1.1 ppmv on a wet basis.

3.4.2.2 Carbon Monoxide and Volatile Organic Compounds

For this project, the proposed control measure to reduce CO and VOC is good combustion practice via burner design. This is true for the CTs and the duct burners. However, any reduction in CO/VOC from the CTs generally results in an increase in NO_x. Conversely, a reduction in NO_x resulting from increased steam injection would result in an increase in CO/VOC. Thus, an appropriate balance must be chosen.

3.4.2.3 Sulfur Dioxide

Precombustion controls are proposed to limit SO_2. These include the use of natural gas (which contains only trace amounts of sulfur-containing mercaptans for the detection of gas leaks) as the primary fuel and low sulfur oil as a backup fuel for the control of SO_2 emissions from the combustion turbines, and the use of only natural gas as the fuel for the duct burners.

3.4.2.4 Particulate Matter

PM emissions arise primarily from noncombustible metals present in trace quantities in liquid fuels. As a practical matter, turbine fuel specifications generally require trace metals in the liquid fuel be kept to no more than a few parts per million to mitigate the potential deleterious action of PM on turbine blades. Other sources of PM include condensible organics and minerals in the injection water and PM present in the combustion air.

The use of clean-burning fuels, such as natural gas and low-sulfur oils, is considered to be the most effective means for controlling PM emissions from CTs. This use will be practiced, along with the removal of PM in the combustion air by inlet air filters and the removal of condensible organics and minerals in the injection water via the use of steam. The inlet air filters remove particulates which would otherwise pass through the CTs and HRSGs and be emitted. Similarly, condensible organics and minerals in injection water which would otherwise be left behind to become particulate matter after the water evaporated, and be emitted out the stacks, have been eliminated by the water treatment system which provides steam generator makeup. The use of clean-burning fuels is also the control for the duct burners.

3.4.2.5 Other Regulated Pollutants

Other regulated pollutants to be considered include lead, mercury, beryllium, fluorides, sulfuric acid mist, and inorganic arsenic. Emissions of these pollutants are addressed in Appendix 10.1.5. No additional controls have been proposed for these other pollutants.

3.4.3 Best Available Control Technology

Appendix 10.1.5 of this SCA contains a complete PSD application. Section 4.0 of that application contains the best available control technology (BACT) evaluation for this project. It addresses nitrogen oxides, carbon monoxide, sulfur dioxide, particulates, lead, beryllium, fluorides, sulfuric acid mist, mercury, and inorganic arsenic. It includes a discussion of the environmental, economic, and energy aspects of alternative control techniques and methods. BACT has been proposed for this project for all pollutants discussed in Section 3.4.2. The remainder of this section briefly describes those control technologies that were considered and found not to represent BACT. A flowchart of the BACT analysis is included as Figure 3.4-1.

3.4.3.1 Nitrogen Oxides

Selective catalytic reduction (SCR) is a technology in which ammonia is injected into the flue gas stream where it selectively reacts with NO_x in the presence of O_2 and a catalyst to form molecular nitrogen and steam. Although the exact catalyst composition is proprietary, the use of base metal oxides for both the active and support materials has been generally acknowledged. The temperature range required for this catalytic reduction process to work properly is typically 570°F to 750°F, which usually exists within the high-pressure boiler section of the HRSG. Generally, this requires that the HRSG be constructed in two pieces with the SCR unit in between.

SCR is considered a proven technology for base-loaded turbine operation when firing natural gas. Base-loaded plants operate at a near constant load, thus providing a constant energy output. The temperature profile in a HRSG of a base-loaded turbine remains constant with time throughout the turbine operation. Since the catalyst can only be located in one fixed place within the HRSG, it will experience near constant temperatures that are within the design temperature window of the catalyst. However, four separate areas of concern should be considered with regard to application of this SCR technology to the project.

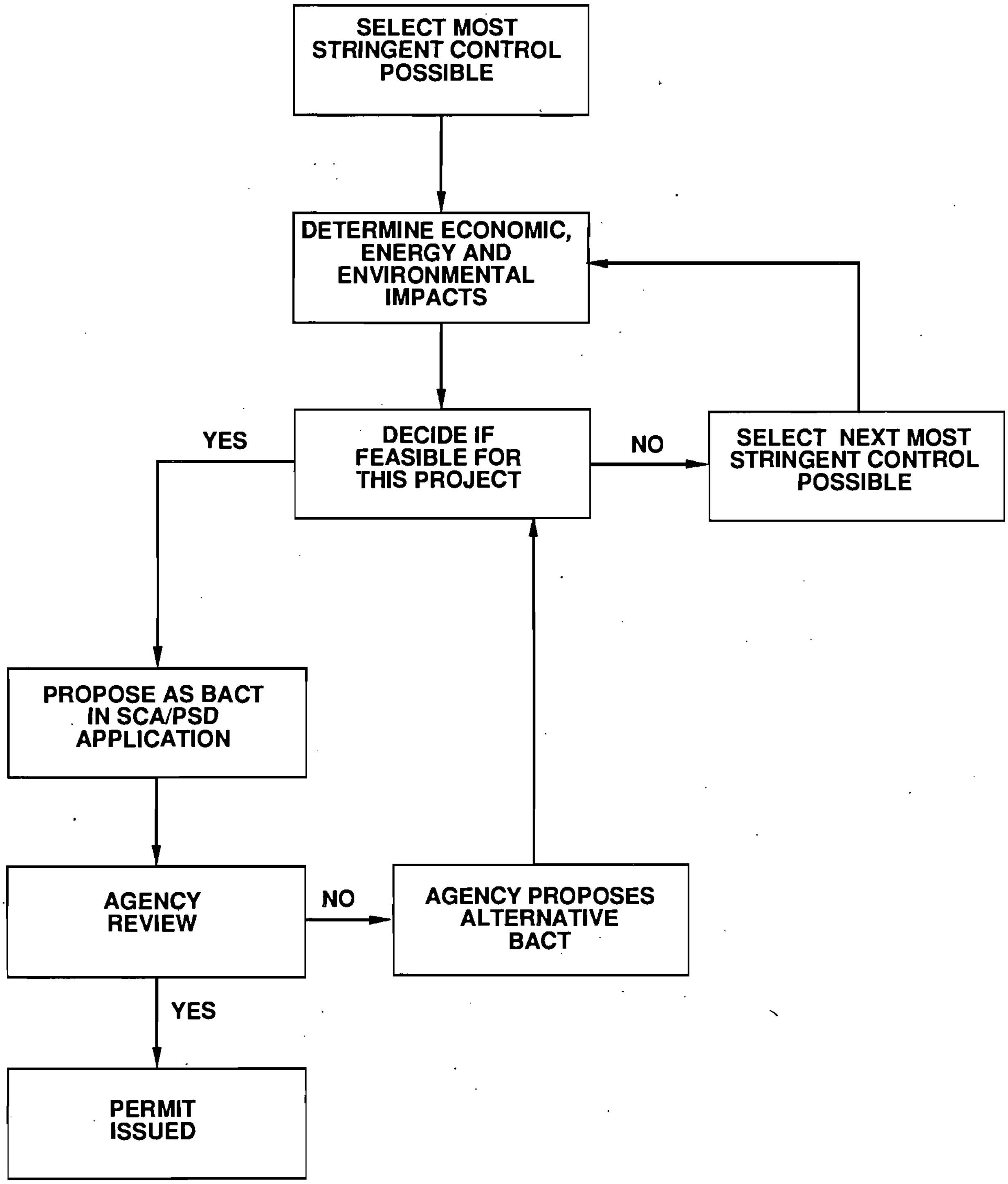

Figure 3.4-1 BACT FLOW CHART

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The first area of concern involves the consideration that the Lauderdale Repowering Project, in order to meet FPL system requirements, is being designed with the capability for cycling (i.e., starting up and shutting down in response to electrical demand). This would require that the SCR catalyst experience many heating and cooling cycles. The result is potential catalyst overheating at startup and shutdown which would have a detrimental effect on catalyst performance and life.

A second concern is that the SCR control technology forms ammonium bisulfate as a reaction byproduct. Ammonium bisulfate can be corrosive and could cause damage to the back end equipment in the HRSG, unless more expensive corrosion-resistant materials, which would otherwise not be required, are provided. Ammonium bisulfate formation could also cause an increase in emissions of particulate matter.

A third area of concern is that the turbine may be fired on No. 2 fuel oil during periods of natural gas curtailment. Sulfur and even minimal amounts of heavy metals contained in the fuel may damage the catalyst through processes known as "masking" and "poisoning", as has occurred in other similar applications. Since it is not technically feasible to bypass the catalyst due to the large ductwork, the catalyst modules would have to be removed every time gas curtailment occurred and be replaced when gas service was resumed. Oil firing has been tried unsuccessfully on a 20-MW LM2500 gas turbine with an SCR at the United Airlines cogeneration project in California.

A fourth area of concern is known as "ammonia slip." The injection of ammonia is performed in excess of the exact theoretical requirements so that the reaction will take place to completion with respect to NO_x removal. The result is the direct discharge to the atmosphere of the excess ammonia.

The cost of removal of NO_x by SCR for this project has been estimated to be more than $4,600 per ton.

Another NO_x control technology is the Exxon Thermal $DeNO_x$ process (or selective noncatalytic reduction). This process utilizes direct ammonia injection at high flue gas temperatures (1,600° to 1,800°F) to reduce NO_x. Since exhaust gas exiting the CT is at a temperature of about 1,000°F, Thermal $DeNO_x$ would be ineffective for this project. Additionally, ammonia injection directly into the combustion zone has been investigated by turbine manufacturers and determined to be impractical.

The other much smaller sources of NO_x emissions associated with the project are the supplemental firing system in the HRSGs (duct burners). No alternatives are available for the control of NO_x at these sources; however, if SCRs were practical, they would remove NO_x produced by the duct burners as well as that produced by the CTs.

3.4.3.2 Carbon Monoxide

The only practical control measure available to reduce CO and unburned hydrocarbon (UHC) emissions from the CT/duct burner units other than good combustion practice is an oxidation catalyst. Exhaust gases from the CT and duct burner are passed over a catalyst bed where excess air oxidizes the CO and UHC. The temperature range for this process is approximately 600 to 1,200°F, with the highest removal efficiencies occurring in the upper temperature range. Carbon monoxide removal efficiencies are expected to be 80 percent initially. Unburned hydrocarbon removal efficiencies of these units range from 15 to 50 percent and are generally not guaranteed by the manufacturer.

An oxidation catalyst will experience the same operating problems as those discussed for the SCR catalyst. Large temperature swings and fuel oil firing will present the same operating problems as those for SCR.
The cost of removal of CO by oxidation catalyst is estimated to be more than $9,556 per ton.

3.4.3.3 Sulfur Dioxide

Postcombustion controls comprise various wet and dry flue gas desulfurization (FGD) processes. However, FGD alternatives are not feasible for use on CT facilities due to high pressure drops across the control device. The only feasible control is clean fuels.

3.4.3.4 Particulate Matter

Postcombustion alternatives such as baghouses, scrubbers, and electrostatic precipitators are not feasible due to the high pressure drops associated with the units and the small amount of PM reduction which would occur since the CT and duct burner PM emissions are minimal (i.e., these emissions are already lower than most baghouses emit). Clean-burning fuels, steam injection, and inlet air filters are all being used.

3.4.3.5 Other Regulated Pollutants

Emissions of other pollutants are expected to be minimal and require no additional control technology. Discharge concentrations of lead, beryllium, and fluorides are not expected to be measurable because of the lack of their presence in the natural gas or light oil to be used as fuel. Additionally, sulfuric acid mist production will be limited by the SO_2 controls previously described. Although mercury and arsenic may be present in trace quantities, these quantities are not expected to be large enough to be removable through the use of special controls. Therefore, no alternative emission controls for these other pollutants are proposed.

3.4.4 <u>Design Data for Control Equipment</u>

Fuel properties have been presented in Section 3.3. Flue gas data are presented in Table 3.4-2 for natural gas firing and Table 3.4-3 for fuel oil firing. These data are estimates based on the most recent information available. A block diagram illustrating the control equipment is shown as Figure 3.4-2.

Table 3.4-2. Estimated Performance on Natural Gas Fuel, Full Load for One CT/HRSG Train (Page 1 of 2)

Parameter	Value
Ambient Temperature (for reference), °F	40
Compressor Inlet Temperature, °F	40
Compressor Inlet Relative Humidity (percent)	60
Load Condition	Base
<u>CT Performance</u>	
Output, MW net	172
Heat Rate, Btu/kW-hr, HHV	10,330
Heat Consumption, Btu/hr x 10^6	1,782
Exhaust Flow, lb/hr x 10^3	3,673
Exhaust Temperature, °F	1,057
Steam Injection, lb/hr	95,253
<u>Conditions For Above</u>:	
• 31-ft elevation, 60 percent relative humidity	
• 5 inches inlet/12 inches exhaust pressure drops with estimated steam injection to limit NO_x to 42 ppmvd at 15 percent O_2	
• Performance is for one CT	
<u>CT Emissions</u>	
NO_x at 15 percent O_2	42 ppmvd/37 ppmvw (278.2 lb/hr)
CO	30 ppmvd/27 ppmvw (97.1 lb/hr)
VOC	1 ppmvd/1 ppmvw (1.4 lb/hr as C)
Particulates	16 lb/hr
SO_x, at 2 grains per 1,000 scf Maximum pipeline concentrations limited to 200 grains per 1,000 scf	0.1 ppmvd/0.1 ppmvw (0.97 lb/hr)
<u>HRSG Parameters</u>	
HRSG Exhaust Temperature, °F	280
HRSG Stack Height, ft	150
HRSG Stack Diameter, ft	18
HRSG Stack Gas Velocity, ft/sec	77
Duct Burner Heat Consumption, Btu/hr x 10^6	90.62

Table 3.4-2. Estimated Performance on Natural Gas Fuel, Full Load for One CT/HRSG Train (Page 2 of 2)

Parameter	Value
<u>Duct Burner Emissions</u>	
NO_x at 0.2 lb/10^6 Btu, lb/hr	18.1 (3.4 ppmvd[a])
CO, lb/hr	5.5 (1.5 ppmvw[a])
VOC, lb/hr as C	1.6 (0.6 ppmvw[a])
Particulates, lb/hr	0.2
SO_x, lb/hr	0.003

[a]ppm based on total exhaust flow from CTs.

Table 3.4-3. Estimated Performance on No. 2 Distillate Fuel, Full Load for One CT/HRSG Train

Parameter	Value
Ambient Temperature (for reference), °F	40
Compressor Inlet Temperature, °F	40
Compressor Inlet Relative Humidity (percent)	60
Load Condition	Base
<u>CT Performance</u>	
Output, MW net	172
Heat Rate, Btu/kW-hr, LHV	9,830
Heat Consumption, Btu/hr x 10^6	1,694
Exhaust Flow, lb/hr x 10^3	3,754
Steam Injection, lb/hr	155,080
Exhaust Temperature, °F	1,040
<u>Conditions For Above</u>:	
31-ft elevation, 60 percent relative humidity 5 inch inlet/12 inch exhaust pressure drops with estimated steam injection to limit NO_x to 65 ppmvd at 15 percent O_2 Performance is for one CT	
<u>CT Emissions</u>	
NO_x[a] at 15 percent O_2	65 ppmvd/58 ppmvw (432 lb/hr)
CO	33 ppmvd/31 ppmvw (109 lb/hr)
VOC	6 ppmvd/5 ppmvw (8.5 lb/hr as C)
Particulates[b]	60.6 lb/hr
SO_x, at 0.5 percent Sulfur	104 ppmvd/92 ppmvw (885 lb/hr)
<u>HRSG Parameters</u>	
HRSG Exhaust Temperature, °F	280
HRSG Stack Height, ft	150
HRSG Stack Diameter, ft	18
HRSG Stack Gas Velocity, ft/sec	78
Duct Burner Heat Consumption, Btu/hr x 10^6	0

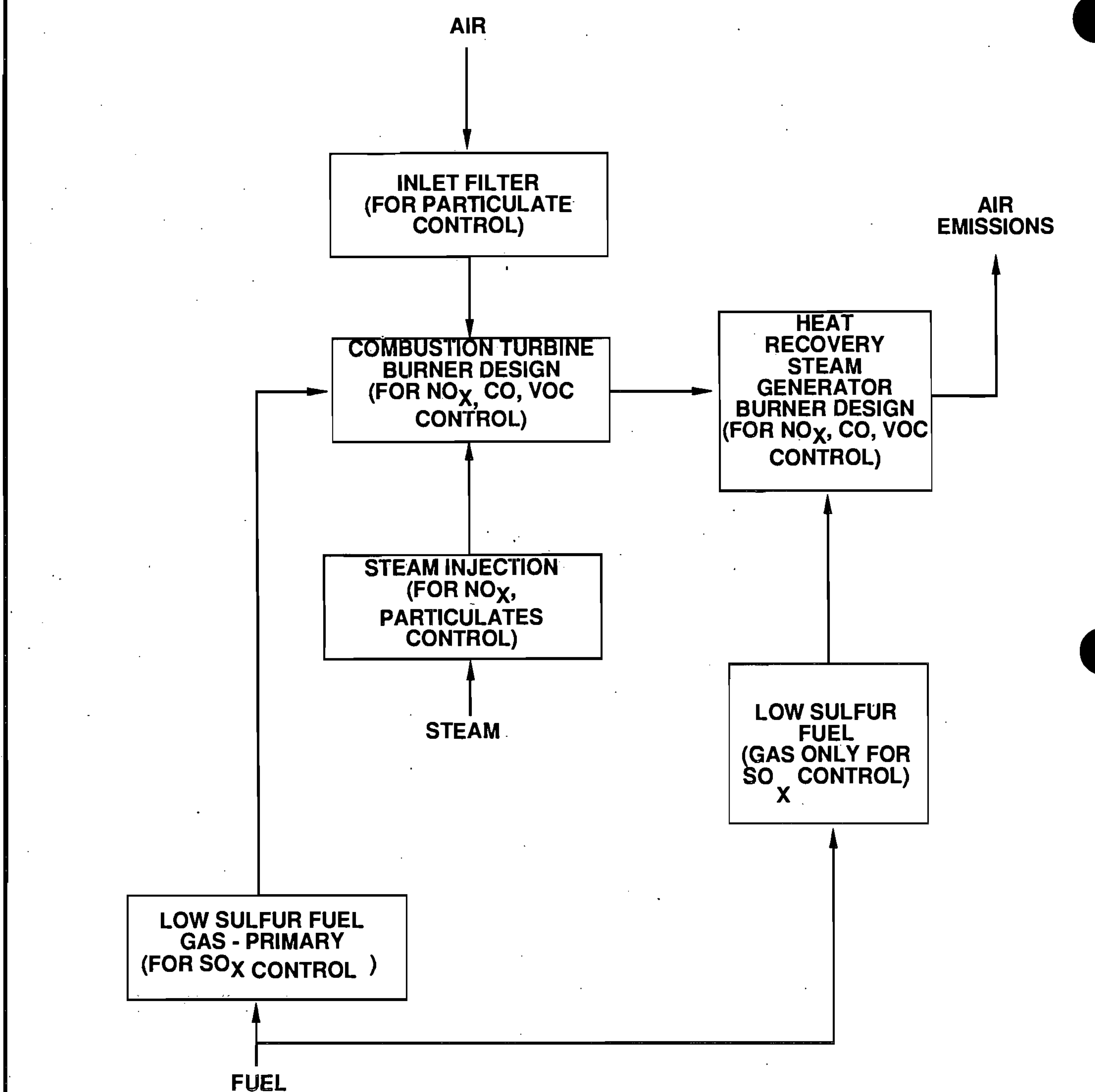

Figure 3.4-2 AIR EMISSIONS CONTROL EQUIPMENT BLOCK DIAGRAM

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3.4.5 Design Philosophy

The design philosophy for air emission controls is straightforward. It recognizes that the first step in minimizing air pollutant emissions is to utilize the most efficient generating technology. This step has been taken in the selection of a combined cycle process utilizing CTs. Combined cycle plants can be expected to achieve fuel conversion rates on the order of 7,550 Btu/kWh, as opposed to values in the 9,000 to 10,000 Btu/kWh range for more conventional generating plants. This is an improvement of about 26 percent. Thus, by maximizing the megawatt output per unit of fuel consumed, the air pollutant emissions per megawatt output are minimized. The second step involves the selection of the most efficient CTs (the advanced type) for the same reason, i.e., the minimization of emissions with respect to power output. The third step involves the use of clean or premium fuels. The fourth step is the utilization of BACT which, in this case, includes burner design and steam injection for NO_x control, and precombustion controls for other parameters.

3.5 PLANT WATER USE

A quantitive water-use diagram showing estimated average (annual) and peak flow rates for the project is presented as Figure 3.5-1. Four different sources of water are used by the existing plant and will continue to be used by the project. They are as follows:

1. Existing off-site wells,
2. Existing on-site wells,
3. Public water supply, and
4. Surface water from the Dania Cut-Off Canal.

The locations of these sources, and detailed descriptions of their quality, are presented in Section 2.3. The qualities of these sources are also briefly described in Tables 3.5-1 through 3.5-4. Expected consumptive uses by the plant, for both average (annual) and maximum conditions, are tabulated in Table 3.5-5. Water use for each plant system is described in the following sections.

3.5.1 Heat Dissipation System

3.5.1.1 System Design

The repowered plant will continue to utilize the existing open cycle cooling canal/pond system for heat dissipation. This system is described in detail in Section 2.3.4.1. The heat will be dissipated via water used for condenser cooling (circulating water) and for open cooling (steam turbine generator hydrogen coolers, steam turbine lube oil coolers, steam turbine hydrogen seal oil coolers, CT generator hydrogen coolers, CT lube oil coolers, HRSG feed pump lube oil coolers, HRSG feed pump mechanical seal water heat exchangers, instrument air compressors and aftercoolers, service air compressors and aftercoolers, steam and water analysis sample cooler, condensate pump motor bearing coolers, and mechanical vacuum pump heat exchangers). Additional data on the heat dissipation system are presented in Table 3.5-6.

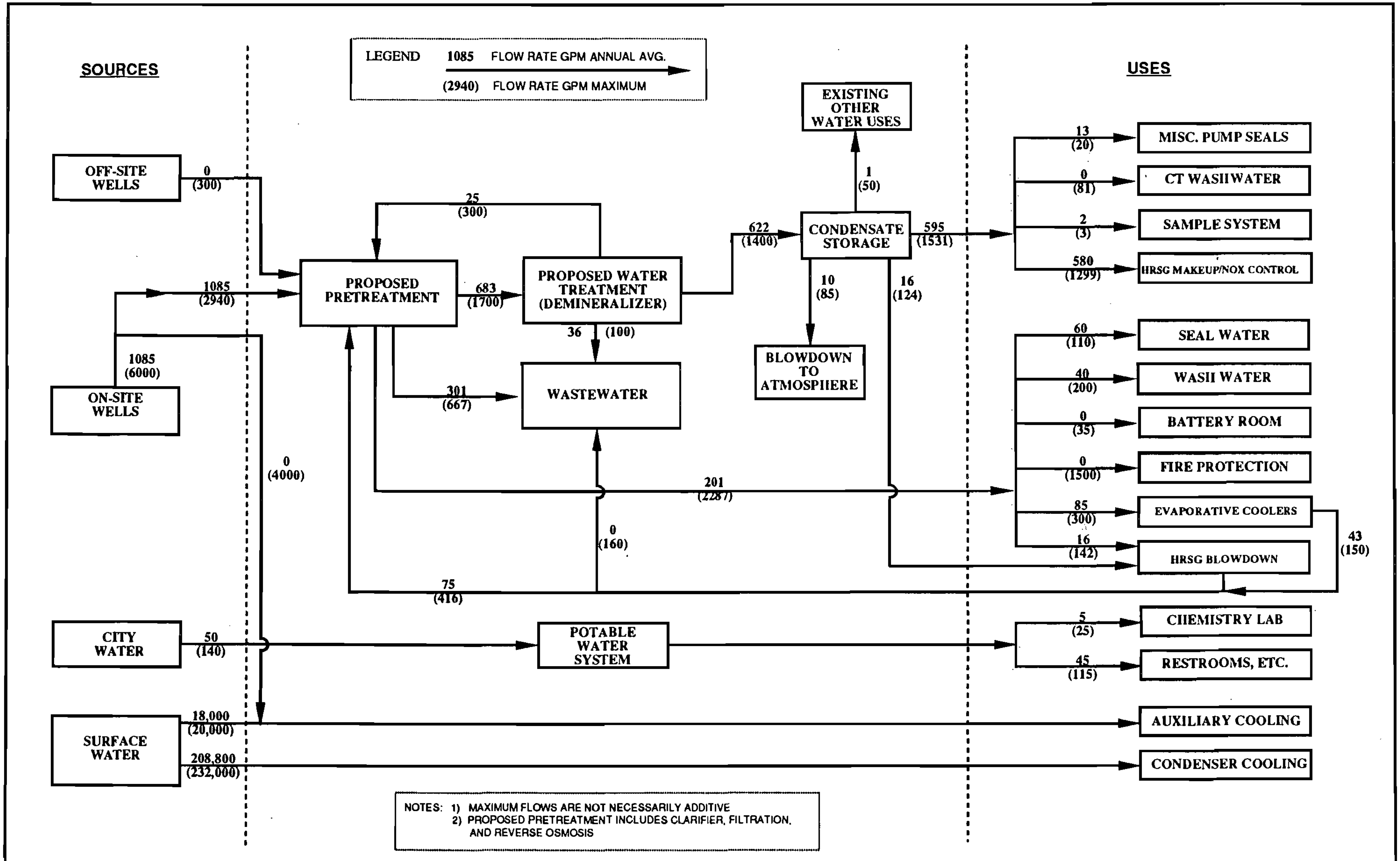

Figure 3.5-1 PROPOSED WATER USES SIMPLIFIED FLOW DIAGRAM

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Table 3.5-1. Off-Site Well Water Quality[a]

Parameter	Range of Values[b]	Average Value	Units
Phenolphthalein Alkalinity	0	0	ppm as $CaCO_3$
Methyl Orange Alkalinity	190 - 246	213	ppm as $CaCO_3$
Hardness	170 - 420	243	ppm as $CaCO_3$
Calcium	57 - 91	78	ppm
Magnesium	5 - 15	7	ppm
Sodium	12 - 30	19	ppm
Bicarbonate	213	213	ppm as $CaCO_3$
Carbonate	0	0	ppm as $CaCO_3$
Chloride	17 - 60	37	ppm
Sulfate	4 - 16	8	ppm
Silicon Dioxide	5 - 20	10	ppm
pH	6.9 - 7.4	7.3	Standard units
Potassium	1 - 1.3	1.3	ppm

[a]Based on data covering the period between May 23, 1986, and August 1, 1988.
[b]Single value indicates no range reported.

Table 3.5-2. On-Site Well Water Quality[a]

1986 Data		1988 Data	
Parameter	Value[b]	Parameter	Range[b]
COD	62	Calcium[c]	300 - 525
Cyanide	0.02	Magnesium[c]	272 - 371
Detergent	0.18	Sodium[c]	1,046 - 1,962
Nitrogen	2.5	Bicarbonate[c]	260 - 266
Odor (TON)	1.0	Chloride[c]	932 - 1,547
Dissolved Oxygen	8.0	Sulfate[c]	198 - 229
pH	7.5	Silicon dioxide[d]	11.0 - 12.1
TSS	8	Iron[d]	1.1 - 4.6
TDS	2,200	Total organic carbon[d]	18
Turbidity (NTU)	1.5	pH (standard units)	7.13 - 7.18
		Conductivity (micromho)	4,020 - 4,280

All below detection limits: arsenic, cadmium, chlorinated hydrocarbons, chromium, coliform, copper, lead, mercury, nickel, oil and grease, phenolics, phosphorus, selenium, silver, and zinc.

[a]Data taken within auxiliary cooling water system;
[b]mg/L, unless otherwise noted.
[c]ppm as $CaCO_3$.
[d]ppm.

Table 3.5-3. Potable Water Quality

Parameter	Range of Values[a]	Average Value	Units
pH	6.3 - 7.6	7.3	standard units
Sulfate	17	17	mg/L
Hardness	79 - 420	265	mg/L as $CaCO_3$
Calcium	25	25	mg/L
Magnesium	3.5	3.5	mg/L
Chloride	17 - 71	38	mg/L
Iron	<0.03	<0.03	mg/L
Carbonate	<1	<1	mg/L as $CaCO_3$
Bicarbonate	91	91	mg/L as $CaCO_3$
Sodium	24	24	mg/L
Silicon Dioxide	4.8 - 20	10	ppm
Potassium	1.7	1.7	mg/L
Hydroxide	<1	<1	mg/L as $CaCO_3$
Conductivity	510 - 550	534	micromho
Methyl Orange Alkalinity	190 - 218	205	ppm
Free Available Chlorine	0.8 - 3.0	1.9	mg/L

[a]A single number in the range column indicates that only one value was available.

Table 3.5-4. Surface Water Quality Dania Cut-Off Canal

Parameter	Value/Range	Units	Year Measured
Bicarbonate	260 - 280	ppm as $CaCO_3$	1988
Calcium	228 - 450	ppm as $CaCO_3$	1988
Chloride	856 - 4,119	ppm as $CaCO_3$	1988
Conductivity	2,530 - 9,250	micromho	1988
COD	40	mg/L	1986
Dissolved Oxygen	2.8	mg/L	1986
Iron	0.1 - 0.44	ppm	1988
Magnesium	173 - 989	ppm as $CaCO_3$	1988
Nitrogen	2.6	mg/L	1986
Odor	1.0	TON	1986
Oil and Grease	9.9	mg/L	1986
pH	7.63 - 7.84	s.u.	1986, 1988
Phosphorus	0.08	mg/L	1986
Silicon Dioxide	10.2 - 12.4	ppm	1988
Sodium	698 - 4,142	ppm as $CaCO_3$	1988
Sulfate	8 - 499	ppm as $CaCO_3$	1988
Total Organic Carbon	25 - 26	mg/L	1988
TDS	405	mg/L	1986
TSS	14	mg/L	1986
Turbidity	2.3	NTU	1986

Tested in 1986 but not detected:

Parameter	Detection Limit (mg/L unless otherwise noted)
Arsenic	0.05
Cadmium	0.01
Chlorinated Hydrocarbons	1 μg/L
Chromium	0.05
Coliform	10 (#/100 mL)
Copper	0.1
Cyanide	0.01
Detergent	0.2
Lead	0.05
Mercury	0.002
Nickel	0.1
PCB	0.1 μg/L
Phenolics	0.01
Selenium	0.01
Silver	0.05
Zinc	0.1

Table 3.5-5. Total Consumptive[a] Water Use (gpm)

System	On-Site Groundwater		Off-Site Groundwater		Potable Water	
	Average	Maximum	Average	Maximum	Average	Maximum
Existing Plant	6,000	6,000	93	300	6.6[b]	24.8[b]
Construction Period	7,000[c]	8,500[c]	200	300	6.6[b]	24.8[b]
Repowered Plant	1,085	6,000	0	300	50[d]	140[d]

[a]Consumptive use is considered that which withdraws water from a source and does not discharge it back to the same source (e.g., well water).
[b]Based on actual data.
[c]Includes dewatering.
[d]Based on South Florida Building Code.

Note: Surface waters withdrawn for heat dissipation purposes are not considered a "consumptive use" for purposes of this table.

Table 3.5-6. Heat Dissipation System Design Basis (Page 1 of 2)

Parameter	Design Basis	
Circulating Water		
Quantity of Heat Dissipated	766×10^6 Btu/hr per unit[a]	
Quantity of Water Required	116,000 gpm per unit[a]	
Consumptive Use	None, excluding evaporation.	
Blowdown Volume (blowdown from boiler drum)	35 gpm per unit[a]	
Temperature Rise at Condenser Outlet	13.2°F with above flows[b]	
Retention Time in Pond	30 hours	
Rate of Evaporation	1,674 gpm	
Intake Structure Design		
Water depth in intake bay w/average water level of +2.0	16.0 ft	
Flow	116,000 gpm per unit[a]	
Velocity	Water Level	Velocity
Condition	(ft msl)	(ft/sec)
Maximum High Water Level	+3.98	0.74
Average High Water Level	+1.66	0.86
Average Water Level	+0.85	0.90
Average Low Water Level	+0.04	0.95
Minimum Low Water Level	-1.97	1.11
Number of screens	two per bay	
Number of pumps	two 50-percent pumps per unit[a]	
Pump capacity	116,000 gpm per unit[a]	
Travel Time From Condenser Inlet to Point of Discharge	30 hours	
Source of Cooling Water	Dania Cut-Off Canal	
Intake Screen Trash Disposal	Will be disposed of off-site in an approved landfill as currently done.	

Table 3.5-6. Heat Dissipation System Design Basis (Page 2 of 2)

Parameter	Design Basis
Open Cooling Water	
Quantity of Heat Dissipated	46.16×10^6 Btu/hr per unit[a]
Quantity of Water Required	10,000 gpm per unit[a]
Consumptive Use	None excluding evaporation[c]
Temperature Changes	9°F average, 9°F maximum
Intake Structure Design	
Flow	10,000 gpm per unit[a]
Velocity	(see circulating water)
Number of screens	Two per bay
Number of pumps	Two 100-percent pumps per unit[a]
Source of Cooling Water	Dania Cut-Off Canal
Rate of Evaporation	Included within circulating water
Intake Structure Design	Included within circulating water
Travel Time From Heat Exchanger Inlet to Point of Discharge	30 hours
Source of Cooling Water	Dania Cut-Off Canal
Intake Screen Trash Disposal	Uses circulating water/screens

[a]Unit indicates one steam turbine and its two associated CT/HRSG boiler replacements.
[b]23°F during steam dump during startup when CTs are operating and steam turbine is still warming up--1 to 2 hours for startup.
[c]May occasionally use up to 4,000 gpm of on-site well water.

Note: Btu/hr = British Thermal Units per hour.

Water from the Dania Cut-Off Canal passes directly through the intake channel into the intake structure. The intake structure is divided in the center by a concrete wall which forms two separate pump bays, each furnished with one vertical circulating water pump (CWP) and one vertical open cooling water pump (OCWP). The dividing wall prevents any possible vortex interference between the two CWPs and reduces the size of the intake screens and stop logs upstream of the pumps. The dividing wall, in conjunction with the stop logs, also permits isolation of each bay to facilitate maintenance. The intake screens, consisting of bar or coarse screens, and traveling screens, and the floating trash boom, minimize the carryover of objectionable debris. The bar screens are furnished with a trash rake to clean off collected debris. Screen wash water and screen debris flow together through intake structure troughs which discharge into a trash bucket. The trash bucket traps the debris and allows the water to return to the channel. Debris is disposed to an off-site landfill.

Each circulating water pump discharges into a separate 4-1/2-ft diameter reinforced concrete pressure pipe which conveys the cooling water to a cast iron pipe and waterbox at the condenser inlet. The water flows through the Sea-cure stainless steel tubes, through a cast iron waterbox and pipe at the condenser outlet, and through both a reinforced concrete pressure pipe and a corrugated pipe encased in concrete, out into the discharge canal. The condenser is of a single shell, single pressure, divided waterbox design. The circulating water picks up heat in the condenser, causing the steam from the steam turbine to condense.

The two open cooling water pumps discharge into a common header which conveys cooling water to two 100-percent self-cleaning strainers which further strain objectionable debris from the water. The strainers are located adjacent to the intake structure and discharge the backwash flow into the Dania Cut-Off Canal. Water from the strainers passes on to and through three 50-percent capacity closed cooling water heat exchangers (HX) and is released to the discharge canal. Isolation valves are furnished for each HX, along with valving to facilitate backwashing the HX. This water from the "open" side of the system is used to cool water from the closed side of the same system. That "closed" cooling water, in turn, has picked up heat from all those items listed above (e.g., hydrogen coolers, lube oil coolers, etc.).

The screen wash booster pump takes suction from the outlet of the self-cleaning strainers, and conveys water to the screen when cleaning is required. The pump is a centrifugal booster type and is located adjacent to the intake structure. A valved intertie is provided between Units 4 and 5, so that should a unit's screen wash booster pump be out of service, the other unit's pump can serve as a backup. Isolation valves are furnished to facilitate maintenance and a discharge check valve is furnished to prevent backflow into an idle pump.

During base load operation, the condensers will receive about 1.53 billion Btu/hour of waste heat from the condensing steam. This corresponds to a circulating water flow rate of 232,000 gpm and a maximum temperature rise of 13.2°F. This translates to a heat load to the cooling canal/pond system of about 36.8 billion Btu per day.

During cycling operation there would be a startup period when the CTs have reached their full load but the steam turbines are still coming up to speed. Such an event, estimated to last less than 2 hours, will require dumping extra steam to the condensers until the steam turbines can accept it. The temperature rise across the condenser during this event is estimated to be about 23°F. However, since this rise would occur less than 2 hours a day and would be accompanied by an estimated 8 hours of plant shutdown, the total daily heat load to the cooling pond/canal system during cycling would be about 29.8 billion Btu, or about 81 percent of the heat load associated with base load operation. The pond retention time is on the order of 1 day.

Occasionally, a failure in a steam turbine might occur during a period of peak demand. During such an event, demand might require running one of the units in simple cycle mode (no steam turbine-generator operation). The most probable time for simple cycle operation would be during summer, daylight hours. The total estimated potential time for simple cycle operation has been estimated at less than 132 hours per year (about 1-1/2 percent of the time). If such an event coincided with a peak demand period, it could involve operating during daylight hours for up to about 8 days. For those 8 days, the average condenser rise has been estimated to be on the order of 15.2°F. Adding a third unlikely event (after steam turbine failure and peak demand period) that the plant would operate at full base load operation the other 22 days of the month, would result in a very unlikely average temperature rise across both condensers, for the month, of 13.7°F. This would represent a heat load increase of about 4 percent over that currently permitted.

3.5.1.2 Source of Cooling Water

The source of cooling water for the project will continue to be the Dania Cut-Off Canal. The temperature range of the cooling water supply is described in detail in Section 2.3.4.1. The only minimum water quality characteristic that the cooling water source must possess in order to operate the heat dissipation system (open cooling water) is that it be less than or equal to 93°F.

The open cooling water system is also cross-connected to the on-site wells. On rare occasions, when the ambient canal water exceeds 93°F, some on-site well water (up to about 4,000 gpm) would be blended with the surface water to reduce the intake temperature to the open cooling water system.

3.5.1.3 Dilution System

There is no dilution system associated with the heat dissipation system.

3.5.1.4 Blowdown, Screen Organisms, and Trash Disposal

The heat dissipation system itself has no blowdown.

Wash water for the circulating water system traveling water screens is supplied by screen-wash pumps which draw water from the Dania Cut-Off Canal. The discharge from the screens is flushed into a collecting box where debris is retained for off-site disposal, and flush water is drained back to the canal.

Each circulating water pump (two per unit, four total) has its own bay. Each bay has one coarse fixed screen which is cleaned by a rake. Each bay has two traveling water screens, each of which is served by a 75-gpm wash pump. The total maximum screen-wash flow is 600 gpm, and the average is estimated to be 60 gpm.

3.5.1.5 Injection Wells

There are no injection wells associated with the heat dissipation system.

3.5.2 <u>Domestic/Sanitary Wastewater</u>

Domestic/sanitary wastewater, as shown in Figure 3.5-1, is now and will continue to be generated from the potable water system. The quality of the source water is described in Table 3.5-3. The expected flow rate is 45 gpm average (about 65,000 gallons a day) and about 115 gpm maximum. The use within showers, sinks, and toilets is only expected to change the water quality from that of the city water in classical sanitary ways by increasing BOD, COD, suspended solids, nitrogen, phosphorous, and fecal coliform. The treatment and disposal system for the project will include an entirely new collection system discharging to the municipal sewer system. The system includes an underground gravity collection system, pumping stations, and a force main connecting to the City of Hollywood sewer system at Edgewater Road. Septic tanks north of the existing discharge canal and east of the existing evaporation/percolation pond will remain in service.

Piping and fittings will be polyvinyl chloride (PVC). Manholes will be constructed of precast concrete. Pump lift stations will include two full-capacity pumps (one a spare) and will meet the requirements of Chapter 17-6.050, F.A.C., including the following:

1. Connections for portable power generating equipment,
2. Connections for portable pumps,
3. Protection from lightning,
4. Protection from voltage surges, and
5. Design to be fully operable during a 25-year flood.

Piping layout in the western portion of the site and Lift Station No. 1 are shown on Figure 3.5-2. A septic tank which is being left in place in the eastern portion of the site is shown on Figure 3.5-3. Septic tanks being left in the northern portion of the site are shown on Figure 3.5-4.

3.5.3 Potable Water Systems

Potable water will be supplied from the City of Hollywood. Therefore, there are no potable water treatment systems. The quality of this water is described in Table 3.5-3, and usage is shown on Figure 3.5-1.

3.5.4 Process Water Systems

Figure 3.5-5 is a flow diagram of the proposed process water treatment system. These uses include CT steam injection, HRSG makeup, pump seal water, evaporative coolers, and HRSG chemical cleaning. Wastewater flows will be recycled or sent to the proposed new central wastewater treatment system.

The proposed process water treatment system includes clarification and filtration to remove suspended solids and color (preceded by flocculation). Because the primary water source is on-site wells, for which expected quality is summarized in Table 3.5-2, further treatment is provided by reverse osmosis (RO) to remove dissolved solids. After undergoing the RO treatment, the water is passed through a degasifier to remove CO_2 and, finally, a mixed-bed demineralizer for final polishing. The demineralized water is thus of very high quality (e.g., TDS less than 1 mg/L). Service

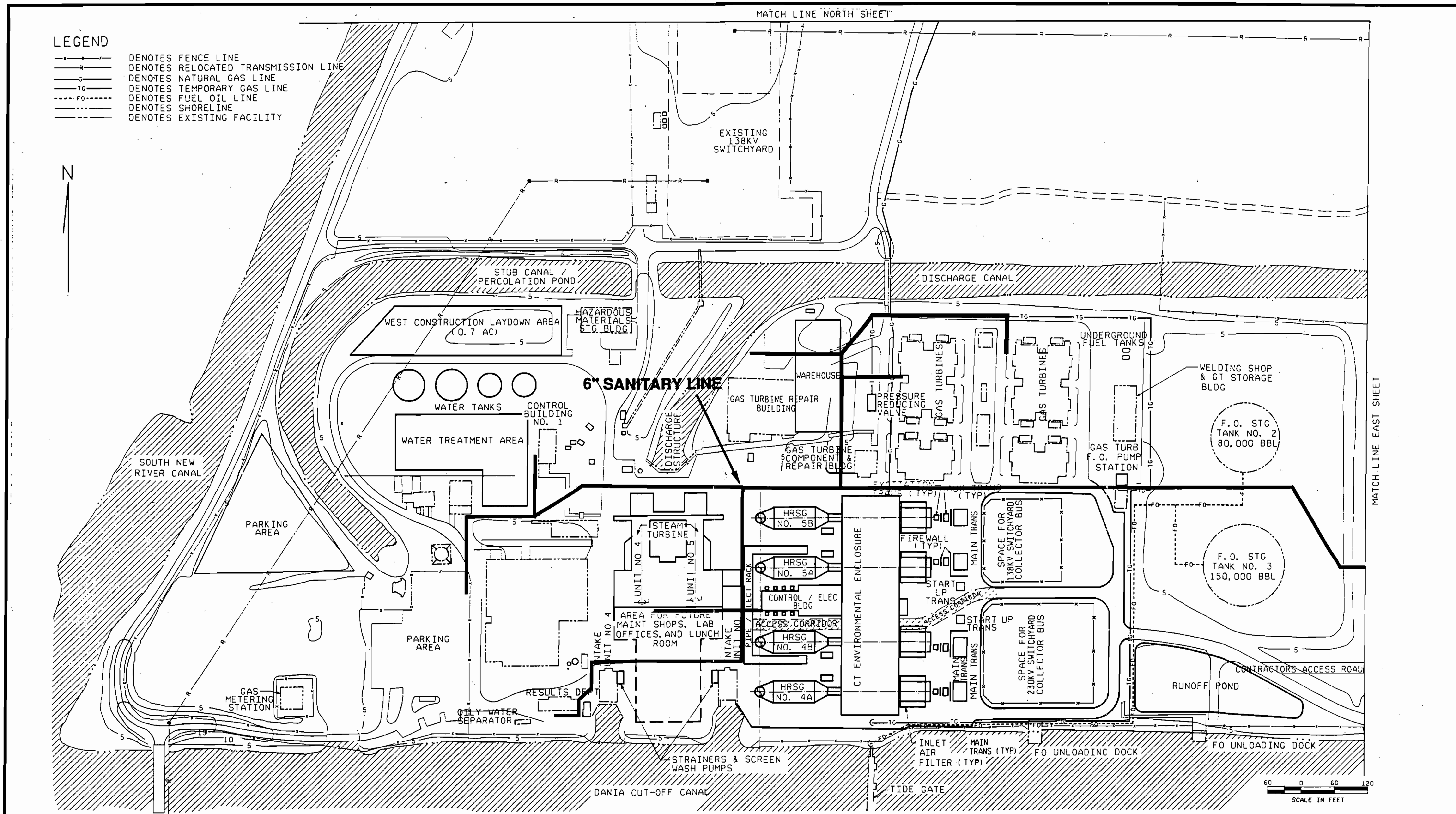

Figure 3.5-2 SANITARY SYSTEM - WESTERN PORTION OF SITE

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FPL

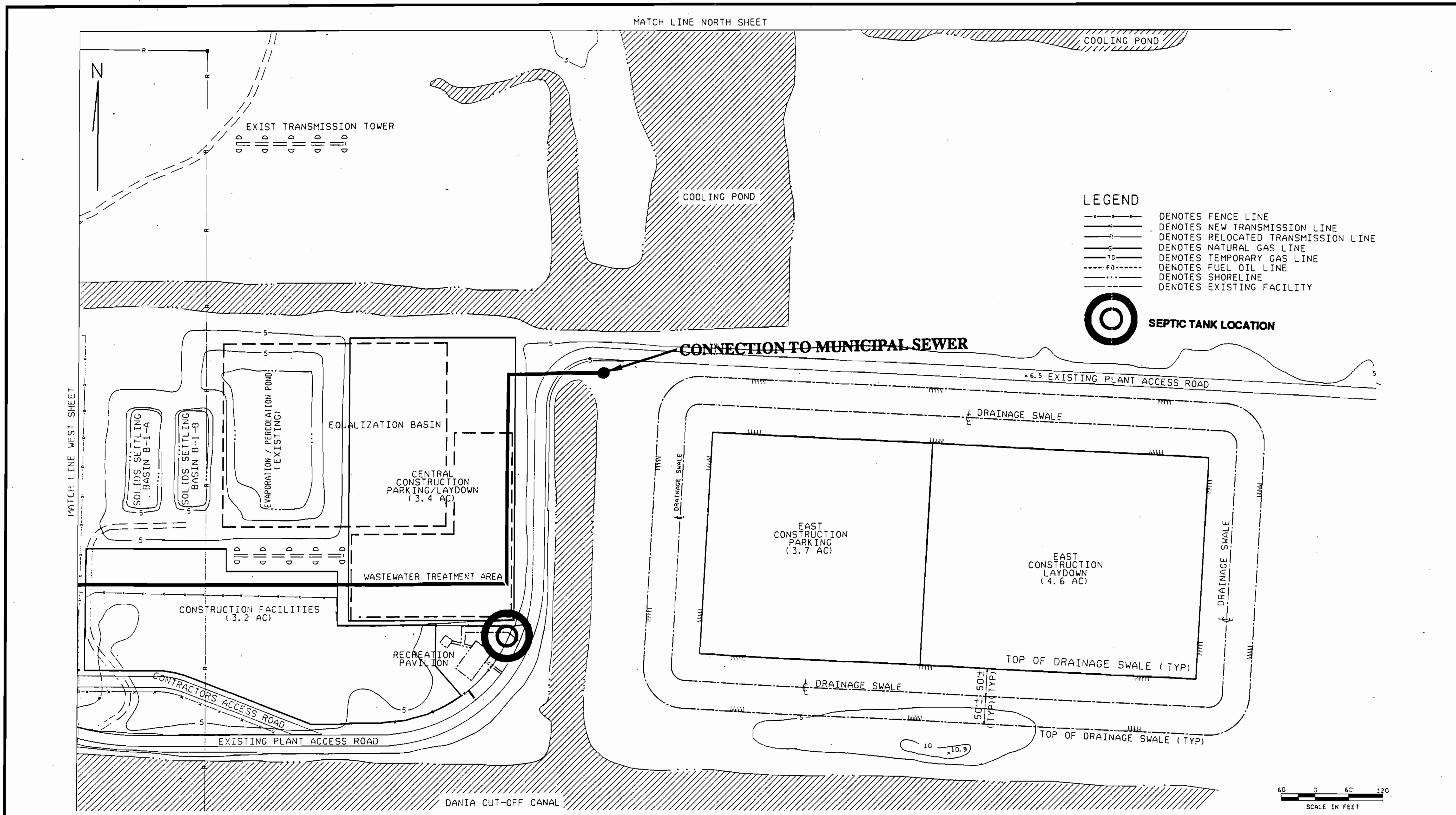

Figure 3.5-3 SANITARY SYSTEM - EASTERN PORTION OF SITE

Lauderdale Repowering Project

FPL

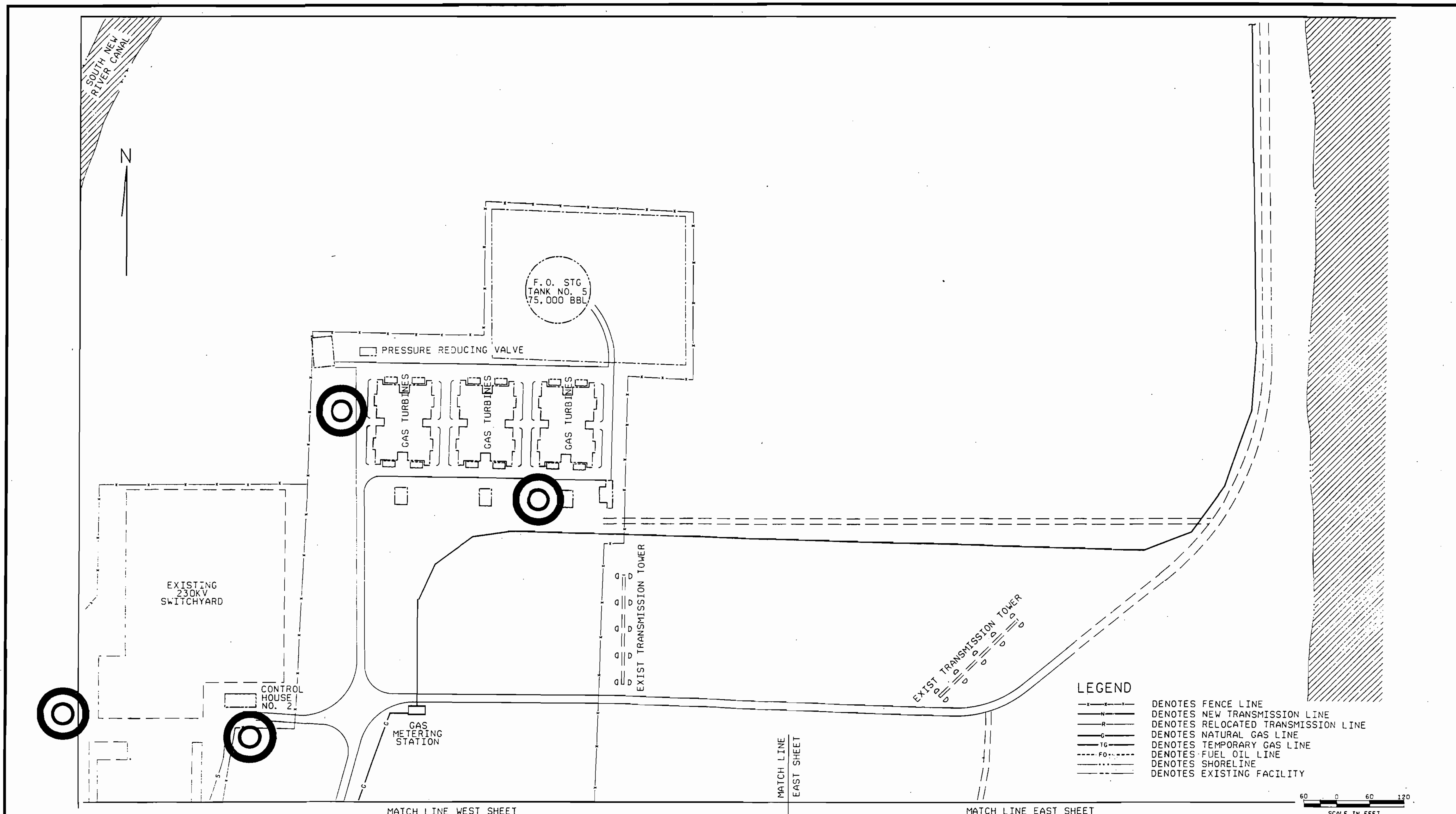

Figure 3.5-4 SANITARY SYSTEM - NORTHERN PORTION OF SITE

Lauderdale Repowering Project

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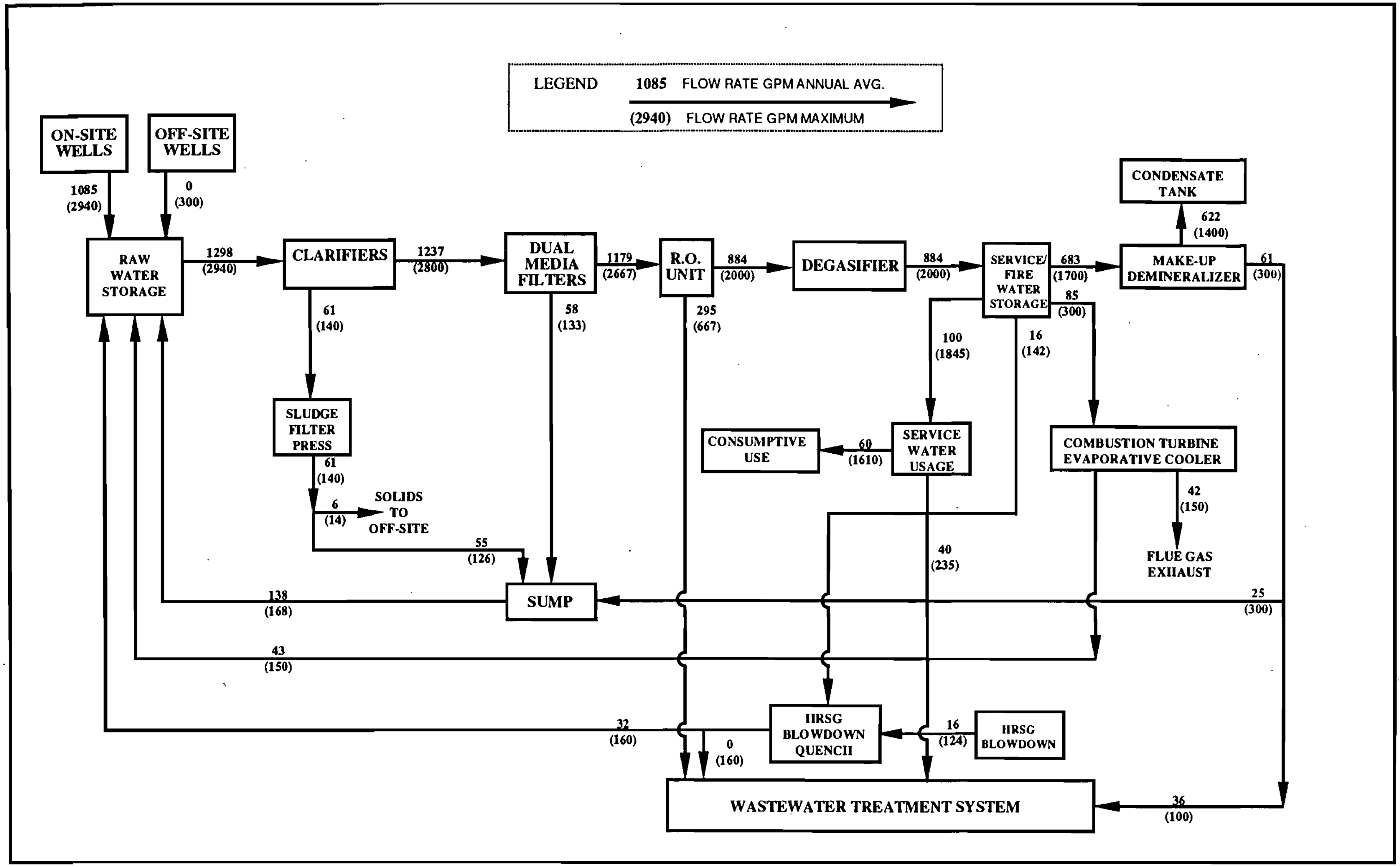

Figure 3.5-5 PROPOSED PROCESS WATER TREATMENT SYSTEM

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water, for fire protection, HRSG blowdown quench, and evaporative coolers, is drawn off after the RO stage (i.e., before demineralization).

Figure 3.5-5 shows the various reuses of water within the water treatment system which will be utilized to minimize source water requirements. Clarifier underflow water will be recycled (averaging 55 gpm) by the use of a filter press to remove that water from the clarifier sludge. Similarly, dual media filter backwash water (averaging 58 gpm) will also be recycled. Evaporative cooler water will be recycled (averaging 43 gpm) as will the rinse waters from demineralizer regeneration (averaging 25 gpm). Blowdown from the HRSGs and blowdown quench water (combined average of 32 gpm) will also be recycled. The total average flow of these recycled streams, about 213 gpm, will be returned to the raw water storage tank, which will be the source of water to the treatment system.

Wastewaters from the proposed process water treatment system will be treated within a new central wastewater treatment facility, as shown on Figure 3.5-6. This facility is described in detail in Section 3.6. A description of the wastewaters which are influent to this facility is presented in the following subsections.

3.5.4.1 Reverse Osmosis Wastes

The use of RO allows the concentration of solute (impurities) to be built up on one side of a membrane while relatively pure water is transported through the membrane. In general, good separation can be expected for high molecular weight organics and charged anions and cations. Thus, the RO wastes are the concentrates of impurities in the source water. The RO waste data listed in Table 3.5-7 were developed by a computer model on the basis of (1) using on-site well water, (2) use of sulfuric acid to reduce the pH of source water to 4.9 to reduce scaling, and (3) 75-percent recovery of the source water. The RO waste can be characterized by high dissolved solids (up to 13,100 ppm) with a pH of about 7.0 and also containing soluble sodium (3,660 ppm), chlorides (6,672 ppm), and sulfate (1,137 ppm).

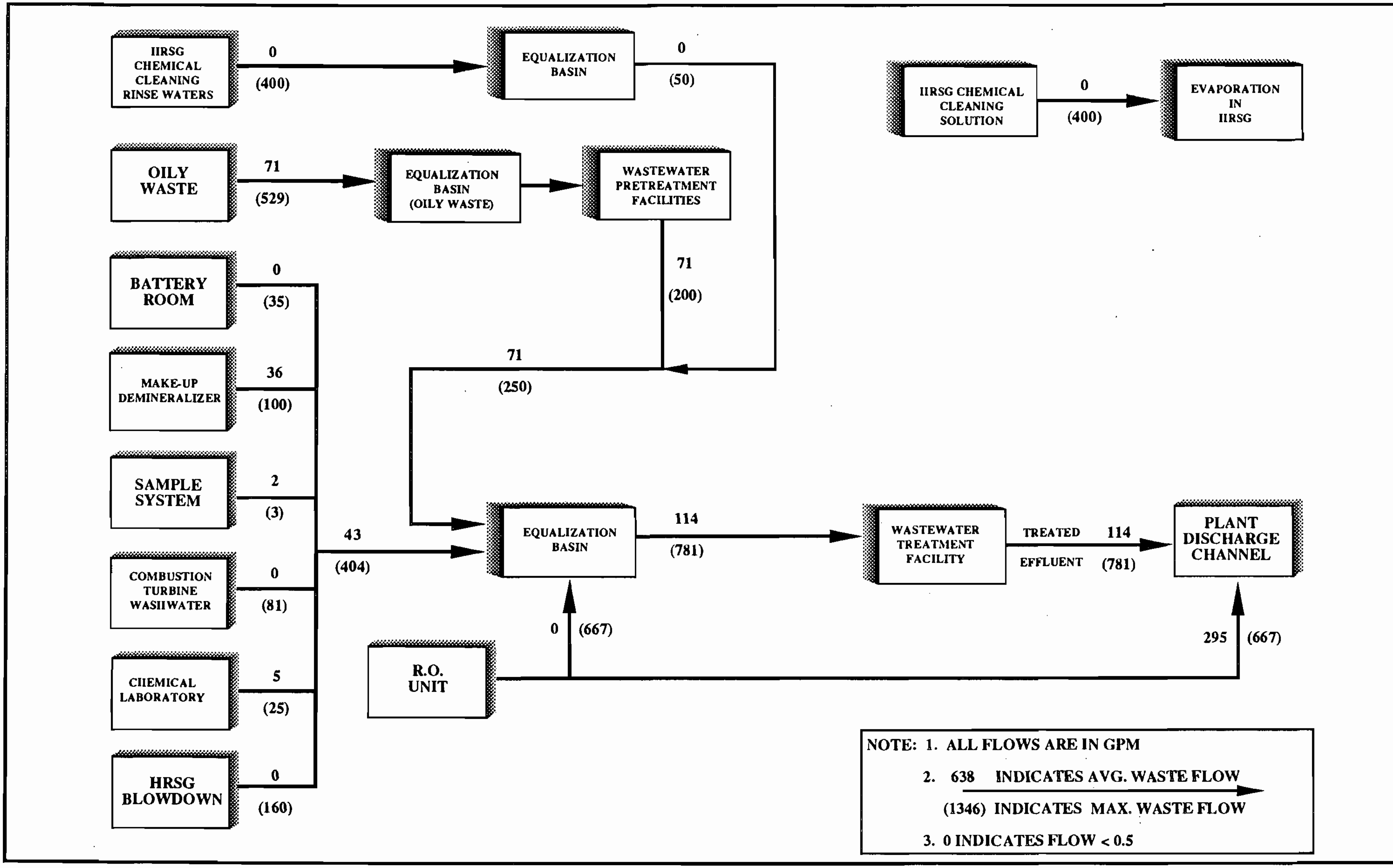

Figure 3.5-6 WASTEWATER FLOW CHARACTERIZATION

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Table 3.5-7. Wastewater Characterization (Page 1 of 3)

	Concentration[a]			
Parameter	Reverse Osmosis Concentrate	Demineralizer Regeneration Waste	Battery Room Waste	Sampling System Effluent
Flow, gpm (average)	295	36	0	2
Flow, gpm (maximum)	667	100	35	3
Calcium (Ca)	476	11	0.3	<1
Magnesium (Mg)	437	10	0.3	<1
Sodium (Na)	3,660	7,063	27	7
Potassium (K)	0	0	0	0
Ammonia (NH_3)	0	0	0	<1 -2
Carbonate (CO_3)	0	0	0	0
Bicarbonate (HCO_3)	674	107	3	0
Chloride (Cl)	6,672	1,443	41	<1
Sulfate (SO_4)	1,137	12,367	0.2	<1
Phosphate (PO_4)	0	0	0	<10
Silica (SiO_2)	44	42	1.2	<1.5
Iron (Fe)	0	0	0	0.01
Copper (Cu)	0	0	0	0.005
Carbon Dioxide (CO_2)	112	0	10	0
Oil and Grease	0	0	0	0
Organics (TOC)	0	0	0	<10
TDS	13,100	21,043	83	<1.0
TSS	0	0	10	0
pH (standard units)	7.0	7.0	7.0	9.4 - 9.8

Table 3.5-7. Wastewater Characterization (Page 2 of 3)

	Concentration[a]			
Parameter	Oily Waste	Combustion Turbine Washwater	HRSG Chemical Rinse Waters	Chemical Laboratory[b]
Flow, gpm (average)	71	0	0	5
Flow, gpm (maximum)	529	81	400	25
Calcium (Ca)	0.3	0	<1	1,566
Magnesium (Mg)	0.3	0	<1	214
Sodium (Na)	26	0.2	7	740
Potassium (K)	0	0	0	1
Ammonia (NH_3)	0	0	<1 - 2	0
Carbonate (CO_3)	0	0	0	620
Bicarbonate (HCO_3)	3	0	0	ND[c]
Chloride (Cl)	41	0.2	<1	331
Sulfate (SO_4)	0.2	0	<1	16
Phosphate (PO_4)	0	0	<10	96
Silica (SiO_2)	1.2	0.1	<1.5	19
Iron (Fe)	0	0.005	0.01	1
Copper (Cu)	0	0.004	0.005	0
Carbon Dioxide (CO_2)	0	0	0	0
Oil and Grease	1,640	0.1	0	0
Organics (TOC)	0	0.1	<10	ND[c]
TDS	72	0.509	<24.5	2,421
TSS	25	100	50	0
pH (standard units)	7.9	ND[c]	9.4 - 9.8	10.8

Table 3.5-7. Wastewater Characterization (Page 3 of 3)

	Concentration[a]	
Parameter	Wastewater Treatment Facility Effluent	Combined Release to Discharge Canal[d]
Flow, gpm (average)	114	409
Flow, gpm (maximum)	781	781
Calcium (Ca)	3	395
Magnesium (Mg)	3	363
Sodium (Na)	2,000	3,547
Potassium (K)	0	0
Ammonia (NH_3)	0	0
Carbonate (CO_3)	<10	<1.7
Bicarbonate (HCO_3)	<50	567
Chloride (Cl)	<400	5,601
Sulfate (SO_4)	3,000	1,455
Phosphate (PO_4)	<1	<.17
Silica (SiO_2)	<10	38
Iron (Fe)	<0.005	<0.001
Copper (Cu)	<0.005	<0.001
Carbon Dioxide (CO_2)	0	93
Oil and Grease	5	0.85
Organics (TOC)	1	0.17
TDS	7,000	12,058
TSS	5	0.9
pH (standard units)	7	7

[a]All units are in mg/L unless otherwise noted.
[b]Also: NH_4 = 6.1, MoO_4 = 18.3, NO_3 = 6.4, N_2H_4 = 32, and citric acid = 11.
[c]Not determined.
[d]Combined total of wastewater treatment system effluent and RO concentrate.

The RO unit will operate continuously, producing a wastestream with a maximum flow rate of 667 gpm. The pH of the RO waste will be maintained between 6.5 to 8.5.

3.5.4.2 Demineralizer Regeneration Waste

Regeneration wastes result from the regeneration cycle of the demineralizer operation. The regeneration cycle consists of backwashing, acid and caustic regeneration and rinsing of the demineralizer beds. The demineralizers must be periodically regenerated to strip absorbed ions from the resin surface and replace them with hydrogen and hydroxyl ions for the cation and anion exchangers, respectively. The regeneration of the demineralizers is achieved by adding the regenerating chemicals (e.g., H_2SO_4 and NaOH) in quantities in excess of the exchange capacity of the bed.

The demineralizer regeneration wastewaters can be characterized by extremes in pH (i.e., from 1 to 13 pH units) and a dissolved solids concentration up to 21,000 ppm. The demineralization wastewaters will be self-neutralized in a totally enclosed treatment system and then collected in a neutralization tank for pH adjustment. The wastewater pH at about 7 (as indicated in Table 3.5-7) is the result of neutralization of the acidic and alkaline waste. Demineralization waste also contains high soluble sodium, chlorides, and sulfates, resulting in a very high concentration of total dissolved solids.

The demineralizer is regenerated daily, producing a wastestream with an average flow rate of 36 gpm and a maximum flow rate of 100 gpm.

3.5.4.3 Battery Room Waste

Battery room waste results from washing the battery room floor and will be collected via the floor drains. The floor washing is done on an irregular basis. Thus, the waste is produced intermittently. The waste is estimated to be produced at a maximum flow rate of 35 gpm for 15 minutes. This produces a volume of 525 gallons estimated to average once per week. The wastestream can be characterized as acidic in nature and may contain cleaning solution, and suspended and dissolved solids.

3.5.4.4 Sampling System Waste

A modern plant such as this one, where close controls on operations are required, has extensive sampling and laboratory activities. The sampling system waste will be produced by sampling activities. This wastestream is expected to be basic in nature. The wastestream may contain sodium, phosphates, hydrazine, and ammonia. The sampling system waste will be produced intermittently at an average flow rate of 2 gpm and at a maximum flow rate of 3 gpm. Although the volume per sample varies, sample system discharges are expected to be occurring about 2/3 of the time.

3.5.4.5 Oily Waste

A number of wastestreams that may contain oil are expected to be generated from equipment drains, floor drains, storm water runoff from equipment maintenance areas, oil storage areas and transformer areas. These wastestreams may contain COD, nitrogen, oil and grease, suspended solids, and dissolved solids, depending upon the sources. In addition to the Repowering Project facilities' wastestreams, the wastewater treatment system has been sized to include capacity to treat wastewater from oil storage and handling facilities that serve the existing gas turbine site north of the discharge canal. The Repowering Project's wastestreams, which may be contaminated with oil and grease, will be pumped to an equalization tank or basin to remove flow surges. From the equalization tank the oily waste will be pumped to a pretreatment facility which removes oil and grease. The removed oil will be stored for eventual off-site disposal. The flow of wastestreams will vary depending on the source. The wastestreams from the floor drains are expected to occur once daily from routine cleaning and washing. The average flow rate is expected to be 40 gpm and the maximum flow rate is estimated to be 200 gpm. Wastestreams from the transformer area, fuel oil transfer and storage areas and the unloading facilities are derived from stormwater runoff which will be contained in diked or curbed areas with controlled flow rates to the pretreatment facility. The average and maximum flow rates are estimated to be 1 gpm and 37 gpm, respectively, from the transformer area, and 17 gpm and 529 gpm from the oil storage and fuel unloading areas. An average flow of 13 gpm, and maximum of 20 gpm, of miscellaneous pump seal water is also included. Because these are pumped flows, the maximums will not be allowed to occur simultaneously. Thus, the total maximum flow is equal to the largest single flow or 529 gpm.

3.5.4.6 Combustion Turbine Washwater

The combustion turbine washwater results from maintenance cleaning of turbines when the turbine is off-line. The specific chemical solution used for cleaning will depend on the type of deposits and scale. The total volume of wastewater expected to be generated is estimated to be about 37,000 gallons per year. The cleaning waste may be acidic or alkaline and contain cleaning solutions, calcium, magnesium, phosphates, silica, metallic ions, and suspended solids. The maximum flow rate is estimated to be 81 gpm.

3.5.4.7 HRSG Chemical Cleaning Rinse Waters

The HRSG chemical cleaning rinse waters are produced from HRSG waterside cleaning to remove corrosion products and scale. The cleaning process is required only once every 3 to 5 years for each unit to maintain normal operating performance. It has been assumed for this study that two HRSGs will be cleaned together during one outage; therefore, a cleaning of a pair of HRSGs is expected about every 2 years. The cleaning solution that will be used is based on citric acid.

The rinse waters generated by chemical cleaning of the HRSG will be routed to the wastewater treatment system. Based on the estimated HRSG volume (67,000 gallons), and an expected rinse volume of four HRSG volumes per HRSG, each HRSG cleaning event is expected to generate about 500,000 gallons of rinse waters. It is estimated that these rinse waters will be generated at a maximum flow rate of about 400 gpm. Because of the large volume of this wastewater, a separate lined equalization basin will be sized to handle it. Because of the infrequency of this operation, its annual average flow is less than 0.5 gpm.

3.5.4.8 Chemical Laboratory Waste

The contaminants within the chemical laboratory waste are expected to vary widely, depending on what particular testing is done. The concentrations presented in Table 3.5-7 were estimated based on quantities of reagents reported being used at the plant in the 1988 Broward County Direct Discharge Industrial Wastewater and/or Hazardous Material Facility and/or Storage Tank Facility License application. All reported monthly reagent usages in excess of 1/2 gallon were considered in that analysis. The major parameters include calcium, magnesium, sodium, carbonate, and chloride. On average, the pH is acidic.

3.5.4.9 Other Wastewaters

Normal operation includes recycle of the HRSG blowdown and blowdown quench water back to the process water treatment system. The wastewater treatment facility has been sized to include that flow, however, so that operation could continue even if the recycling system suffered a failure. The quality of this water would be expected to be similar to that reported for sampling system effluent in Table 3.5-7.

3.6 CHEMICAL AND BIOCIDE WASTE

3.6.1 Chemical Wastestreams

Operation of the repowered Units 4 and 5 will generate various chemical-containing liquid wastestreams which are described in detail in Section 3.5. Certain of these wastestreams will be treated before discharge. The wastewater treatment system design (see Figure 3.6-1) consists of the following processes:

1. Pretreatment of oily waste (to remove oils) through the use of a physical/chemical separation process,
2. Neutralization and filtration of the wastewater before discharge, and
3. Off-site disposal for separated oil and dewatered sludge.

Following are brief descriptions of each of the treatment processes involved.

3.6.1.1 Oily Waste

Physical Separation Process

A physical separator, as shown in Figure 3.6-2, will be used to remove free oils and grease from the oily wastestream. This separator is capable of effectively separating free oils, grease and settleable solids from water. The slant rib coalescer pack (SRCP) in the separator provides greater coalescing and solids separation area than any other media currently available. The ribs of the SRCP are slanted toward the surface in the direction of flow, encouraging separated oil to float to the surface along the plates before breaking free. The separator consists of the following:

1. Inlet and diffusion chamber where larger solids will drop out into the sludge chamber before entering the pack.
2. Separation chamber filled with the SRCP. The ribbed plates are arranged perpendicular to the direction of flow. The ribbed plates will increase the resistance to flow, enlarge the oil droplets, and separate the oil from the water.
3. Sludge chamber providing adequate volume for the settled sludge.

DESIGN PHILOSOPHY:

PRETREAT OILY WASTE TO REMOVE OILS THROUGH THE USE OF PHYSICAL/CHEMICAL SEPARATION PROCESS AND NEUTRALIZE AND FILTER THE COMBINED WASTEWATER BEFORE DISCHARGE AND OFF-SITE DISPOSAL FOR SEPARATED OIL AND DEWATERED SLUDGE

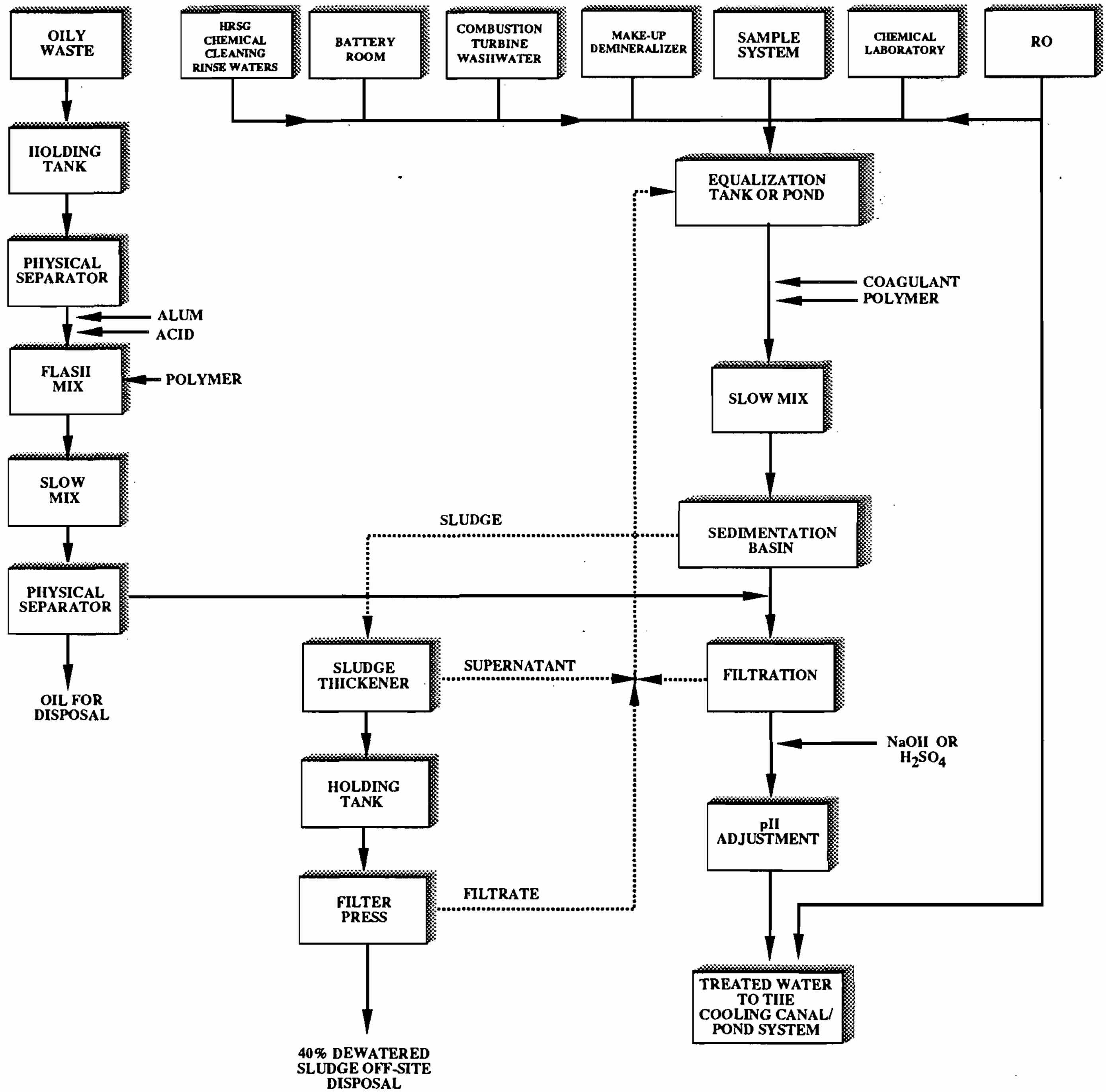

Figure 3.6-1 WASTEWATER TREATMENT SYSTEM

Note: For flow rates, see Figure 3.5-6

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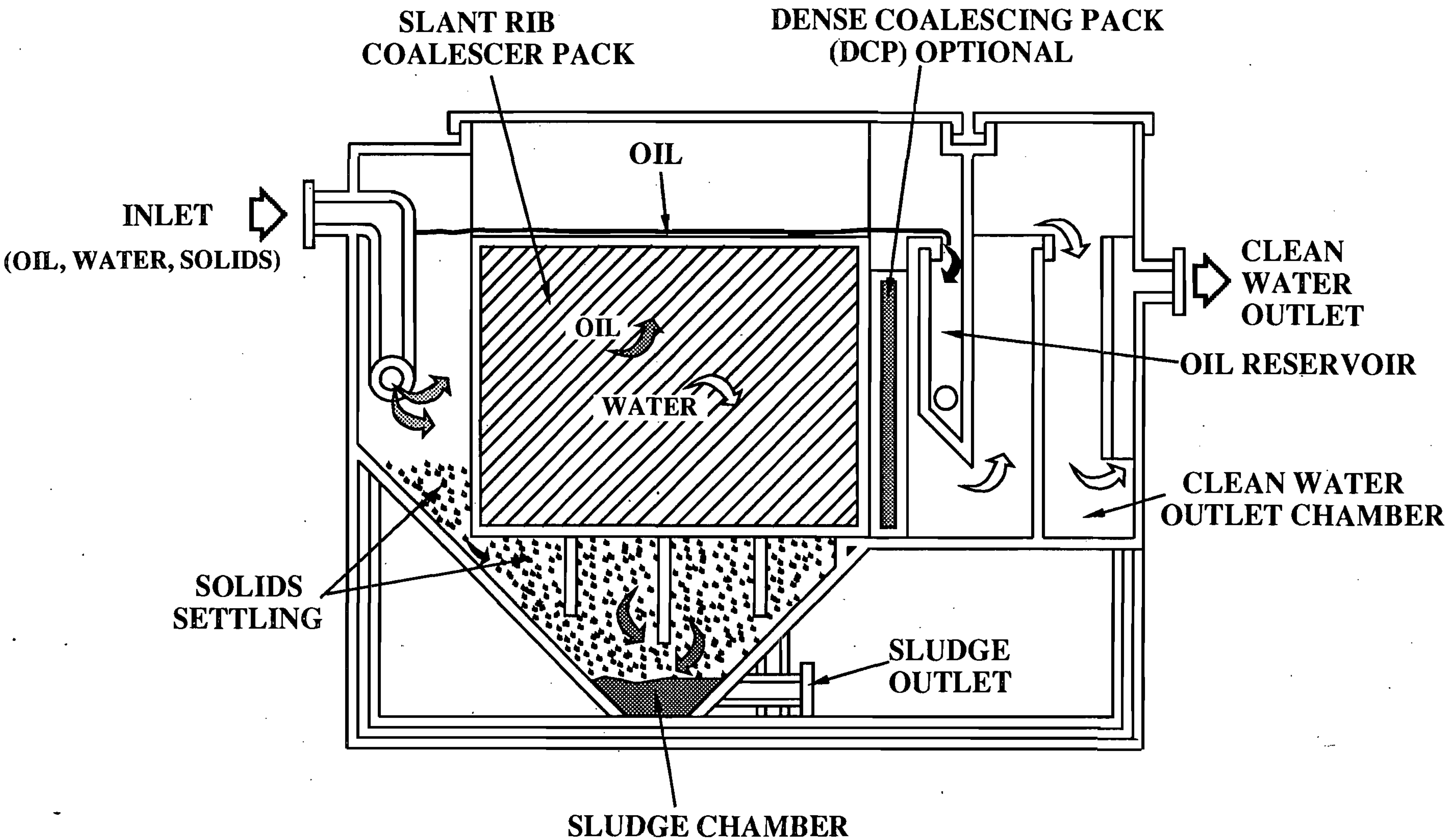

Figure 3.6-2 PHYSICAL SEPARATOR

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4. Oil reservoir to accumulate the separated oil before it is removed to a remote storage tank.

Chemical Separation Process

A chemical separation process will be used to break the emulsification of oils in the water and enhance their separation. The first step is to lower the pH to 4 by adding sulfuric acid. At this pH level the chemical compound emulsions will be broken and oils will be freed from the wastewater. To ensure completion of the desired reactions and an increase in oil droplet sizes, aluminum sulfate (alum) will be added simultaneously with the acid.

The chemical process requires a rapid mixing (flash mix) tank for pH adjustment and a flocculation tank (slow mix) to enhance the particle size growth. A second physical separator will be provided to separate the oils and grease from the water.

Design Basis	
Flow (gpm)	200[a]
Oil influent concentration (ppm)	229 average, 1,600 maximum
Oil separation rate (gpm/ft^2)	0.2

[a]An equalization basin (holding tank) is provided to allow the design flow to be less than the maximum.

Note: gpm/ft^2 = gallons per minute per square feet.

Effluent Disposition

The effluent from the chemical separation process is recombined with the other wastewater flows to receive filtration and pH adjustment before discharge.

3.6.1.2 Non-Oily Wastestreams

Chemical Precipitation Process

The chemical precipitation process is very effective in removing total suspended solids, inorganic contaminants, and for making pH adjustments. The chemical precipitation process may consist of coagulation/ flocculation/precipitation/ filtration depending on test results of actual wastewater testing. Chemical additions such as alum, iron salts, sulfuric acid (H_2SO_4), sodium hydroxide (NaOH), or polymer, may be needed to carry out the treatment function. The following unit processes will be provided and utilized as necessary.

Slow Mix Flocculation Tanks--Two tanks will be provided for flocculation. The minute particles will be brought into contact with each other and with other particles under prolonged agitation in this slow mix flocculation tank, during which time the particles coalesce, increase in size, and will be packed to a greater density for settlement.

Sedimentation Basin--One inclined upflow clarifier will be provided for precipitation. The inclined plate settler unit contains a series of stacked plates, approximately 2 inches apart, inclined at an angle of 55 to 60 degrees from the horizontal.

Filters--Two dual media pressure filters are provided for filtration. The objective of filtration is to produce an effluent with very low total suspended solids.

Finally, a pH adjustment stage is used to maintain the effluent pH between 6.5 and 8.5.

Design Basis:

Flow (gpm)	650
Slow mix (minutes detention time)	20
Precipitation overflow rate (gpm/ft^2)	0.5

Filtration rate (gpm/ft^2)	5
Backwash rate (gpm/ft^2)	15

3.6.1.3 Sludge Handling

Sludge Dewatering

The removal of pollutants or impurities from the wastestreams will result in the production of water insoluble compounds called sludge. It is desirable to minimize the volume of this waste product through sludge dewatering. The sludge volume reduction will be achieved by means of a thickener and mechanical dewatering device.

A thickener is comparable to a conventional settling tank except that the tank is deeper to accommodate a greater volume for sludge and has a heavier raking mechanism.

The mechanical dewatering device that will be used is a pressure filter because of the expected sludge dewaterability and desired cake dryness.

Design Basis:

Flow (gpm)	60
Thickener overflow rate (lb/ft^2/day)	8
Pressure filter cycle (hr)	2.5
Solid content (%)	40

Note: lb/ft^2/day = pounds per square foot per day.

3.6.2 Biocide Wastestreams

Present design of the Lauderdale Repowering Project does not include the installation of a dispensing system for injecting biocide into the circulating water system. Likewise, the existing plant does not use such biocides.

In the future, should biofouling become a serious problem in the circulating water system, FPL would evaluate the cause and all potential solutions to such a problem. Chlorination on an intermittent basis is the present preferred conventional method to control biofouling. Potential alternatives include but are not limited to bromine chloride, chlorine dioxide, sodium bromide, ozonation, ultraviolet, and mechanical cleaning.

Should future conditions warrant the use of a biocide, FPL would request a modification to the Site Certification to allow such use, consistent with 40 CFR 423.13 (federal BAT); Chapter 17-3.121, F.A.C. (state Class III Water Quality Criteria); and BEQCB 27-5.081 (Broward County effluent limits).

Two biocides which are presently in use at the site will be used after repowering. They are both added to the fuel oil to prevent microbial growth. Biobor JF is an anti-microbe additive reported (MSDS, U.S. Borax and Chemical Corporation) to be an organoboron compound (mixed dioxaborinanes). It includes 5 percent naptha. It is added to the oil at 1 part to between 55 and 4,500 parts oil when testing indicates microbial growth. Its toxicity is as follows:

Acute oral in albino rats--3.16 milliliters per kilogram (mL/kg).
Acute dermal LD_{50} in albino rates--4.64 mL/kg.
No known human experience.

Long-term stability additive (LTSA) is a mixture of amines, polyamines, and alkyl ammonium alkyl phosphate (MSDS, Fuel Quality Services, Inc.) with kerosene (58 percent) as the solvent. It is a combustible liquid. It is added to the oil at 1 part to 5,000 parts of oil.

Handling and storage of these two materials is discussed within Section 3.7.

3.6.3 <u>Chemical Additives</u>

A list of the chemical additives presently used for various processes and systems at the plant is as follows:

1. Lime [calcium hydroxide, $Ca(OH)_2$] is a basic compound used to adjust pH levels. It is used in raw water treatment (softening).
2. Polymer is a substance with a high molecular weight composed of repeating chemical units linked together into chain or network structures. Used as a flocculant to enhance sedimentation and sludge dewatering.
3. Sulfuric acid (H_2SO_4) is an acidic compound used to reduce pH levels. It is used in demineralizer regeneration and in pH adjustment before discharge to break oil emulsification and to aid in chemical precipitation.
4. Sodium Hydroxide (NaOH) is a basic compound used to raise pH levels, used in demineralizer regeneration, pH adjustment, and to aid in chemical precipitation.
5. Hydrazine (H_2NNH_2) is a strong reducing agent used as an oxygen scavenger to inhibit corrosion in steam generator condensate and feedwater.
6. Ammonia (NH_3) is a basic compound used to adjust pH levels in steam generator condensate and feedwater.
7. Tri-, di-, and mono-sodium phosphates are inorganic salts used in steam generator water to prevent scaling (deposition).
8. Molybdate is a substance used as a corrosion inhibitor in the closed side of an open cooling water system.
9. Tolyltriazole ($CH_2C_6H_3N_3H$) is a substance used as a corrosion inhibitor in the closed side of an open cooling water system.
10. Aluminum sulfate [alum, $Al_2(SO_4)_3$] is an inorganic salt used as a coagulant in separating emulsified oil from wastewater and for chemical precipitation.
11. Iron salts are inorganic salts used as a coagulant.
12. Diatomaceous earth is a natural material used in sludge dewatering.

3.7 SOLID AND HAZARDOUS WASTES

3.7.1 Solid Wastes

Solid wastes generated from the Lauderdale Repowering Project include:

1. Wastewater treatment sludge,
2. Waste oils,
3. Plant refuse, and
4. Used inlet air filters.

Wastewater Treatment Sludge--As shown in Figure 3.6-1, sludge dewatering is a final process in the wastewater treatment system. The sludge dewatering process is described in Section 3.6.1.3. The expected quantity of sludge requiring disposal is estimated to be 7.5 gpm, assuming a moisture content of 60 percent.

The sludge cake will be disposed of off-site at a licensed sanitary landfill.

Waste oil is generated as described in Section 3.6.1.1. The volume of this material that will be produced is estimated to be less than 500 gallons per month. This material is presently being recovered via existing oil/water separators and disposed off-site to an oil recycler. Future disposal is anticipated to be by the same process.

Plant Refuse--Plant refuse including scrapings from the intake screens (mostly grass, described in Section 3.5.1.4) is collected in dumpsters on-site and periodically removed by an outside contractor who disposes it in an off-site sanitary landfill. The only significant change in quantity or composition of this material, with respect to current operation of the plant, will be the addition of inlet air filter elements. It has been estimated that these elements will require changing approximately every 30 months, resulting in an annual solid waste generation volume of about 39 cubic yards (yd^3). These filter elements are very similar in nature to automobile air cleaners except that they are larger.

3.7.2 Hazardous Wastes

Florida's hazardous waste management program is codified under Chapter 17-730, F.A.C., which adopts and incorporates by reference EPA's rules on the identification and listing of hazardous waste which are published in 40 CFR 261. Chapter 17-730, F.A.C., also states that Florida standards applicable to generators and transporters of hazardous waste and to owners and operators of hazardous waste facilities are substantively identical to federal regulations in 40 CFR Parts 262, 263, 264, 265, and 266. Therefore, the federal regulations will be referred to in this chapter as the regulations which must be met.

Chapter 27-12 of the BCEQCB Code of Regulations includes the county regulations regarding management of hazardous materials. Chapter 27-12.071 prohibits the discharge of any hazardous materials to the environment. This prohibition includes petroleum products (Chapter 27-12.01) as a hazardous material. Otherwise, with the exception of infectious disease, the county definition of hazardous materials does not differ significantly with the state and federal definitions. Chapter 27-12.073 prohibits disposal of any hazardous material in a trash or garbage receptacle. Chapter 27-12.074 requires that outdoor storage of hazardous materials be in product-tight containers, with secondary containment. The remainder of Chapter 27-12 deals with licenses and fees.

3.7.2.1 Definition Of Hazardous Wastes

Any solid waste is a hazardous waste if it meets either of the following criteria:

1. It exhibits any of the characteristics of hazardous waste identified in 40 CFR 261 Subpart C, or
2. It is listed in 40 CFR 261 Subpart D.

3.7.2.2 Identification/Treatment of Hazardous Wastes

The Lauderdale Repowering Project will generate both listed and characteristic hazardous wastes. The hazardous wastes which could be generated at the plant fall into the following categories:

1. Nonthermal wastewaters,
2. Waste oils containing hazardous constituents, and
3. Miscellaneous hazardous wastes.

NONTHERMAL WASTEWATERS

Nonthermal wastewaters is a broad category of various wastewaters resulting from operation of a power plant. The Lauderdale Repowering Project has been designed so that none of these wastes will be hazardous. Nonhazardous nonthermal wastewaters and treatment strategies are described below.

1. Water and Wastewater Treatment Sludges
   Sludges containing water treatment chemicals have the potential to be hazardous due to high pH levels. This type of sludge will not be generated because these treatment chemicals will not be used.
2. Demineralizer Regenerant
   The regeneration of the demineralizers is achieved by the addition of regenerating chemicals (e.g., sulfuric acid and sodium hydroxide). The spent sulfuric acid and sodium hydroxide will be neutralized in a totally enclosed treatment facility (TETF) as defined under 40 CFR 260.10. TETFs are exempted from being regulated as hazardous waste treatment units under 40 CFR 265.1(c)(9) and their effluent is considered nonhazardous.
3. Steam Generator Blowdown
   This blowdown may contain trace levels of hydrazine (a conditioning chemical), but is typically a high quality wastestream and will be recycled into the water treatment system.
4. Metal Cleaning Waste
   Nonhazardous steam generator cleaning waste (spent citric acid solution) is presently evaporated in one of the steam generators. After repowering is completed, this practice will be modified because the steam generators will be replaced with CTs and associated HRSGs. Since the HRSGs are augmented with supplementary firing duct burners, the waste will be evaporated in the duct burners.

5. Demineralizer Brining Solution
   The spent demineralizer brining solution (which is not a regenerant) contains caustic and sodium chloride but is not hazardous.
6. Reverse Osmosis Wastes
   None of the reverse osmosis wastestreams will be hazardous.

WASTE OILS CONTAINING HAZARDOUS CONSTITUENTS

The only waste oils containing hazardous constituents which might be generated on site would be spilled fuel oil containing biocides (see Section 3.6.2). Drainage from all such areas is routed to the central wastewater treatment facility (see Section 3.6.1). Levels of biocides in these oils are expected to be significantly below hazardous levels.

MISCELLANEOUS HAZARDOUS WASTES

Miscellaneous hazardous wastes include toxic laboratory wastes and wastes from painting/degreasing operations. Table 3.7-1 lists these wastes and their corresponding EPA identification numbers. According to FPL's existing Lauderdale Plant Hazardous Waste Management Plan, these wastes are accumulated in containers of 55 gallons or less near their respective points of generation (satellite accumulation areas). As these containers are filled, they are transferred to a storage-for-disposal area where they are stored prior to being transported off-site for disposal at a licensed hazardous waste disposal facility. Figures 3.7-1 and 3.7-2 show the location of both the satellite accumulation areas and the central storage-for-disposal area. Because wastes accumulate in the storage-for-disposal area for less than 90 days, a storage permit is not required, provided certain management standards are met [40 CFR 262.34(a)]. Handling of these wastes will not change after repowering.

Table 3.7-1. Miscellaneous Hazardous Wastes Generated

Hazardous Waste	EPA Identification Number
Ignitable and EP Toxicity	D001, F005
Wastes From Painting and Degreasing Operations	D007, D006 D008, D009
EP Toxicity Laboratory Waste	D007, D009
EP Toxicity Solid Waste From Painting and Degreasing Operations	D007, D008 D009, F003

Note: EP = Extraction procedure.

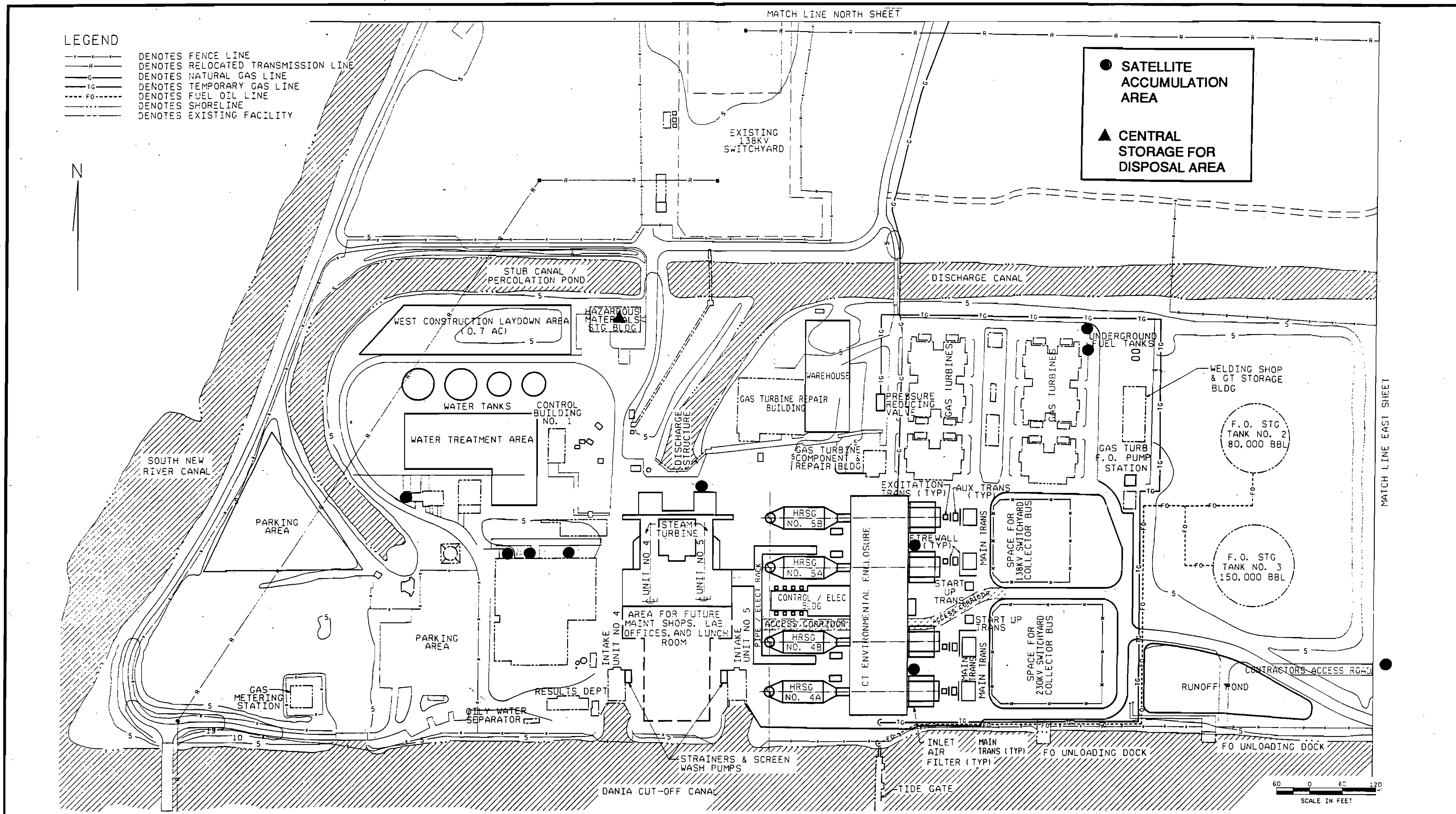

Figure 3.7-1 HAZARDOUS WASTE SATELLITE ACCUMULATION AREAS AND CENTRAL STORAGE FOR DISPOSAL - POWER BLOCK AREA

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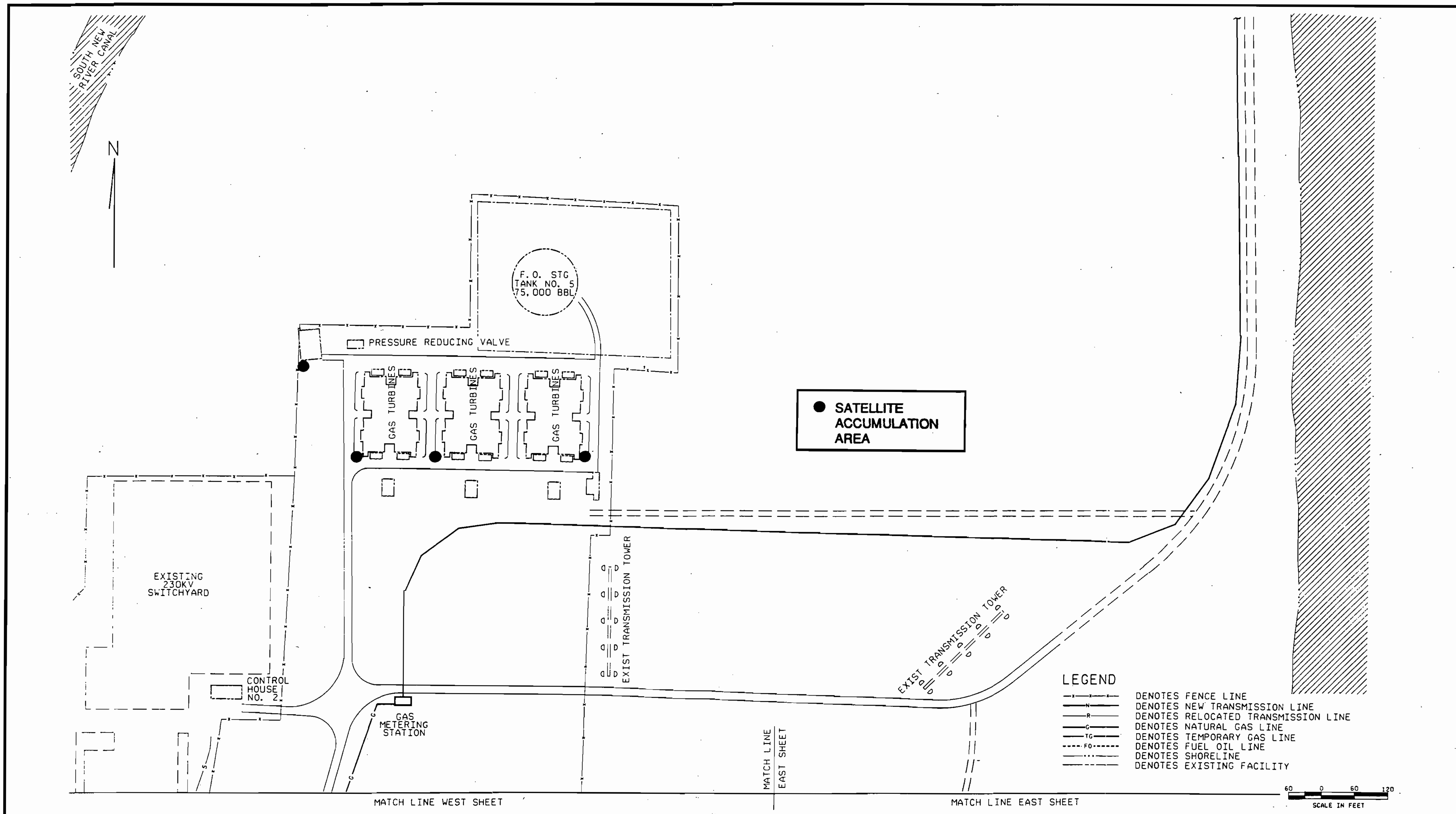

Figure 3.7-2 HAZARDOUS WASTE SATELLITE ACCUMULATION AREAS - NORTHERN PORTION OF SITE

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3.8 ON-SITE DRAINAGE

3.8.1 Environmental Regulations

On-site drainage is regulated by federal, state, water management district, and county regulations. Following are the major key regulations affecting this project.

3.8.1.1 Federal Regulations

Power plant discharges to navigable waters are regulated under 40 CFR Part 423 (Steam Electric Power Generating Point Source Category). Part 423 sets effluent limitation guidelines for low volume waste sources. Low volume waste sources are defined as all sources of power plant wastewater not specifically defined elsewhere in Part 423 taken collectively as if there were only one source. Stormwater and on-site drainage are covered under this category.

For the existing site stormwater drainage system, Part 423.12 Best Practicable Control Technology Currently Available (BPT) is applicable. The applicable effluent limitations guidelines pertaining to Part 423.12 are summarized in Table 3.8-1.

3.8.1.2 State Regulations

Florida Statutes Sections 403.182 and 403.812 authorize FDER to delegate to local governments or water management districts the authority to issue or deny permits, process notices, initiate enforcement actions, and monitor for compliance in the regulation of stormwater discharge. Under Chapter 17-25.090, F.A.C., such authority has been delegated to SFWMD whose regulations are outlined below.

3.8.1.3 District Regulations

The SFWMD has adopted rules published as Chapter 40E, F.A.C., which describe the permit requirements for construction, alteration, or operation of surface water management systems. Specific criteria which the district uses for evaluating projects in urban areas fall under Chapter 40E-4.091 and are described in a document entitled "Basis of Review For Surface Water

Table 3.8-1. Existing Point Source Effluent Limitations From 40 CFR Part 423.13

Component	Effluent Limitation
pH	6 to 9
PCB's	Zero discharge
TSS	100 mg/L maximum 30 mg/L average
Oil and Grease	20 mg/L maximum 15 mg/L average

Note: PCB = Polychlorinated biphenyl.
TSS = Total Suspended Solids.

Management Permit Applications within the South Florida Water Management District (BOR)."

That document lists the following major areas of concern: drainage water quantity, drainage water quality, environmental (specifically, wetlands) impacts, and construction criteria for the discharge structures/systems. Key technical requirements under each of these areas are summarized below.

DRAINAGE WATER QUANTITY

Section 3.2.1 of the BOR requires that off-site drainage be limited to one of the following:

1. Historic discharges,
2. Amounts determined in previous SFWMD permits, or
3. 40 cfs per square mile (for drainage basin C-11, east of S-13A).

A storm event of 3-day duration and 25-year return frequency is to be used for computing off-site discharge. The magnitude of this storm is approximately 15 inches, with a peak hourly rate of about 4 inches per hour. On-site diversion swales are allowed as necessary to provide for the passage of drainage from offsite upland areas to downstream areas.

DRAINAGE WATER QUALITY

Section 3.2.2 of the BOR requires that discharges meet state water quality standards as set forth in Chapter 17-3, F.A.C. Retention and/or detention in the overall system, including swales, lakes, canals, greenways, etc., is required to meet one of the three following criteria or equivalent combinations thereof:

1. Wet detention volume shall be provided for the first inch of runoff from the developed project, or the total runoff of 2.5 inches times the percentage of imperviousness, whichever is greater.
2. Dry detention volume shall be provided equal to 75 percent of the above amounts computed for wet detention.

3. Retention volume shall be provided equal to 50 percent of the above amounts computed for wet detention. Retention volume included in flood protection calculations requires a demonstration of guarantees of long term operation and maintenance of system bleed-down ability.

Industrial zoned projects are required to provide at least one half inch of dry detention or retention pretreatment as part of the required retention/detention, unless reasonable assurances can be offered that hazardous materials will not enter the project's surface water management system.

ENVIRONMENTAL IMPACTS

Section 3.2.3 of the BOR deals specifically with wetlands and has not been considered to be applicable to this project.

CONSTRUCTION CRITERIA

Section 3.2.4 of the BOR requires all design discharges to be made through structural discharge facilities, and that earth berms be used only to disperse or collect sheet flows from or to ditches, swales, etc., served by discharge structures. Discharge structures must be fixed so that discharge cannot be made below the control elevation, and they should include gratings for safety and maintenance purposes. The use of trash collection screens is desirable. Discharge structures are required to include a baffle system to encourage discharge from the center of the water column rather than the top or bottom. Discharge structures from areas with greater than 50 percent impervious area or from systems with inlets in paved areas must include a baffle, skimmer, or other mechanism suitable for preventing oil and grease from discharging to and/or from retention/detention areas.

Direct discharges, such as through culverts, storm drains, weir structures, etc., are allowed to receiving waters which by virtue of their large capacity, configuration, etc., are easily able to absorb concentrated discharges. Such receiving waters can include existing storm sewer systems and man-made ditches, canals and lakes. Indirect discharges, such as overflow and spreader swales, are required where the receiving water or its adjacent supporting ecosystem might be degraded by a direct discharge. The discharge structure would therefore discharge into the overflow, spreader swale, etc., which in turn would release the water to the actual receiving water. Such receiving waters can include natural streams, lakes and marshes and land naturally receiving overland sheetflow.

3.8.1.4 County Regulations

The Broward County Transportation Department water management regulations and standards apply to all water management works within Broward County (Ordinance 74-21). These regulations include the following substantive requirements:

1. Provisions are required for certain excavations in order to prevent lowering of the groundwater table or saltwater intrusion.
2. The following values for the 5-day, 10-year and 5-day, 100-year rainfall are to be used in the design of local drainage facilities: 14.0 inch and 20.24 inch, respectively.
3. The design capacity and maximum allowable infall rate permitted by the SFWMD into their primary canals of 40 cfs per square mile shall constitute the maximum total design outflow from any development.
4. Storm systems which drain to open bodies of water will include a structure designed to trap floating trash and oils prior to the discharge outlet.

In April 1989, BCEQCB adopted Chapter 27-14 into their Code of Regulations. This section is entitled "Management of Storm Water Discharges and Non Point Source Water Pollution." The provisions of this chapter which are applicable to stormwater management are essentially the same as the SFWMD regulations described in Section 3.8.1.3.

3.8.2 Design Parameters

All drainage and runoff calculations are contained in Appendix 10.7. The site is shown on three figures. They include the western portion of the site (Figure 3.8-1), the eastern portion of the site (Figure 3.8-2), and the northern portion of the site (Figure 3.8-3). The areas affected by the project and included on Figure 3.8-1, their estimated runoff coefficients [based on the rational runoff method described in 4.6(b) of the BOR], and their acreage are as follows:

Area	Acres	Runoff Coefficient
Runoff Pond	0.7	0.00
West Construction Laydown Area	0.7	0.65
Power Block Area	9.3	0.87
Water Treatment Area	1.1	0.90

The areas affected by the project and included on Figure 3.8-2, their estimated runoff coefficients, and their acreage are as follows:

Area	Acres	Runoff Coefficient
Equalization Basin	3.0	0.00
Wastewater Treatment Area	1.5	0.90
Construction Facilities	3.2	0.65
East Construction Parking	3.7	0.65
East Construction Laydown	4.6	0.65
Central Construction Parking/ Laydown Area	3.4	0.65

The central construction parking/laydown area shares a common 3.0 acres with the equalization basin and wastewater treatment area.

The only area on Figure 3.8-3 which will be affected by construction and operation of the project is the route for the new gas line. Assuming a corridor width of 30 ft, and a length of about 600 ft from the new metering station to the discharge canal, the area affected is approximately 0.4 acre. The runoff coefficient for this area is estimated to be about 0.10.

3.8.3 Construction Phase Stormwater Runoff

During construction, all 10 of the areas described in Section 3.8.2 will require active management of stormwater runoff. The power block area (Figure 3.8-1) will be sloped to convey as much of its runoff as possible to the construction runoff pond. Where necessary, this runoff will be collected in sumps and pumped to that pond. The pond is sized to hold more than 30,000 cubic feet (ft^3), which is equivalent to the wet retention criteria specified in 3.2.2.2 (3) of the BOR. Runoff in excess of the retention amount will be discharged via an overflow weir to the Dania Cut-Off Canal. From the pond, the retained water will percolate into the groundwater.

The west construction laydown area and water treatment area (Figure 3.8-1), except for potential chemical spill areas within the water treatment area which will be diked and drained to the wastewater treatment facility, will be sloped to drain into the existing stub canal percolation pond as overland flow. This pond, which was created from the discharge canal of older units which were retired, is large enough to percolate the entire storm volume (567,000 ft^3) from a total area of 10.4 acres which includes these 1.8 acres. It discharges by percolation and presently receives those areas' runoff.

The equalization basin area (Figure 3.8-2) has no runoff. Until its construction is complete, its western portion will serve as a percolation pond for rainfall upon itself and the northern portion of the wastewater treatment area. The remainder of the equalization basin area and the wastewater treatment area (which will be within the central construction parking/laydown area) and construction facilities area (Figure 3.8-2) will be sloped to drain to the existing evaporation percolation pond. The total storm volume of about 837,000 ft^3 of water from an area of about 10 acres will be percolated from the existing evaporation/percolation pond (Figure 3.8-2) (located within the equalization basin area). An overflow from that pond to the existing discharge canal will accommodate overflow should storms in excess of the design storm occur.

The east construction parking area and east construction laydown area (Figure 3.8-2) will be surrounded by a discharge swale which will provide wet detention for the entire storm volume (estimated at 452,000 ft^3 for these areas). An overflow from the swale to the existing cooling pond will accommodate flows in excess of the design storm.

During installation of the new gas line (Figure 3.8-3), only a small portion of the on-site corridor will be affected at any given time. Both sides of each affected area will be lined with turbidity screens prior to excavation. After pipe installation and backfill, the affected areas will be seeded with a quick-growing grass. The turbidity screens will be left in place until the grass is well-established.

3.8.4 Operational Phase Stormwater Runoff

Only four of the areas discussed in Section 3.8.3 will still require active management of stormwater runoff after construction is complete. The west construction laydown area shown on Figure 3.8-1; the construction facilities area, east construction parking area, and east construction laydown area shown on Figure 3.8-2; and the corridor surrounding the new gas line shown on Figure 3.8-3 will not be incorporated within the project after construction. These areas will be restored essentially to their original contours so that stormwater runoff will be as presently exists. A description of the existing drainage for these areas is included in Section 2.3.4.1 of this SCA. The remaining four areas are discussed in the following sections.

The power block area runoff and the water treatment area runoff (Figure 3.8-1) will be handled the same way during operation as during construction (see Section 3.8.3).

Rainfall onto the equalization basin area and runoff from the wastewater treatment area will be treated by the wastewater treatment system, as described in Section 3.6.1.1.

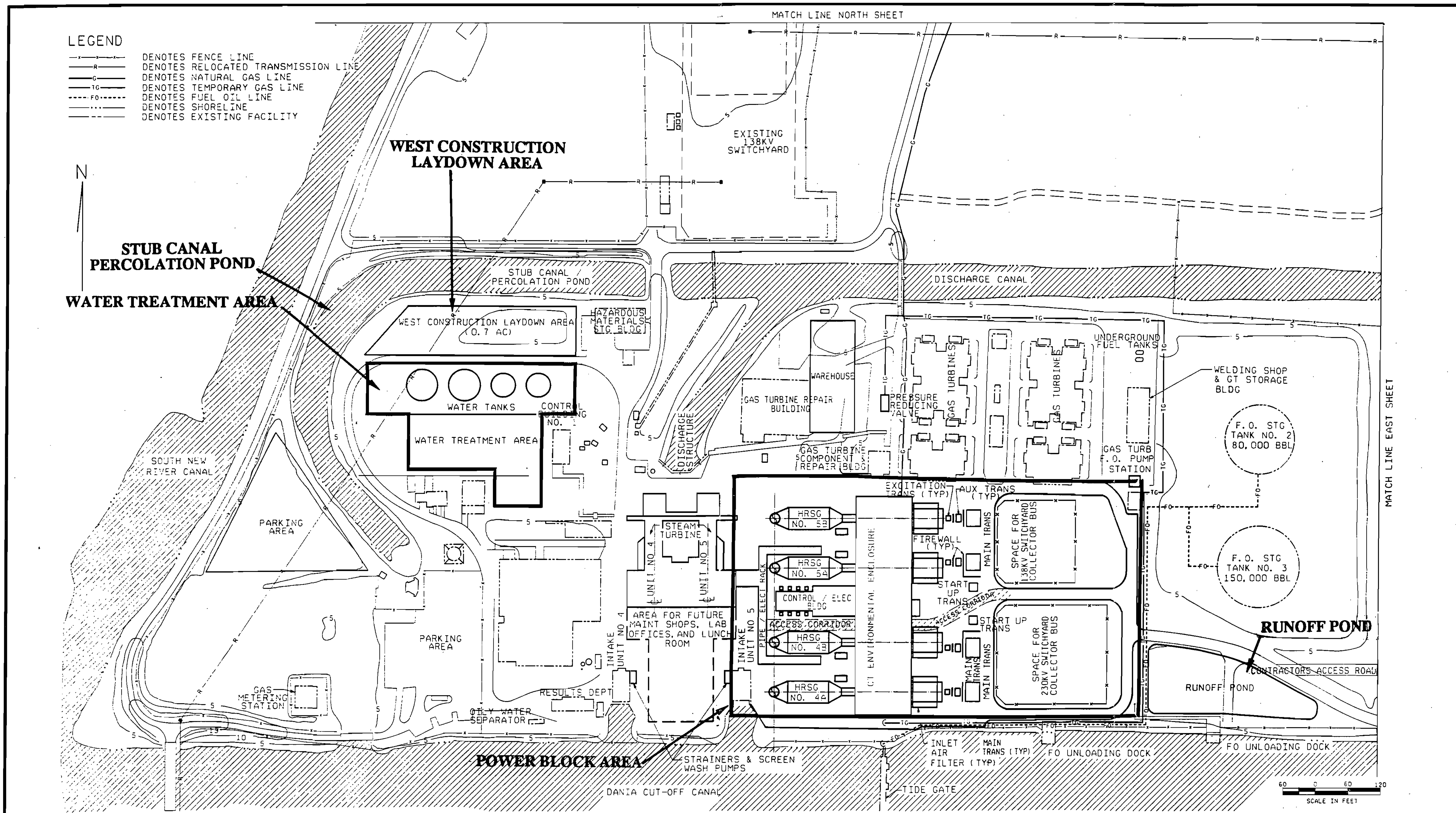

Figure 3.8-1 SITE DRAINAGE - WESTERN PORTION OF SITE

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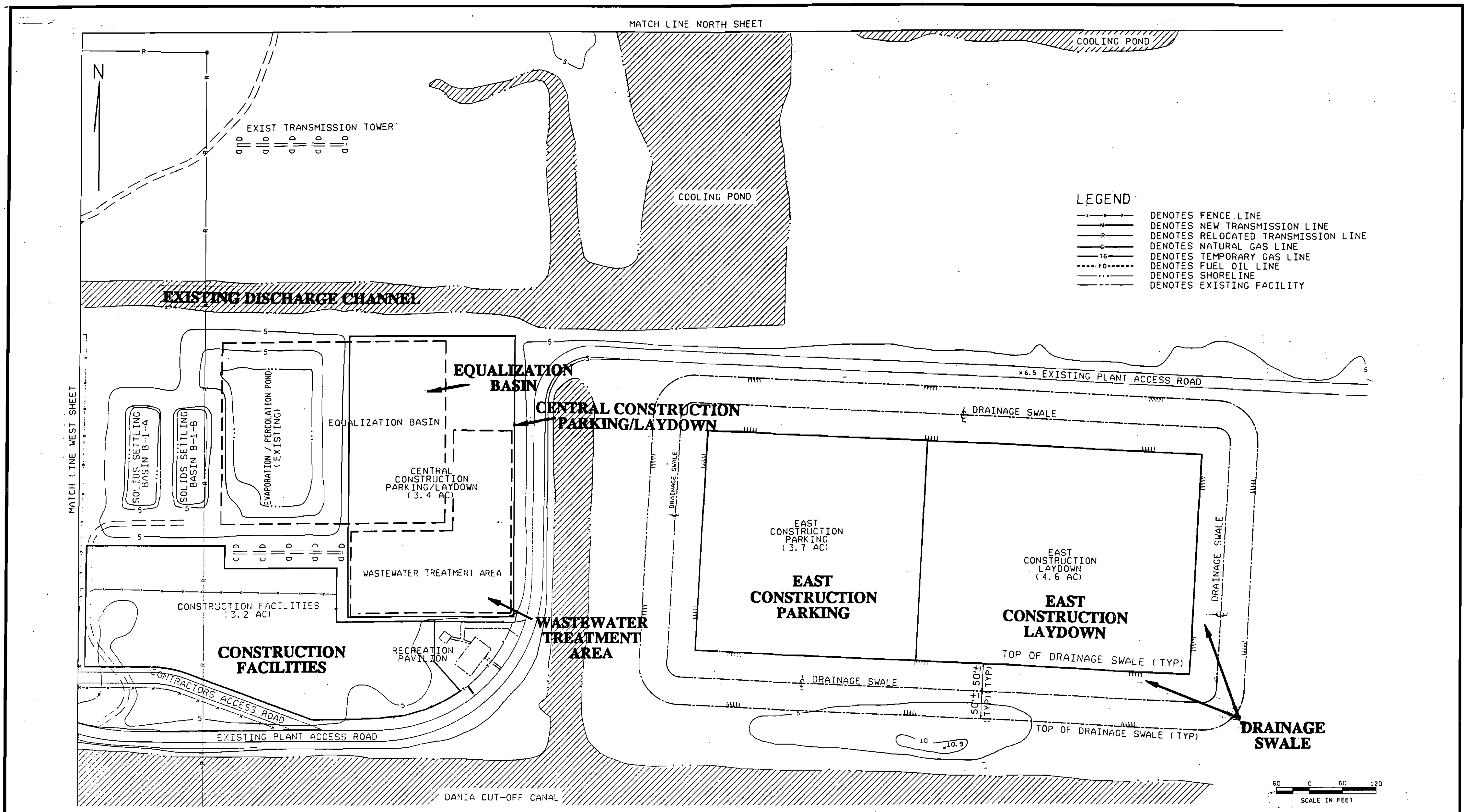

Figure 3.8-2 SITE DRAINAGE - EASTERN PORTION OF SITE

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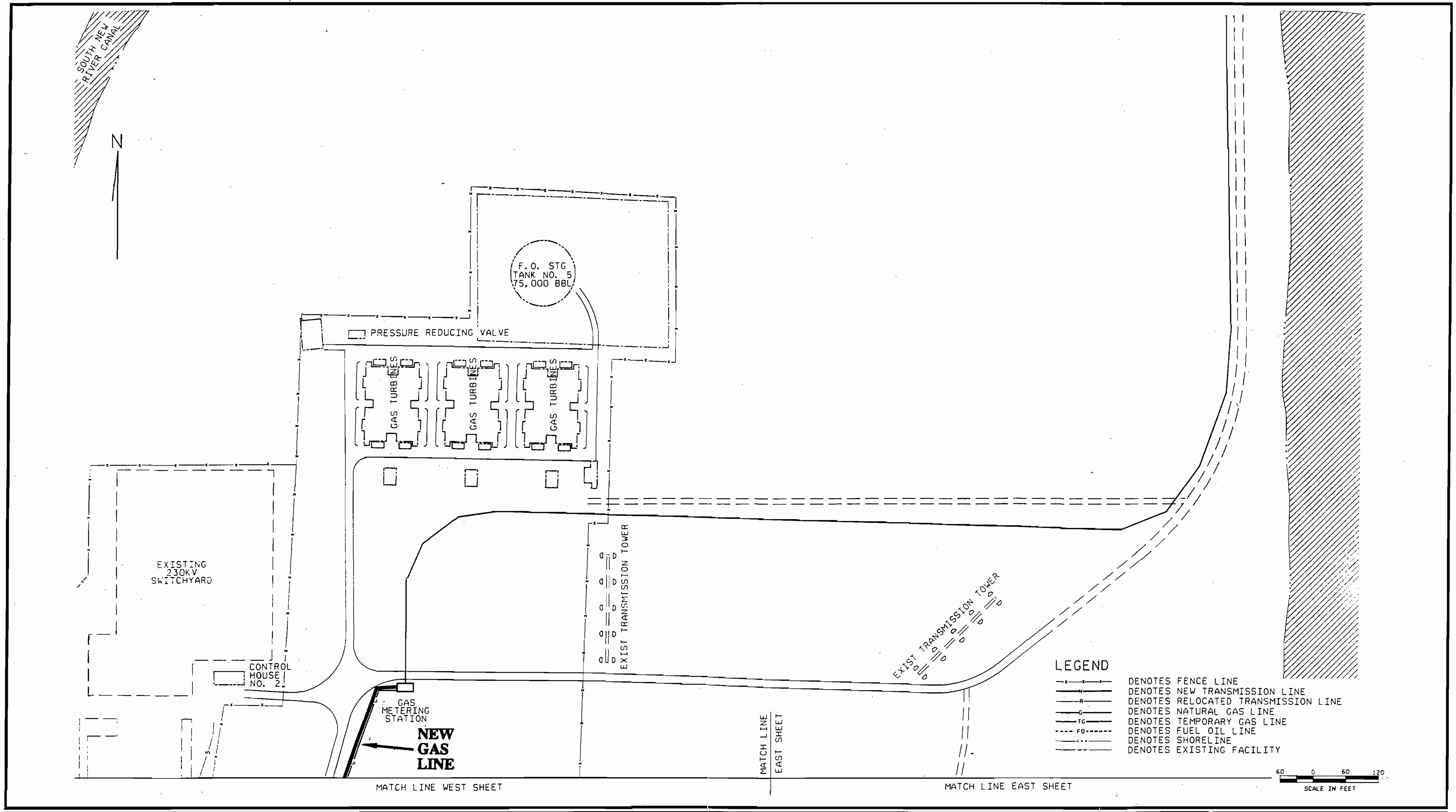

Figure 3.8-3 SITE DRAINAGE - NORTHERN PORTION OF SITE

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3.9 MATERIAL HANDLING

Roads within the plant vicinity are shown on Figure 3.9-1. Primary plant access for construction traffic will be via SW 42nd Street (also known as Edgewater Road) which enters the site from the east. Access to SW 42nd Street will be from Ravenswood Road (which runs north-south) or, if completed, possibly from the proposed Port 95 Boulevard. Main east-west roads providing access to Ravenswood Road are State Road 84 (north of the plant) and Griffin Road (south of the plant). Should Port 95 Boulevard be complete, access to it will be from State Road 84. Non-construction traffic will gain site access via SW 42nd Avenue (see Figure 3.9-2). If necessary, some construction traffic may access the site via an unpaved road which runs south from State Route 84 along the west boundary of the cooling pond and eventually follows the same route as the gas pipeline discussed in Section 3.3.

Heavy equipment will ultimately be delivered to the site on trucks. This equipment is estimated to consist of four CTs (about 377,000 lb each), four CT generators (about 476,000 lb each), several HRSG modules (about 300,000 lb each), and at least eight transformers (about 300,000 lb each). This heavy equipment will most likely be delivered prior to installation and stored temporarily in the 3.4-acre central construction parking/laydown area (see Figure 3.9-3). Figure 3.9-3 also shows the existing plant access road, which is an extension of SW 42nd Street (see Figure 3.9-1). Additional laydown acreage (0.7 acre) for smaller equipment has been designated as the west construction laydown area on Figure 3.9-2.

Although ultimate site delivery will be by truck, much of the equipment could be shipped to the area on the CSX Railroad. Rail sidings that could be used as intermediate destinations include the Griffin Road siding, Broward Boulevard, Tiger Tale Boulevard, and Hallandale. Additional sidings under consideration include those at the Fort Lauderdale-Hollywood Airport, Hollywood Boulevard, and Oak Park Boulevard. After rail delivery to a siding, the equipment would be transferred to a truck for site delivery.

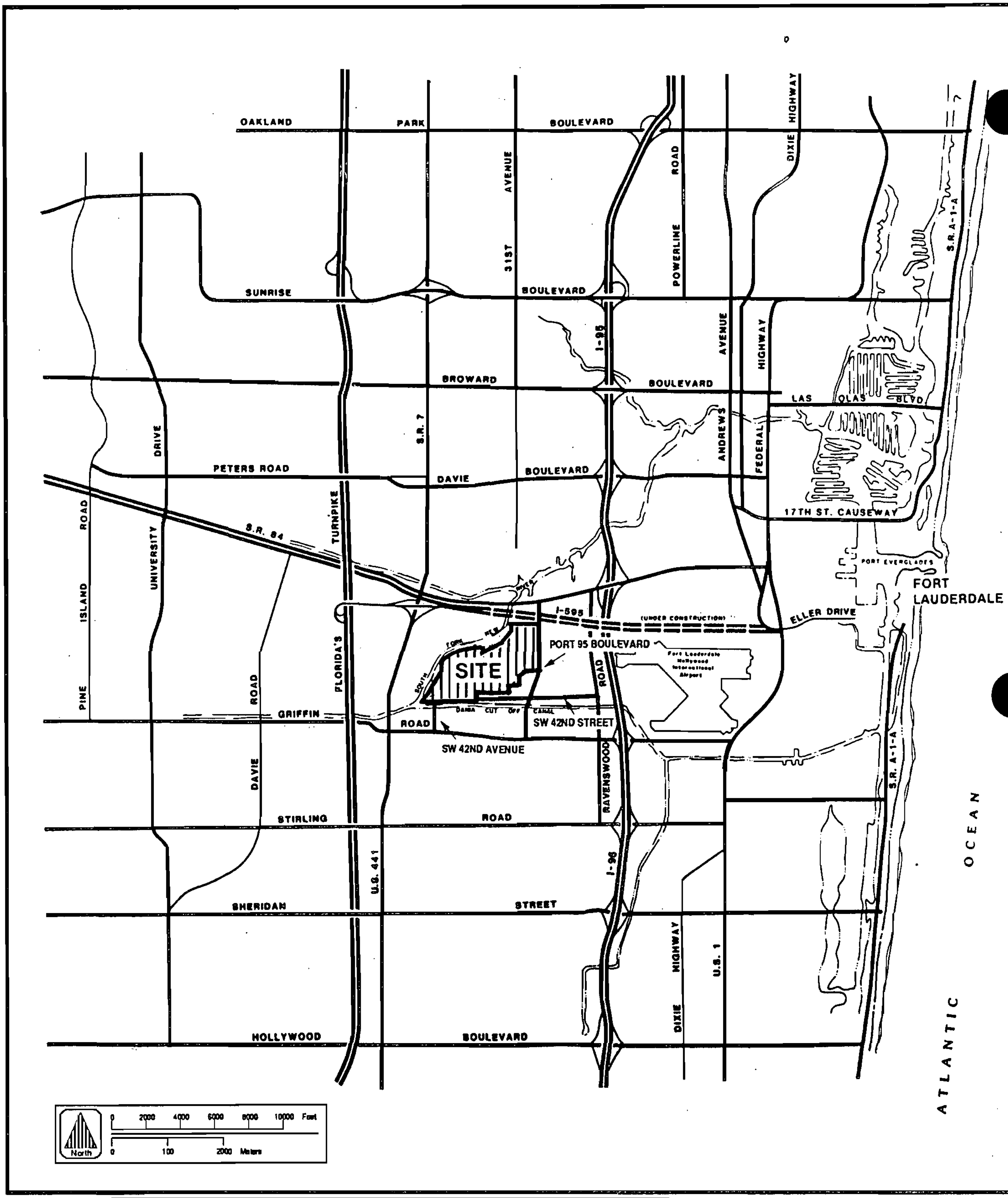

Figure 3.9-1 PRIMARY PLANT ACCESS

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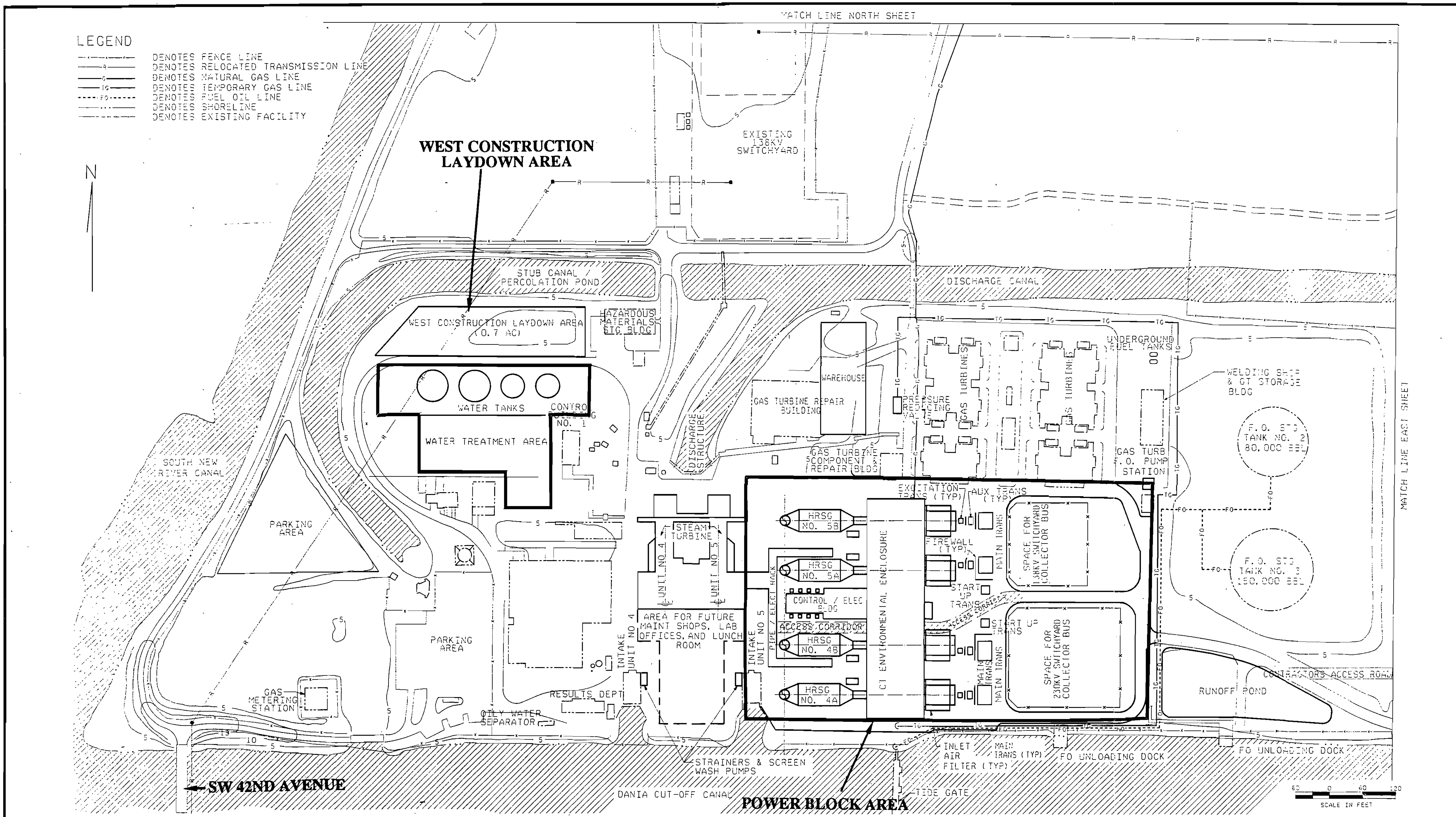

Figure 3.9-2 WESTERN PORTION OF SITE - POWER BLOCK AREA

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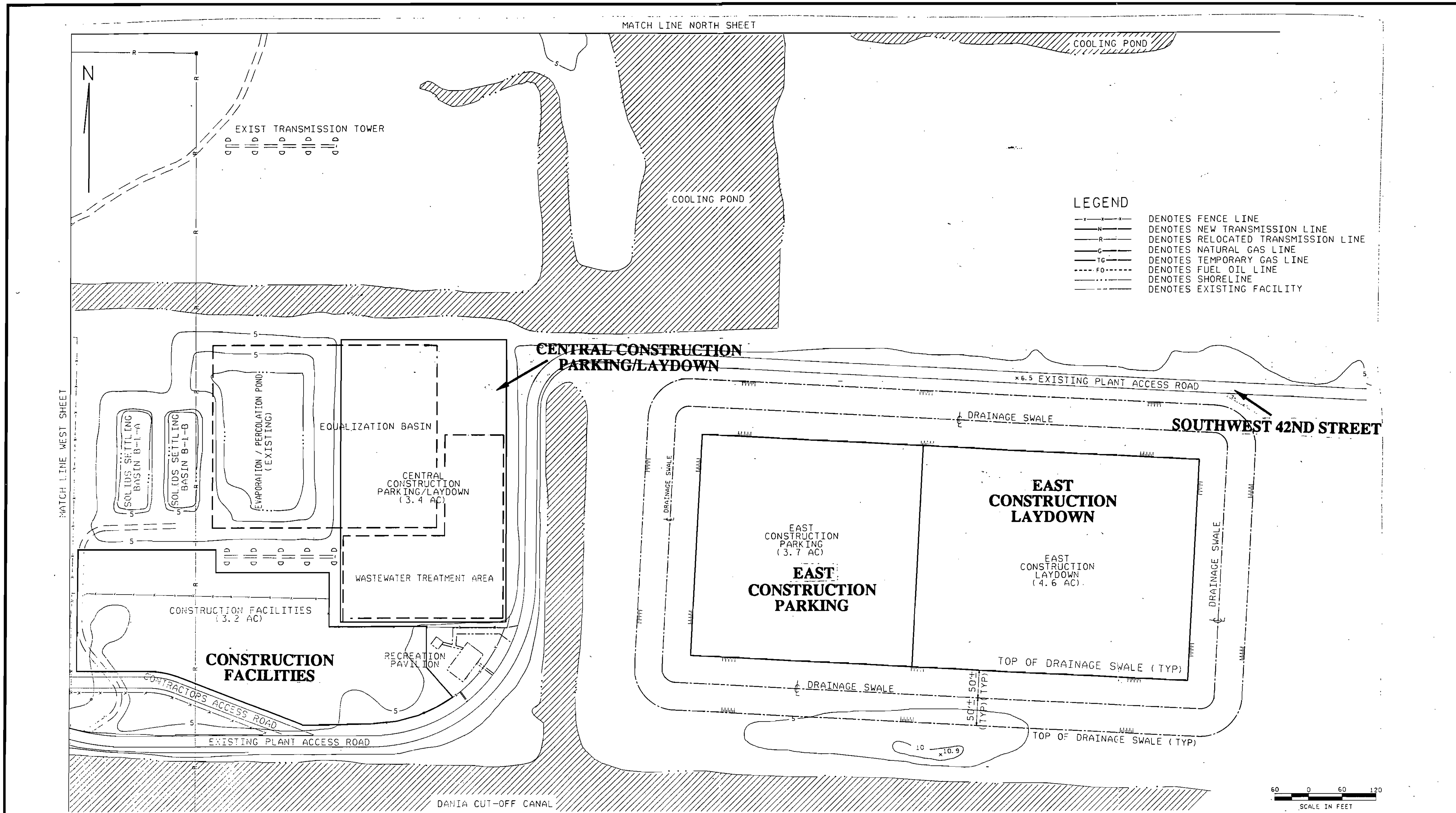

Figure 3.9-3 EASTERN PORTION OF SITE - CONSTRUCTION FACILITIES AREA

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Site Certification Application

Chapter 4

Effects Of Site Preparation And Plant And Associated Facilities Construction

TABLE OF CONTENTS

TABLE OF CONTENTS
(Continued)

LIST OF TABLES

LIST OF FIGURES

4.0 ENVIRONMENTAL EFFECTS OF SITE PREPARATION AND PLANT AND ASSOCIATED FACILITIES CONSTRUCTION

4.1 LAND IMPACTS

4.1.1 General Construction Impacts

The portions of the site that will be affected by the construction of the Lauderdale Repowering Project are discussed in Section 3.8 and are shown in Figure 4.1-1. As described in Section 3.8.2, a total of about 28.2 acres will be impacted. Of this total, 15.6 acres will be utilized for construction support as follows: construction facilities (3.2 acres), and construction laydown and construction parking areas (9.0 acres). The east construction laydown (4.6 acres) and parking (3.7 acres) areas are part of the Port 95 Commerce Park and will only be used during construction. Portions of the equalization basin and the wastewater treatment area and an additional 0.4 acre north and east of these areas will be used for temporary construction laydown and parking. The west construction laydown area and the construction facilities area will be used for activities associated with construction. These areas will be cleared of vegetation and grubbed. Construction laydown areas, which may be heavily traveled, will be stabilized with shell or rock. Other more lightly traveled areas will be seeded with grass to prevent erosion.

Permanently affected areas include the power block area, water treatment area, runoff pond, equalization basin, and wastewater treatment area (see Figure 4.1-1). The power block area, water treatment area, and runoff pond will require minimal clearing because they are within the vicinity of the existing power plant. The other areas will be cleared as described for the areas affected only by construction.

There will be no use of explosives during construction of the repowering units. However, between the time that the repowered units come on line and the time that the maintenance shops, laboratory offices, and lunch room are

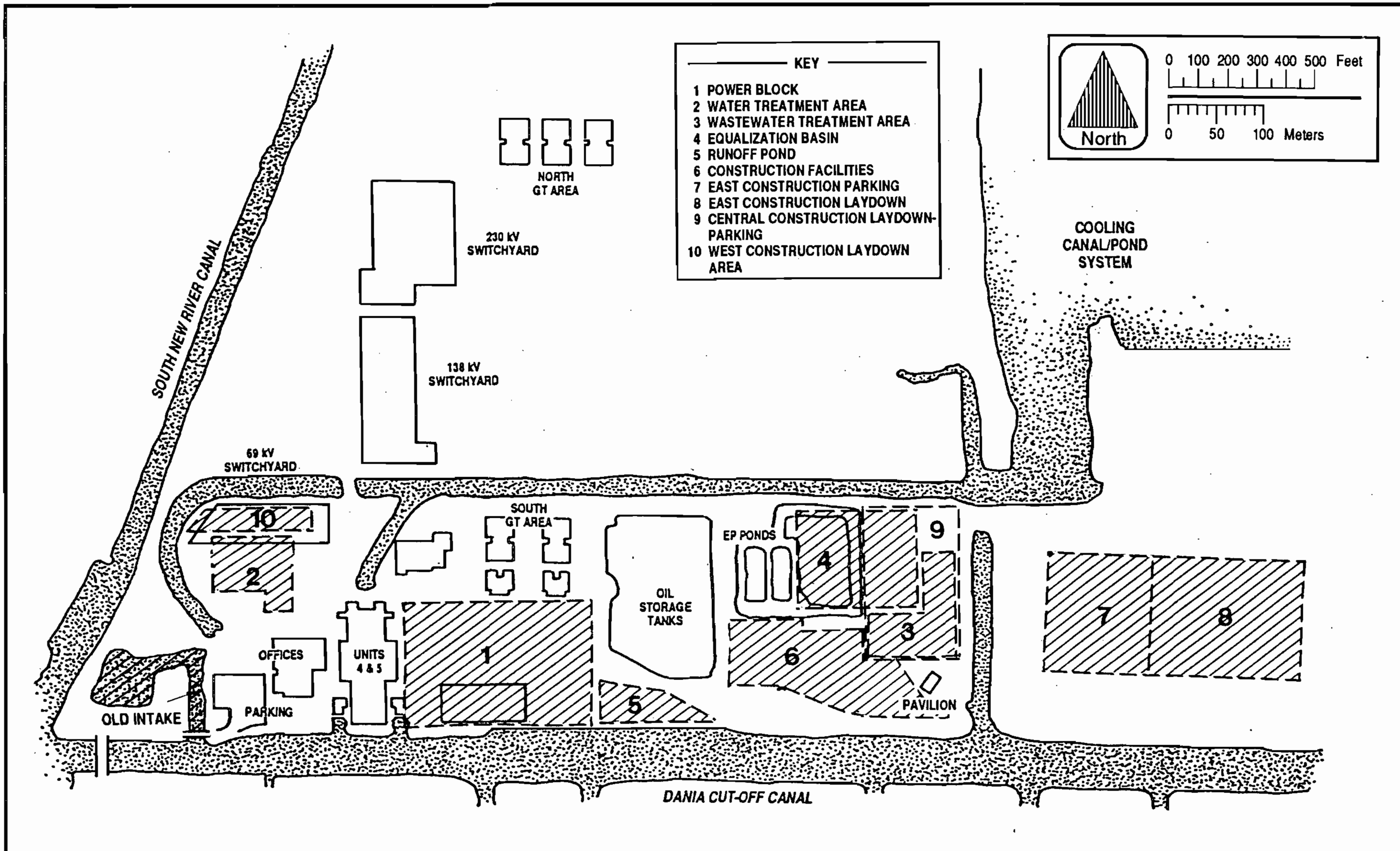

Figure 4.1-1 AREAS AFFECTED BY CONSTRUCTION

Lauderdale Repowering Project

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installed (south of the steam turbines), the existing fossil-fuel-fired steam generators and associated facilities will be demolished. Explosives may be used, for example, during the demolition of the existing Units 4 and 5 stacks. Any use of explosives will be coordinated through Broward County government with notice provided to the surrounding residential areas.

The impacts of creating material laydown areas will be minimal, temporary, and associated mainly with clearing, grubbing, and grading for proper drainage.

There will be no construction of new temporary or permanent roads that connect off-site, or new on-site railroads. Fugitive dust generation from traffic and/or excavations will be minimized through the use of water sprinkling.

The existing grade is on the order of 4 to 7 ft above msl. The power block area, water treatment area, and the wastewater treatment area will be filled to an elevation of approximately 8 ft above msl and graded.

Excavation of soils in the power block area will be required to provide support for the plant foundation, piping, electrical duct banks, and manholes. Pockets of material unsuitable for buildings or heavy equipment foundation are expected to be found in this area. Removal of this material and the unavoidable removal of some adjacent material will be required. About 30,000 yd^3 has been estimated for removal. Because this material is clean debris, some of it will be disposed of in the old (Units 1, 2, and 3) abandoned intake canal (see Figure 4.1-1). A copy of the application for a dredge and fill permit for this operation is included in Appendix 10.1.4 and is being submitted separately to the U.S. Army Corps of Engineers (USACE). This material is not a solid waste (see Chapter 17-701.061, F.A.C.), but is defined as "Construction and Demolition Debris" [Chapter 17-701.020 (14), F.A.C.]. Foundations required to support heavy loads, such as building columns, CTs, and generators, will be supported on cast-in-place pilings; therefore, removal of soils below the existing compacted fill layer will not be required. Excavation of soils in the wastewater treatment area may be required depending on the structural capacity of the existing soils and the design of the proposed facility. It is not anticipated that this excavation would exceed a depth of 15 ft below msl.

Dewatering may be required during foundation installation and construction of facilities designed with base elevations below 1.0 ft above msl. This foundation and construction activity should be minimal; therefore, dewatering effects from shallow well points and pumpage will be confined to a relatively small area surrounding the dewatering site. The effluent from the dewatering operation will be routed to the discharge canal leading to the cooling canal/pond system.

Waste materials will be disposed of in accordance with applicable rules and regulations. Construction wastes, such as scrap wood and metal, will be transferred to a specified storage area on the site where they will be separated and stockpiled for salvage. General waste materials (i.e., typical of municipal solid wastes) will be collected in appropriate waste collection containers for disposal at an approved off-site location.

During construction, the construction labor force will use portable chemical toilets. All sanitary sewage will be pumped frequently from the individual toilets as needed and transported to an approved disposal facility by a licensed contractor.

Waste oil from construction vehicles and equipment will be collected in appropriate containers and transported off-site for recycling or disposal at an approved facility. The approved disposal facility will be an existing facility that has been previously permitted for commercial recycling or disposal of waste oils.

Individual contractors will be responsible for handling any hazardous materials required to perform their tasks and hazardous wastes resulting from their use. This responsibility includes the proper off-site disposal of such wastes.

4.1.2 Roads

There will be no permanent new roads connecting the site to state roads.

4.1.3 Flood Zones

The entire proposed construction area at the Lauderdale Repowering Project site is within the 100-year flood zone. However, all proposed facilities have been designed and located so that no adverse impact on the 100-year flood elevations or flood flows is expected. In addition, the Lauderdale Repowering Project will not adversely impact adjacent surface water flood elevations or flows and will not cause any adverse flooding or related impacts to off-site property.

4.1.4 Topography and Soils

Current topographic features at the Lauderdale Plant site reflect past and present power-plant-related activities. The existing grade is approximately 4 to 7 ft above msl. Several areas will be excavated to remove material unsuitable for foundations. About 30,000 yd^3 will be removed from the power block area, about 2,200 yd^3 will be removed from the wastewater treatment area, and about 5,800 yd^3 will be removed from the water treatment area. About 20,800 yd^3 will be used to fill in the old intake canal to elevation 4.0 msl (refer to Appendix 10.1.4, dredge and fill permit application, for more information). The remaining 17,200 yd^3 will be placed in the stub canal; the area used will not preclude its use for stormwater retention. Since the stub canal is an existing wastewater treatment facility and not connected to waters of the state or the United States, no dredge and fill permit is required to place fill in it. The power block area, as well as the water treatment area and wastewater treatment area, will be further filled with crushed limestone and rock to raise the elevation to approximately 9 ft above msl at the highest point.

No adverse impact is anticipated to soil stability or bearing strength because the power block foundation will be supported by cast-in-place concrete piles; therefore, overall subsidence of the land area will be negligible. Slight settlement may take place in areas of construction, but this will be moderate and localized in extent. It is not anticipated that sinkhole formation will be enhanced.

The areas affected by construction do not include any areas designated as Prime and Unique Farmland.

Construction-related changes in site topography will not have any adverse affect on aesthetics or viewshed. Since the elevations after construction will be no more than 9 ft above msl, no significant topographical changes will be observable from off-site locations.

Construction activities will alter runoff in several parts of the site; however, no adverse effects are anticipated from this alteration. In the vicinity of the power block, surface water runoff will be conveyed to the runoff pond as discussed in Section 3.8. The west construction laydown and water treatment areas (see Figure 3.8-1) will be sloped to drain into the existing stub canal percolation pond as overland flow. The wastewater treatment area and construction facilities area (see Figure 3.8-2) will be sloped to drain to the existing evaporation/percolation pond prior to construction of the equalization basin. The east construction parking and laydown areas (see Figure 3.8-2) will be surrounded by a discharge swale which will be constructed. This swale is designed to provide wet retention for all runoff from these areas.

The equalization basin area (see Figure 3.8-2) will have no runoff. Until its construction is complete, the existing evaporation/percolation pond will serve as a percolation pond for rainfall in the basin area. The area topography and soil percolation will be modified by the excavation. Topographically, a depression will be excavated to create the basin.

Percolation rates will temporarily increase in response to removal of surficial soils and exposure of higher permeability underlying sediments.

Prior to completion of equalization basin construction, stormwater collected in the basin will percolate into the soil.

Groundwater levels will not be affected by modifications to soil percolation from construction activities at the site, due to the close proximity of surface water canals and the interconnection between these surface water bodies and the underlying aquifer. Slight changes in percolation rates will have negligible impact on water levels, because the aquifer is recharged by the adjacent canals and surface infiltration affects only localized areas of the site.

4.2 IMPACT ON SURFACE WATER BODIES AND USES

4.2.1 Impact Assessment

The surface waters surrounding the Lauderdale Plant site which potentially could be affected by site preparation and construction activities include the Dania Cut-Off Canal, South New River Canal, and South Fork New River. Figure 4.1-1 presents the land areas that will be impacted by construction. The focus of the impact evaluation is on potential discharges to those systems and the filling of the old intake canal.

4.2.1.1 Surficial Hydrology--Physical and Chemical Impacts

The primary potential impacts from site preparation and construction are erosion and sedimentation due to earthmoving and material placement associated with site preparation and plant construction. These impacts will be controlled and minimized through proper design and placement of runoff control features in accordance with SFWMD regulations described in Section 3.8. Specific regulations are presented in Section 3.8.1, and design parameters and construction phase stormwater runoff management practices to be followed are presented in Sections 3.8.2 and 3.8.3, respectively.

Runoff from areas of the site not disturbed by construction activities will continue to be directed to the natural drainage systems within the area. Runoff from areas of the site disturbed by construction activities, including material laydown areas, will be controlled by grading methods and collected in a retention pond, existing percolation ponds, or retention swales (see Section 4.1.4). The retention pond will be located east of the power block area and will be built early during the construction phase. A system of temporary construction ditches, sumps, and associated piping will direct stormwater runoff to the retention pond. Runoff in excess of the design basis of the runoff pond will be routed to the Dania Cut-Off Canal (see discussion in Section 3.8.3).

Erosion will be controlled by compaction of soils, construction of ditches and embankments, maintenance of relatively flat grades, and other appropriate erosion control techniques. Sedimentation will be controlled during construction by use of sediment control basins and traps, filter berms, straw bales, and other applicable devices as appropriate.

Surface water runoff from the vicinity of the power block will be conveyed to the runoff pond. The pond is sized to hold more than 30,000 ft^3 of water, with runoff in excess of this amount to be discharged using an overflow weir to a new outfall location in the Dania Cut-Off Canal (see Figure 3.2-1 for location).

The west construction laydown area and water treatment area (see Figure 3.8-1) will drain into the existing stub canal percolation pond. This pond is large enough to hold the entire storm volume from these areas; this pond, in fact, currently receives runoff from these areas.

The wastewater treatment, equalization basin, and construction facilities areas (see Figure 3.8-2) will drain to the equalization basin area for wet retention of some 837,000 ft^3 of water. This water will percolate from the existing evaporation/percolation pond. An overflow from that pond to the existing discharge to the cooling canal/pond system will accommodate overflow should storms in excess of the design storm occur.

The east construction parking and laydown areas (see Figure 3.8-2) will be surrounded by a swale which provides wet retention for the entire storm volume (452,000 ft^3). Overflow from the swale will be routed to the existing cooling canal/pond system.

The old intake canal is connected directly to the Dania Cut-Off Canal and by a culvert to the South New River Canal. This intake canal will receive fill from excavating the power block area. The material, which consists primarily of sand with limestone fragments with some silt, will be placed in the old intake canal after it is isolated from the South New River Canal and the Dania Cut-Off Canal. This material will not include asphalt that currently covers a portion of the power block area; old asphalt will be recycled. During isolation of the old intake canal (installation of a coffer dam in the connection to the Dania Cut-Off Canal and filling of the culvert to the South New River Canal), turbidity screens will be used to mitigate the effects of turbidity. Percolation calculations indicate that displaced water will enter the groundwater rapidly enough so that there will be no overflow.

Based on the limited discharge quantity and treated nature of runoff to surface water bodies associated with construction activities, adverse impacts to surface waters are anticipated to be negligible.

Following completion of construction, laydown, parking, and other non-paved areas will be replanted with appropriate ground cover.

A final potential impact to surface waters from construction activities is related to dewatering. Dewatering activities will be required during below-grade construction and will be accomplished by localized pumping of the shallow aquifer to lower the water table. Discharge rates from dewatering will not exceed 2,500 gpm (3.6 million gallons per day) and will not occur for more than 250 days. The dewatering release will be routed by pipe to the cooling canal/pond system. The quality of the dewatering release essentially will be identical to the groundwater currently being used for auxiliary cooling. Given the similarity in quantity and quality of the dewatering discharge to the existing auxiliary cooling water discharge, no significant incremental impacts are expected.

Impacts from the use of chemicals for cleanup of spillage of chemicals or oil and grease will be mitigated through proper handling and disposal practices. Until the new wastewater treatment facility is operational, all wastewater resulting from preoperation and cleaning activities will be either treated in neutralization basins and routed to the SSB/EP ponds as currently permitted or disposed of off-site by a contractor. Construction contractors will be required to implement practices to assure spills are minimized. This will include the designation of specific areas for fueling and maintenance. These areas will be located so that any spills, if they do occur, will not be adjacent to any surface waters. If any spills occur, immediate cleanup will be performed with ultimate disposal in an approved facility. When appropriate, such materials will be handled as described in FPL's existing Lauderdale Plant hazardous waste management plan as described in Section 3.7.2.2.

4.2.1.2 Aquatic Systems

As described in Section 4.2.1.1, the potential for impacts to aquatic systems will be minimized through the use of appropriate construction techniques to control erosion, sedimentation, and surface runoff.

No construction is proposed in open water areas with the exception of the old intake canal which will be filled. Aquatic impacts to this area will be minor since this area was previously dredged.

Construction-related impacts may potentially occur to manatees during downtime of Units 4 and 5. The manatee, listed as endangered by the USFWS and FGFWFC, is known to occur in the cooling canal/pond system (including the discharge canal near the plant site) during cooler months of the year (i.e., December to March), using the canal system as a thermal refuge (see Section 2.3.6.1). Since the Lauderdale Plant has operated on a periodic schedule in the past, it is not a major thermal refuge for manatees in the region.

During construction activities, Units 4 and 5 will continue to operate. There will be a temporary cessation of power plant operation and the discharge of heated water (i.e., during integration of the new equipment with the existing steam cycle). If this activity occurs in the winter, this thermal refuge for the manatee may not be provided. Depending on the timing and duration of this integration phase, manatees may use other thermal refuges along the coast. This impact, if it should occur, is not considered significant.

Construction activities potentially could cause runoff containing high suspended solids to reach surface waters. To minimize possible impacts to surface waters and aquatic systems, sedimentation traps and other spill control measures will be used during the construction phase.

4.2.2 Measuring and Monitoring Programs

Surface water monitoring will be performed to monitor any discharges from construction activities. Monitoring locations will include (see Figure 4.2-1):

1. Stormwater discharge locations on the Dania Cut-Off Canal,
2. Dania Cut-Off Canal outside the old intake canal, and
3. South New River Canal outside the old intake canal.

Samples will be taken weekly during the filling of the old intake canal and during discharges of stormwater to the Dania Cut-Off Canal or cooling canal/pond system. Releases of dewatering effluent will be observed. If water containing high suspended solids is noticed entering the cooling canal/pond system, the discharge location will be sampled (i.e., the box culvert at State Road 84). Analyses will be performed for pH, total suspended solids (TSS), turbidity, and oil and grease.

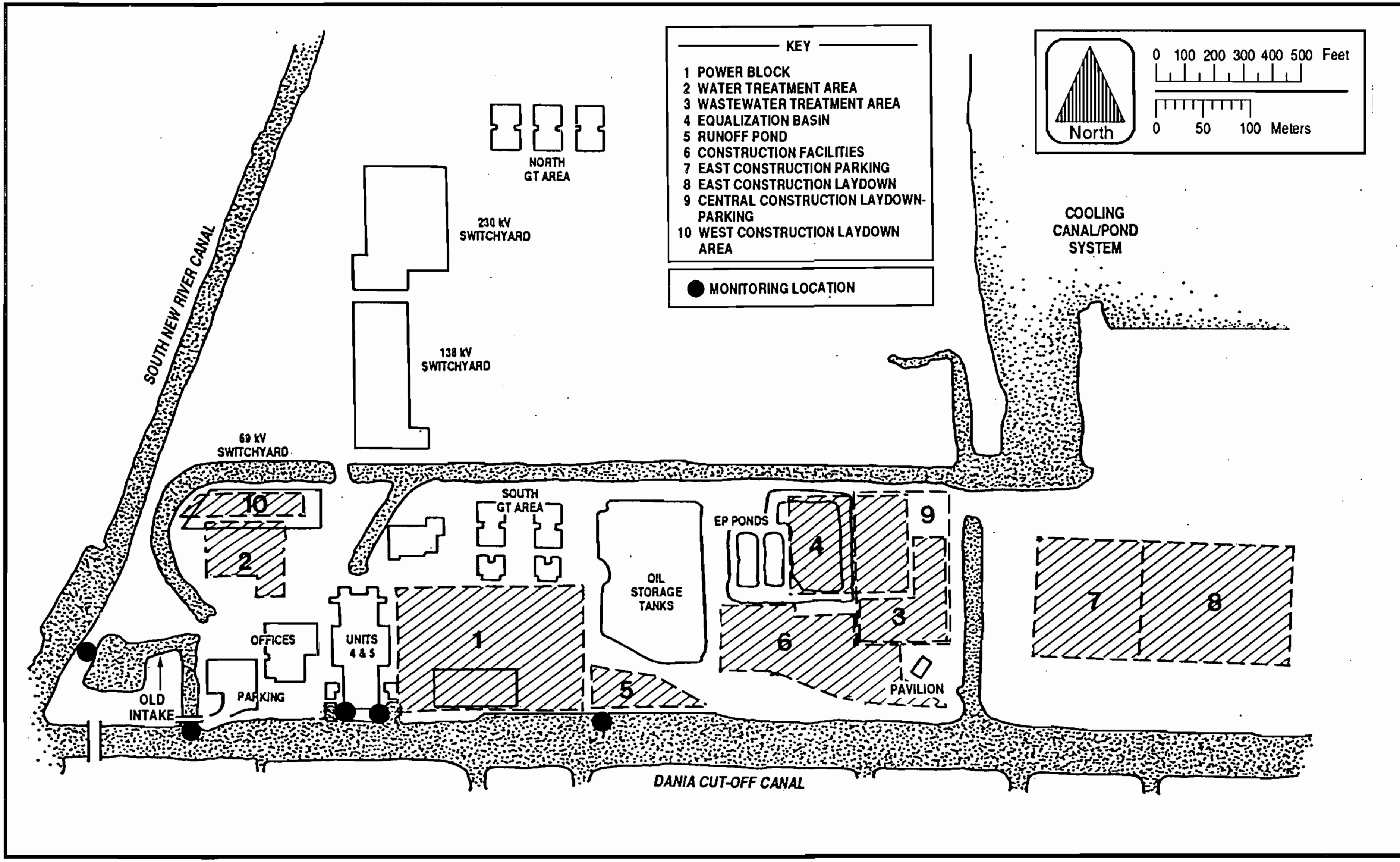

Figure 4.2-1 SURFACE WATER MONITORING LOCATIONS DURING CONSTRUCTION

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4.3 GROUNDWATER IMPACTS

4.3.1 Physical and Chemical Impacts of Dewatering

Activities associated with site preparation and construction are not expected to produce any significant changes to groundwater quality, quantity, or levels in the site vicinity. Dewatering may be required during the foundation installation and construction of facilities designed with base elevations below 1 ft above msl. This foundation and construction activity should be minimal; therefore, dewatering effects from pumpage of shallow well points (less than 20 ft) will be confined to a localized area surrounding the dewatering site. Impacts from current pumpage of 3,000 gpm from each of two on-site wells are discussed in Section 2.3.3. Drawdown at each of these on-site wells is approximately 3.2 ft based on groundwater flow modeling (see Figure 2.3-2). The canals surrounding the site provide constant recharge to the aquifer; therefore, the effects of groundwater withdrawal are localized to the vicinity of dewatering activities. As a result, no impacts to off-site wells will occur from dewatering activities.

The effluent from the dewatering operation will be released to the cooling canal/pond system. The water quality of both the groundwater underlying the site and the cooling canal/pond system is brackish, with chloride concentrations ranges of 932 to 1,547 mg/L and 856 to 4,119 mg/L, respectively. Therefore, no adverse impacts to groundwater or receiving water quality from dewatering activities are anticipated.

As discussed in Section 4.2.1.1, construction contractors will be required to implement practices to minimize spills. Maintenance and refueling will be performed only in designated areas. Any spills will be disposed of properly.

4.3.2 Measuring and Monitoring Program

During construction dewatering, county, state, and federal requirements will be met for on-site withdrawal and release of groundwater. Broward

County does not have regulations which specifically address monitoring requirements for general construction dewatering projects.

During construction dewatering, monitor wells adjacent to the dewatering sites will be routinely measured to assess impacts to groundwater levels. Water-level measurements will be obtained weekly from monitor well B-2 installed in the power block area during the foundation suitability study (Figure 4.3-1), as well as previously existing monitor wells M-2 and OB-3 in the SSB/EPP and stub canal areas, respectively. These wells are the closest wells to the construction activities and associated dewatering. Monitor wells M-2 and OB-3 are sampled and analyzed quarterly as part of the groundwater monitoring plan for the site. Analyses of well B-2 and wells M-2 and OB-3 will be sufficient to monitor impacts to groundwater quality from dewatering.

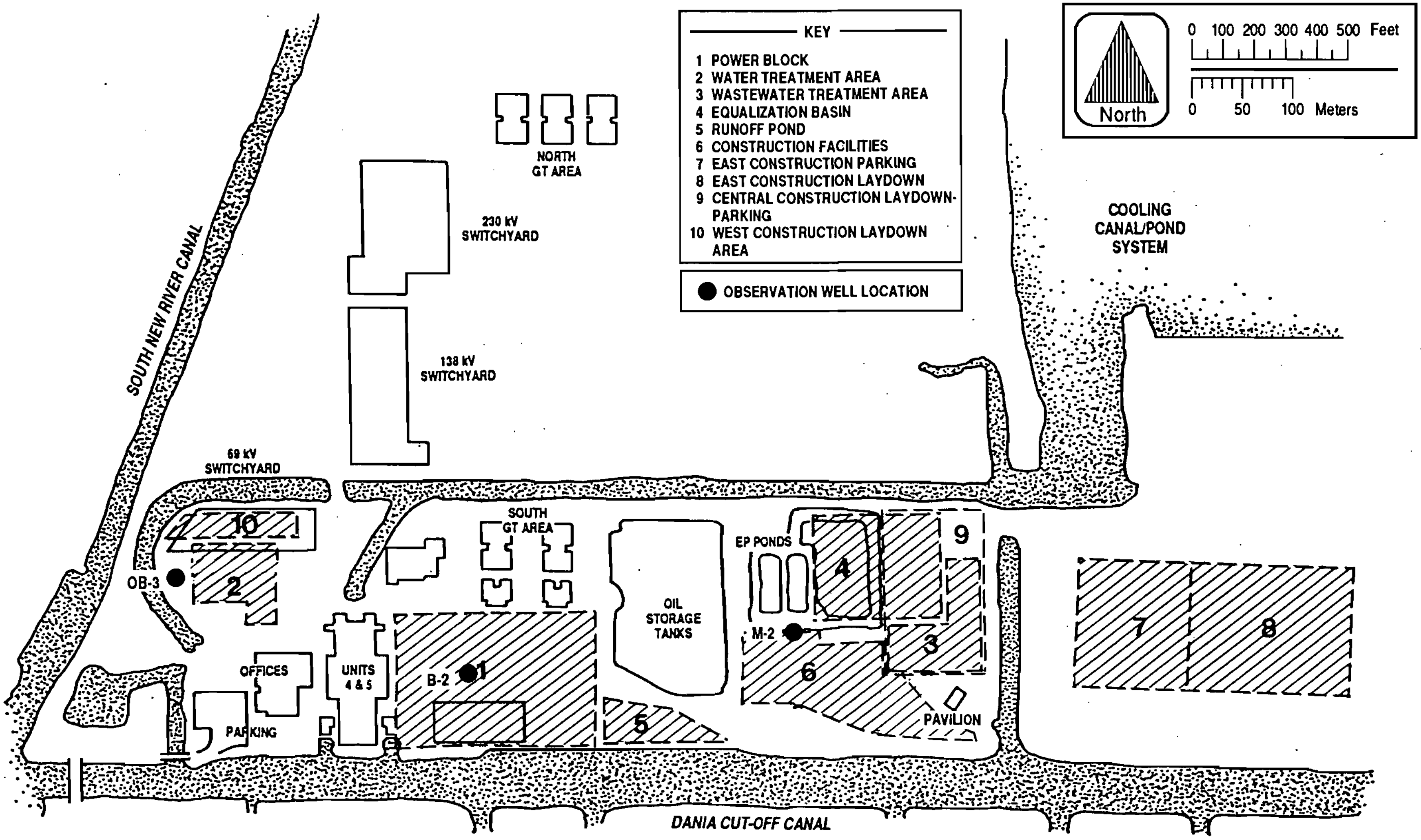

Figure 4.3-1 LOCATION OF WELLS WHERE WATER LEVEL MEASUREMENTS WILL BE COLLECTED DURING CONSTRUCTION DEWATERING ACTIVITIES

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4.4 ECOLOGICAL IMPACTS

4.4.1 Impact Assessment

4.4.1.1 Aquatic Systems

Based on the areas affected by construction and the measures to mitigate impacts of runoff, impacts to aquatic ecological systems resulting from construction phase activities are not anticipated. Filling of the old intake canal will be accomplished by segregating this water body from the Dania Cut-Off Canal and South New River Canal. The old intake canal was previously dredged but is not currently used by the plant. Erosion, sedimentation, and runoff control measures will mitigate the potential for water quality degradation; therefore, associated impacts to aquatic biological communities are not expected to be significant.

4.4.1.2 Terrestrial Systems

The construction activities associated with the Lauderdale Repowering Project will affect only about 3.5 acres not currently impacted by ongoing activities associated with the existing plant. This area is shown as Area 9 in Figure 4.1-1. Construction activities around the power block will not cause any significant adverse impacts to terrestrial systems at the site. This area has been repeatedly disturbed such that the remaining vegetation is ruderal in nature and not representative of native ecological communities.

Construction of parking lots and other support facilities will primarily affect disturbed areas dominated by ruderal and exotic species such as Brazilian pepper and Australian pine. East of the SSB/EPPs, a small, isolated, disturbed area of red maple and royal palm will be cleared (shown as Area 9 on Figure 4.1-1). This second-growth vegetation, while not representative of a native plant community, contains wetland vegetation. The area is about 3.5 acres, of which about 73 percent is forested with native vegetation (primarily red maple and royal palm) and about 27 percent has an overstory of Australian pine. This wetland is not connected directly to waters of the state; a berm of about 7 ft in height separates this area from a dead-end canal connected to the Dania Cut-Off Canal.

Therefore, this wetland is not jurisdictional by the state. Based on soils and vegetation, a portion of this area about 2.5 acres in size would be considered jurisdictional by USACE and Broward County. Appendix 10.1.4 contains a copy of the dredge and fill permit application for this area which is being submitted separately to USACE.

The east construction parking and laydown areas (shown as Areas 7 and 8 on Figure 4.1-1) have been previously cleared as a result of the Port 95 Commerce Park which has an approved development order (Broward County Ordinance 88-82, December 27, 1988).

Construction activities will not hydrologically alter surface water flows to any vegetated or wetland area. Impacts due to erosion will not occur with the implementation of the runoff control measures proposed for the project.

Air quality impacts due to the fugitive dust generated by construction (see Section 4.5) will be controlled and localized. Impacts to terrestrial systems are not expected to occur.

Noise associated with construction will not significantly affect the social behavior of wildlife (i.e., reproductive and breeding activities) found on or adjacent to the site. The area is presently subjected to varying noise levels (refer to Section 2.3.8), and wildlife living in the area are acclimated to such conditions (refer to Section 2.3.6.1, Terrestrial Ecology).

4.4.2 <u>Measuring and Monitoring Programs</u>

4.4.2.1 Aquatic Systems

No fish or benthic invertebrates are expected to be affected by construction activities. Annual manatee surveys will be continued during the winter months to monitor movements of this endangered species (refer to Section 2.3.6.1, Aquatic Mammals).

4.4.2.2 Terrestrial Systems

Because no important terrestrial systems will be affected by construction activities proposed for the site, no monitoring programs will be undertaken.

4.5 AIR IMPACT

4.5.1 Air Emissions

Construction activities will result in the generation of fugitive particulate matter (PM) emissions and vehicle exhaust emissions. Open burning may also be used in connection with land-clearing activities, resulting in emissions of combustion products to the atmosphere.

Fugitive PM emissions will result primarily from land clearing and grubbing, ground excavation, grading, cut and fill operations, and vehicle travel over unpaved roads. Vehicle traffic will include heavy-equipment traffic and traffic due to construction workers entering and leaving the Lauderdale Plant site. Construction personnel and equipment will enter the site primarily over surfaced roadways. Exposed land areas may also generate fugitive dust due to wind erosion.

Emissions of fugitive PM from these activities are extremely difficult to quantify because of their variable nature. They can only be estimated since emissions are dependent upon a number of factors, including specific activities conducted, level of activity, meteorological conditions, and control measures utilized.

AAQS for particulate matter have been promulgated by both EPA and FDER. Previously, the standards regulated concentrations of total suspended particulate matter (TSP). These AAQS have recently been revised to consider concentrations of PM having an aerodynamic particle size of 10 micrometers or less (PM10).

Table 4.5-1 presents the estimated fugitive PM10 emissions associated with construction activities. Over the construction period, 10.8 tons of PM10 particles are estimated to be emitted. This is an average of about 5.4 TPY, 29.6 lb/day, or 1.2 lb/hr.

An emission of 5.4 TPY of PM10 is less than the PSD significant emission rate of 15 TPY which is the emission criterion for triggering PSD review.

Table 4.5-1. Estimated Fugitive PM10 Emissions During Construction

Source	Tons	Comments
Construction Worker Vehicles	0.72	Controlled with watering; average of 305 vechicles per day, 6 days/week over 2 years
Delivery Trucks	3.84	Re-entrained from paved road, 1-mile length; 20 deliveries/day.
Construction Activities	3.22	9,000 ft of movement per day for four pieces of equipment, controlled with watering
Wind Erosion	2.97	28.2 acres with watering
Total:	10.76	

Note: All calculations based on equation in EPA AP-42 (1986) for 2-year duration.

PM10 = Particulate matter with an aerodynamic particle size of 10 μm or less.

As a result, the estimated fugitive emissions are not expected to significantly affect air quality outside the site boundary.

Vehicle exhaust emissions will also result from on-site vehicular traffic and construction equipment. Vehicle exhausts produce primarily CO, NO_x, and VOC emissions, but also emit PM and sulfur dioxide. Using EPA emission factors (AP-42), emissions of CO, NO_x, and VOCs are estimated to be 83, 12, and 5 TPY, respectively, over the 2-year construction period. This level of emissions will not cause significant impacts to air quality in the vicinity of the site.

Open burning produces primarily PM emissions, with lesser quantities of NO_x, CO, VOCs, and SO_2. If performed, open burning will be conducted in accordance with Chapter 17-5, F.A.C., Open Burning and Frost Protection Fires, and Broward County Code of Regulations, Chapter 29-9. Compliance with these requirements will minimize the air emissions associated with open burning.

4.5.2 Control Measures

A number of control measures will be implemented during the construction period in order to minimize air emissions and potential impacts. Clearing of the site or adjoining properties will be kept to a minimum, thereby reducing air emissions due to wind erosion of exposed surfaces. After grading, the untraveled or lightly traveled areas will be vegetated to minimize fugitive PM and wind erosion. Heavily traveled construction laydown areas and unpaved roads will be stabilized with shell or rock. Fugitive dust from highly traveled areas will be controlled by watering on an as-needed basis. All plant entrance roads except the north entrance are currently paved, which minimizes dust emissions from vehicles entering the site.

Open burning, if performed, will be conducted using an air curtain incinerator, and if it does not cause or constitute a hazard to air traffic. Prior to open burning, the Broward County Fire Marshall, Aviation Department, and Environmental Quality Control Board will be contacted.

4.5.3 Potential Impacts

Potential air quality impacts due to the construction activities will vary depending on the level of activity, the specific operations, site conditions, control measures, and prevailing weather conditions. Because of the type and nature of potential emission sources at the site, the maximum impacts due to construction are expected to occur near the construction activities in areas on or near plant property.

Many of the construction operations, such as land clearing, site filling and grading, and foundation work, will be intermittent and of short duration. Open burning will occur only from 9:00 a.m. to 1 hour before sunset (i.e., during daylight hours). These aspects of the construction activities will act to reduce potential impacts, since better dispersion conditions exist during the daytime as opposed to nighttime.

Based on the intermittent nature of construction activities, the air emission control measures implemented to reduce emissions, and the distance to plant property boundaries from the activities, air impacts off-site are not expected to be adverse due to construction activities or open burning.

Activities that potentially generate fugitive PM emissions will be visually monitored. If fugitive emissions become visible, water spraying will be applied to the affected areas. No ambient air quality monitoring is planned due to the short-term nature and magnitude of such emissions.

4.6 IMPACT ON HUMAN POPULATIONS

4.6.1 Noise Impacts

The impacts of noise on human populations are dependent upon the proximity of residences to construction activities and the type and extent of noise sources. The nearest human populations (i.e., receptors) to the proposed facility construction area are located approximately 400 ft to the south-southeast along the southern bank of the Dania Cut-Off Canal (see Figure 2.3-35).

Broward County noise regulations applicable to construction activities are:

1. Section 27-200(a), Sound Levels by Receiving Land Use--55 dBA for residential land use district,
2. Section 27-200(b)(1) and (2)., Maximum Sound Level--sound level limits of 10 dBA above 55 dBA for residential land use district from 7 a.m. to 10 p.m. and 5 dBA above 55 dBA for residential land use district from 10 p.m. to 7 a.m., and
3. Section 27-201(c), Specific Prohibitions--construction and demolition between the hours of 7 p.m. and 7 a.m.

Major sources of construction noise likely would be cranes, bulldozers, graders, front-end loaders and air compressors. These sources have maximum noise levels ranging from about 80 to 90 dBA (at 50 ft). Since the power block foundation pilings will be augured cast-in-place concrete pilings, the loud noise levels normally associated with pile driving activities (i.e., 101 dBA peak) will not occur.

Background and average equivalent SPLs observed during the daytime at nearfield receptors (refer to Section 2.3.8, Table 2.3-55) are expected to increase during the construction phase of the project. The increase in average equivalent SPLs (L_{eq}) during construction is expected to be small in magnitude; however, noise generated from aircraft takeoffs and landings at the Fort Lauderdale-Hollywood International Airport dominates noise levels in the area.

The impact evaluation of construction activities was performed using the NOISECALC computer program (NYDPS, 1986). NOISECALC was developed by the New York State Department of Public Service to assist with noise calculations for major power projects. Noise source levels are entered as octave band SPLs. Coordinates, either rectangular or polar, can be specified by the user. All noise sources are assumed to be point sources; line sources can be simulated by several point sources. Sound propagation is calculated by accounting for hemispherical spreading and three other user identified attenuation options: atmospheric attenuation, path specific attenuation and barrier attenuation. Atmospheric attenuation is calculated using the data specified by the American National Standard Institute method for the Calculation of the Absorption of Sound by the Atmosphere (ANSI, 1978). Path specific attenuation can be specified to account for the effects of vegetation, foliage and wind shadow. Directional source characteristics and reflection can be simulated using path-specific attenuation. Attenuation due to barriers can be specified by giving the coordinates and height of the barrier. Barrier attenuation is calculated by assuming an infinitely long barrier perpendicular to the source-receptor path. Total and A-weighted SPLs are calculated. Background noise levels can be incorporated into the program and are used to calculate overall SPLs.

NOISECALC was performed to predict the maximum noise levels produced by a combination of likely noise sources with and without background noise levels. Since the construction equipment use schedule has not been finalized, a conservative estimate of the number and type of construction equipment was assumed to calculate noise levels.

Table 4.6-1 presents a representative list of the major types of construction equipment that will potentially be used and their associated SPLs. For the purpose of the analyses, several combinations of equipment were assumed to operate concurrently over a period of at least 1 hour.

Table 4.6-1. Example of Major Construction Equipment and Associated Noise Levels for the Lauderdale Repowering Project

Construction Equipment[a]	Noise Level (dBA) per Unit @ 50 ft
Caterpillar Bulldozer	74
65-Ton Crawler Crane	88
65-Ton Truck Crane	83
24-yd^3 Dirt Scraper	88
3/4-yd^3 Front-End Loader	84
3/4-yd^3 Backhoe	85
Air Compressor (250 cfm)	73
Air Compressor (750 cfm)	73
Gas-Driven Welding Units	78
Concrete Mixers	85
Concrete Pumps	82

[a]Includes only major construction noise sources greater than 70 dBA.

The noise source combinations selected for the analysis were:

1. One source at 88 dBA, one source at 84 dBA, and one source at 74 dBA;
2. Two sources at 84 dBA and two sources at 73 dBA;
3. Two sources at 84 dBA and one source at 70 dBA; and
4. One source at 84 dBA, one source at 78 dBA, and one source at 74 dBA.

The noise levels resulting from these combinations of equipment were input as multiple sources into NOISECALC. Octave bands were estimated from EPA, 1971. Appendix 10.5.1 presents the octave bands used in the analysis. Since it is unlikely that all the equipment would be operating simultaneously and continuously, this assessment is conservative. Background SPLs and average L_{eq} values were used to calculate impacts at each of the residential receptor areas identified as being close to the site. Atmospheric and path-specific attenuation options were used.

The results of the analysis are presented in Tables 4.6-2 and 4.6-3. The predicted impacts using background SPLs reflect the predicted noise levels without the influence of intermittent sources such as the aircraft noise associated with the Fort Lauderdale-Hollywood International Airport. The predicted impacts using the average L_{eq} values reflect the construction noise levels in combination with aircraft noise and more realistically represent noise levels that likely will be observed.

The estimated noise levels numerically exceeded the Broward County noise regulation of 55 dBA plus a peak of 10 dBA using both the background and average L_{eq} values. Using the background SPL, the maximum calculated impacts during construction are predicted to range from 71.1 dBA at Site A4 to 58.5 dBA at Site A2. The background SPLs, when combined with the estimated SPL impacts due to construction, are appropriate for comparison to the regulations since they exclude the measurements during times when aircraft are operating. Currently, the average L_{eq} values measured in the area exceed the Broward County noise limits due to aircraft takeoffs and

Table 4.6-2. Predicted Sound Pressure Levels (SPLs) Based on Measured Background Values (Page 1 of 2)

Site	Description	Background SPL[a] (dBA)	Predicted SPL from Construction Activities Alone (dBA)	Total Predicted SPL (dBA)
For One Source @ 88 dBA, One Source @ 84 dBA, and One Source @ 74 dBA[b]:				
A2	Residence at 4409 SW 35th Avenue	48.4	58.5	58.9
A4	Residence at Northwest corner of Davis Isles	51.6	71.1	71.1
A7	SW 39th Avenue; Southwest of Plant	50.2	60.2	60.6
A9	SW 42nd Avenue at SW Plant Entrance	48.6	60.3	60.6
For Two Sources @ 84 dBA and Two Sources @ 73 dBA[b]:				
A2	Residence at 4409 SW 35th Avenue	48.4	56.1	56.8
A4	Residence at Northwest corner of Davis Isles	51.6	68.1	68.2
A7	SW 39th Avenue; Southwest of Plant	50.2	57.5	58.2
A9	SW 42nd Avenue at SW Plant Entrance	48.6	57.6	58.1
For Two Sources @ 84 dBA and One Source @ 70 dBA[b]:				
A2	Residence at 4409 SW 35th Avenue	48.4	56.5	57.1
A4	Residence at Northwest corner of Davis Isles	51.6	67.3	67.4
A7	SW 39th Avenue; Southwest of Plant	50.2	56.9	57.7
A9	SW 42nd Avenue at SW Plant Entrance	48.6	57.0	57.6

Table 4.6-2. Predicted Sound Pressure Levels (SPLs) Based on Measured Background Values (Page 2 of 2)

Site	Description	Background SPL[a] (dBA)	Predicted SPL from Construction Activities Alone (dBA)	Total Predicted SPL (dBA)
For One Source @ 84 dBA, One Source @ 78 dBA, and One Source @ 74 dBA[b]:				
A2	Residence at 4409 SW 35th Avenue	48.4	53.4	54.6
A4	Residence at Northwest corner of Davis Isles	51.6	65.6	65.8
A7	SW 39th Avenue; Southwest of Plant	50.2	55.5	56.6
A9	SW 42nd Avenue at SW Plant Entrance	48.6	55.9	56.6

[a]From Table 2.3-55.
[b]Sources from Table 4.6-1.

Table 4.6-3. Predicted Sound Pressure Levels (SPLs) Based on Average Equivalent SPL Values (Page 1 of 2)

Site	Description	Background SPL[a] (dBA)	Predicted SPL From Construction Activities Alone (dBA)	Total Predicted SPL (dBA)
For One Source @ 88 dBA, One Source @ 84 dBA, and One Source @ 74 dBA[b]:				
A2	Residence at 4409 SW 35th Avenue	68.2	58.5	68.6
A4	Residence at Northwest corner of Davis Isles	66.2	71.1	72.3
A7	SW 39th Avenue; Southwest of Plant	66.4	60.2	67.3
A9	SW 42nd Avenue at SW Plant Entrance	62.4	60.3	64.7
For Two Sources @ 84 dBA, and Two Sources @ 73 dBA[b]:				
A2	Residence at 4409 SW 35th Avenue	68.2	56.1	68.5
A4	Residence at Northwest corner of Davis Isles	66.3	68.1	70.3
A7	SW 39th Avenue; Southwest of Plant	66.4	57.5	66.9
A9	SW 42nd Avenue at SW Plant Entrance	62.7	57.6	63.9
For Two Sources @ 84 dBA, and One Source @ 70 dBA[b]:				
A2	Residence at 4409 SW 35th Avenue	68.2	56.5	68.5
A4	Residence at Northwest corner of Davis Isles	66.3	67.3	69.8
A7	SW 39th Avenue; Southwest of Plant	66.4	56.9	66.9
A9	SW 42nd Avenue at SW Plant Entrance	62.7	57.0	63.7

Table 4.6-3. Predicted Sound Pressure Levels (SPLs) Based on Average Equivalent SPL Values (Page 2 of 2)

Site	Description	Background SPL[a] (dBA)	Predicted SPL From Construction Activities Alone (dBA)	Total Predicted SPL (dBA)
For One Source @ 84 dBA, One Source @ 78 dBA, and One Source @ 74 dBA[b]:				
A2	Residence at 4409 SW 35th Avenue	68.2	53.4	68.3
A4	Residence at Northwest corner of Davis Isles	66.3	65.6	69.0
A7	SW 39th Avenue; Southwest of Plant	66.4	55.5	66.7
A9	SW 42nd Avenue at SW Plant Entrance	62.7	55.9	63.5

[a]From Table 2.3-55.
[b]Sources from Table 4.6-1.

landings. While the regulations (i.e., Article VII 202 Section 27-202 of the Broward County Code) exempt aircraft, the average L_{eq} values represent the actual sound levels currently observed in residential areas. The maximum predicted noise level using the average L_{eq} was 72.3 dBA at site A4. This is only 1.2 dBA higher than the average L_{eq} of 71.1 dBA measured at that site.

In contrast to the short-term construction noise, the most overwhelming noise source in terms of maximum noise levels is aircraft noise. The maximum aircraft noise levels far outweigh any other existing noise sources in the project area and would overshadow most, if not all, of the noise emanating from the construction activities. Indeed, the maximum measured noise levels with aircraft operating range from 89.7 dBA at Site A2 to 92.4 dBA at Site A4 (refer to Table 2.3-55), and these levels are significantly greater than those predicted due to construction activities (i.e., 71.1 dBA). As shown in Table 4.6-3, the projected increase in average noise levels due to construction is 5 dBA or less above the average measured L_{eq}.

The potential noise impact of the construction of the repowered units was also evaluated against the community noise criteria described in Section 2.3.8.1. The uncorrected community ratings were determined by comparing the predicted octave band noise levels from NOISECALC with the modified CNR curves (see Figure 2.3-32; the highest noise level within a rating curve establishes the modified CNR). The uncorrected ratings are "i" for Site A4 and "h" for Sites A2, A7, and A9. The uncorrected ratings were adjusted for background noise using the average daytime L_{eq} values observed at each of the sites (see Figure 2.3-33; -4 based on background octave band >50dB at 1,000 Hz) and intermittency of noise [see Table 2.3-54; -1 based on 2 log(16/24) = 0.35]. The corrected ratings are "c" for Sites A2, A7, and A9 and "d" for Sites A4. The highest rating (i.e., "d") suggests that there would potentially be some, but minimal, community reaction to the construction activities (see Figure 2.3-34).

During the initial startup activities, steam pipe blowing and steam venting will be required. The maximum calculated sound level from these activities at Site A4 is 98.7 dBA, which is in the same order of magnitude as the measured aircraft noise. These activities will occur for only a short duration, and the neighborhood will be notified prior to occurrence of these activities.

Although estimated noise impacts in the residential areas are not substantially greater than current levels, it is possible that the construction activities associated with the project may not comply with the Broward County standards. As a result, a variance from these standards is requested for the construction period since there is no known practical means of attaining compliance with the regulations at all times. Section 4.11 presents the basis for the variance.

4.6.2 Transportation Impacts

Traffic generated by construction will temporarily affect the roadways in the vicinity of the site. Construction access will be through existing or planned roads. Vehicle traffic will include heavy-equipment traffic and traffic due to construction workers entering and leaving the site.

Construction personnel may access the site from one of four routes (Figure 4.6-1):

1. SR 84, south on Ravenswood Road and west on SW 42nd Street;
2. Griffin Road, north on Ravenswood Road and west on SW 42nd Street;
3. State Road 84, south on Port 95 Boulevard and west on SW 42nd Street; or
4. SR 84 south on an existing northern plant access road along the northern and western boundaries of the cooling canal/pond system.

Route 3 is being constructed as part of the Port 95 Commerce Park development. The first phase of development, which includes the traffic improvements, is expected to be completed by 1992.

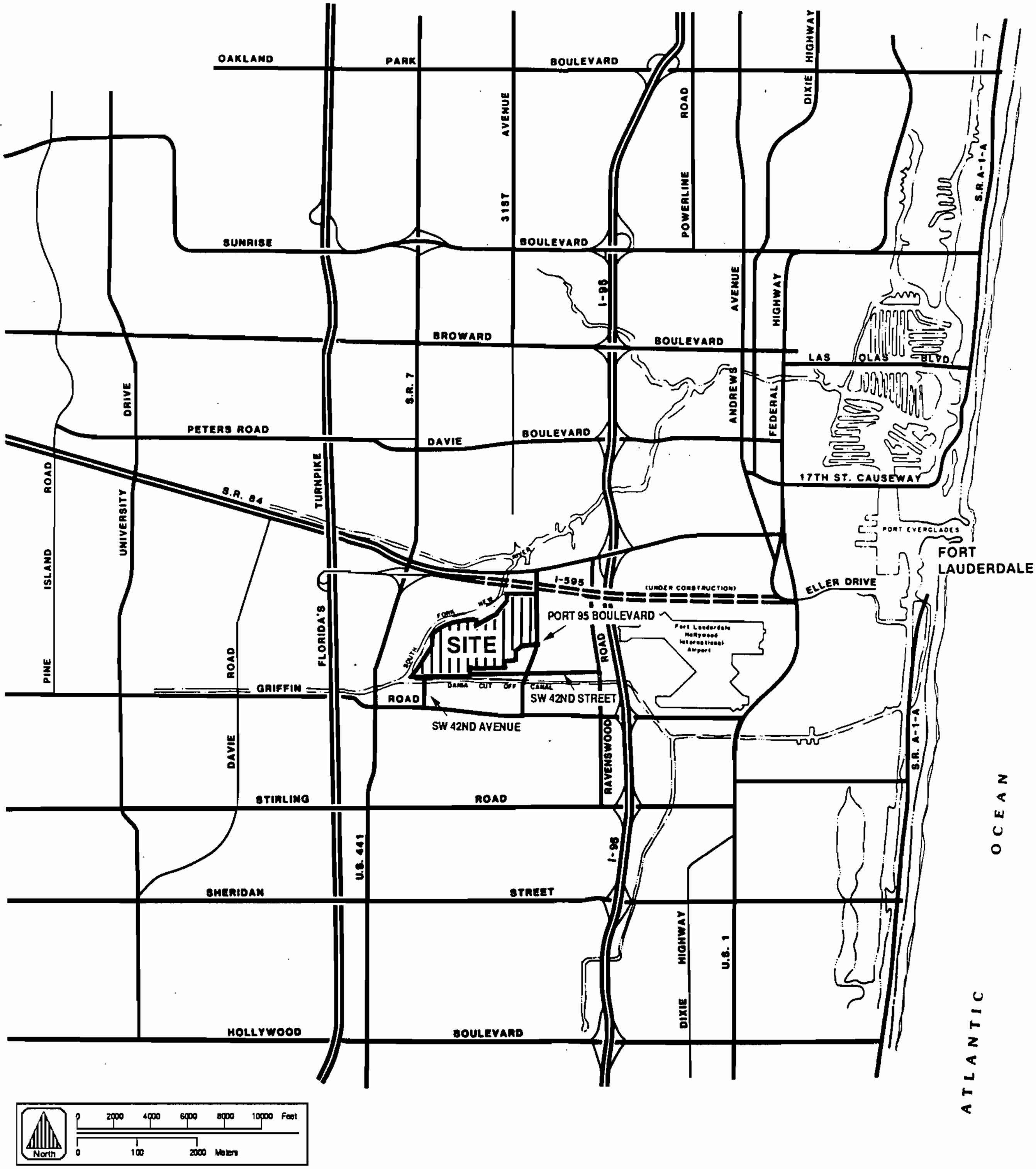

Figure 4.6-1 ALTERNATIVE SITE ACCESS CORRIDORS WITH PORT 95 COMMERCE PARK

Lauderdale Repowering Project

FPL

The delivery of heavy equipment will use Routes 1 or 3 (see discussion in Section 3.9). These deliveries will be made using specially designed trucks and trailers. The load distribution and times of travel will conform with Florida Department of Transportation requirements.

To provide a conservative estimate of potential transportation impacts, only that portion planned for the Port 95 Commerce Park that connects to SR 84 was included in the analysis. This assumption would provide a worst-case assessment of the capabilities of the existing roadways to provide adequate construction access.

Any impacts generated by construction traffic will be short term. The primary duration of the construction phase will be from early 1991 to early 1993; some minor facilities would be constructed and demolition would occur until late 1994. Transportation impacts on the external roadway system adjacent to the project site were evaluated for the peak construction phase. Since this peak construction phase is expected to occur in 1992, the analysis of construction impacts was conducted to reflect 1992 conditions. During peak construction, it is assumed that 504 construction workers and supervisors will be on-site during an average work day. Construction activities were conservatively assumed to occur during one shift Monday through Friday, although two shifts are planned. Using a vehicle occupancy rate of 1.12 persons per vehicle, 450 vehicles will be exiting the site during the afternoon peak hour. This occupancy rate was based on the HBW vehicle occupancy rate used by Broward County.

To evaluate 1992 traffic conditions, 1992 background (nonconstruction) traffic was first estimated. This procedure involved increasing the 1989 existing p.m. peak-hour roadway link volumes, as shown in Table 2.2.7-13 Section 2.2.7, by a 4-percent annual growth factor. This growth factor is documented in Section 2.2.7. In addition, background traffic for the nearly completed I-595 connector had to be estimated. Completion of this six-lane roadway is anticipated in early 1991. As stated in Section 2.2.7, I-595 is expected to divert a significant number of trips from SR 84.

Based on diversion rates for areas where new roadways have been opened and the diversion percentages obtained from Broward County's Long-Range Transportation Plan, a diversion rate of 55 percent of SR 84 future traffic volumes was used to estimate I-595 and SR 84 background traffic. Construction traffic was then added to the background traffic to obtain a 1992 total traffic projection.

As previously stated, 450 construction-related vehicles are expected to exit the project site during the afternoon peak hour. All 450 vehicles were assumed to use SW 42nd Street to exit the site. In addition, it was estimated that a significant number of these vehicles will exit onto SR 84 via Port 95 Boulevard. It is anticipated that construction traffic will travel in both directions along SR 84. The remaining portion of construction traffic is expected to exit onto Ravenswood Road and traverse in a southerly direction towards Griffin Road. This directional distribution pattern was based on the assumption that a majority of the construction workers will be arriving/departing from the immediate Fort Lauderdale metropolitan area north of the project site.

Using the background and construction traffic estimates and the directional distribution, roadway link conditions for 1992 were analyzed. Table 4.6-4 indicates the results of this analysis. The LOS D volume for I-95 has been increased due to the scheduled widening improvement for I-95 through the study impact area. This improvement is currently under construction and will be completed by 1991. In addition, the Florida Turnpike has been analyzed from Griffin Road to SR 84 instead of Hollywood Boulevard to SR 84. This change of segment links is due to the construction of a new interchange along the Florida Turnpike at Griffin Road. This interchange, which is currently under construction, is part of the I-595 roadway construction project and is expected to be completed by 1991.

As shown in Table 4.6-4, all roadway links near the project site, except SR 7 from Stirling Road to Griffin Road, will operate at LOS D or better. SR 7 is expected to operate at LOS F in both directions along this link.

Table 4.6-4. 1992 Roadway Link Conditions for Peak Construction Traffic

Facility	Link	Direction/ Geometrics	LOS D p.m. Peak-Hour Service Volume[a]	1992 p.m. Peak-Hour			
				Background Traffic Volume	Construction Traffic Volume	Total Traffic Volume	LOS[a]
Florida Turnpike (6-lane expressway)	Griffin Road to SR 84	Northbound/3L	5,570	2,733	--	2,733	B
		Southbound/3L	5,570	2,237	--	2,237	B
SR 7 (4- to 6-lane divided roadway)	Stirling Road to Griffin Road	Northbound/2L	1,720	2,237	--	2,237	F
		Southbound/2L	1,670	1,830	23	1,853	F
	Griffin Road to SR 84	Northbound/3L	2,600	2,080	--	2,080	C
		Southbound/3L	2,530	1,702	45	1,747	C
Ravenswood Road (2-lane undivided roadway)	Stirling Road to Griffin Road	Northbound/1L	880	567	--	567	A
		Southbound/1L	890	693	14	707	A
	Griffin Road to SW 42nd Street	Northbound/1L	890	467	--	467	A
		Southbound/1L	880	382	45	427	A
	SW 42nd Street to SR 84	Northbound/1L	890	413	--	413	A
		Southbound/1L	880	339	--	339	A
I-95 (10-lane freeway)	Stirling Road to Griffin Road	Northbound/5L	9,280	8,178	--	8,178	D
		Southbound/5L	9,280	6,692	54	6,746	C
	Griffin Road to SR 84	Northbound/5L	9,280	7,906	9	7,915	D
		Southbound/5L	9,280	6,468	45	6,513	C
Stirling Road (6-lane divided roadway)	I-95 to SR 7	Eastbound/3L	2,210	1,573	7	1,580	D
		Westbound/3L	2,510	1,921	7	1,928	D
Griffin Road (6-lane divided roadway)	I-95 to SW 42nd Avenue	Eastbound/3L	2,210	1,490	18	1,508	D
		Westbound/3L	2,510	1,821	14	1,835	D
	SW 42nd Avenue to SR 7	Eastbound/3L	2,210	1,328	--	1,328	D
		Westbound/3L	2,510	1,624	14	1,638	C
SR 84 (4-lane divided roadway)	I-95 to SR 7	Eastbound/2L	1,670	879	202	1,081	C
		Westbound/2L	1,720	1,074	203	1,277	C
I-595 (6-lane freeway)	I-95 to SR 7	Eastbound/3L	5,570	1,074	--	1,074	A
		Westbound/3L	5,570	1,313	--	1,313	A

[a]Based on FDOT generalized peak hour level of service maximum volumes tables, January 1989. See Table 2.2-12 for LOS definitions.

However, since construction traffic will only contribute less than 2 percent of LOS D service volume for this link, construction impacts on this roadway will be negligible.

An intersection analysis of 1992 conditions was also conducted for the unsignalized Griffin Road/SW 42nd Avenue and the Ravenswood Road/SW 42nd Street intersections. In addition, the SR 84/SW 26th Terrace intersection, which is currently signalized, was analyzed. Although no construction traffic has been assumed to travel through the Griffin Road/SW 42nd Avenue intersection, this intersection was analyzed because it would provide secondary access to the project site for construction vehicles if needed.

Using the Highway Capacity Manual computer software programs (Institute of Transportation Engineers, 1985) and projected turning-movement volumes at these intersections, 1992 p.m. peak-hour operating conditions were estimated. The 1992 turning-movement volumes were estimated by increasing the 1989 turning-movement volumes by a 4-percent annual growth factor. For the Griffin Road/SW 42nd Avenue intersection, an additional 26 vehicles were added to the southbound approach. These 26 vehicles are the average number of existing plant employee vehicles that currently park in the east parking lot. However, since the Lauderdale Repowering Project will eliminate this parking area, these vehicles will be relocated to the parking area near SW 42nd Avenue.

The results of this analysis, which are included in Appendix 10.5.6, indicated that the Griffin Road/SW 42nd Avenue intersection will operate at LOS D, while the Ravenswood Road/SW 42nd Street intersection will operate at LOS A. In addition, the SR 84/SW 26th Terrace intersection is expected to operate at LOS B.

Based on the results of the roadway link and intersection analyses, construction traffic generated by the project site will not substantially influence the LOS anticipated without the project shown in Table 4.6-4; therefore, minimal impacts will occur on the adjacent roadway system due to the project. Mitigation measures and monitoring are not proposed.

4.6.3 <u>Other Impacts</u>

Potential impacts to the economic base, employment, and services in Broward County are presented in Section 7.2. This section addresses temporary external costs (impacts) related to the requirements of construction-phase labor, housing, education, medical facilities, firefighting, police protection, recreation, natural gas, water supply, sewage treatment, and solid waste disposal.

4.7 IMPACT ON LANDMARKS AND SENSITIVE AREAS

None of the areas identified in Section 2.2.5, Regional Scenic, Cultural, and Natural Landmarks, will be impacted due to the construction of the Lauderdale Repowering Project. The areas closest to the proposed facility are the South New River and North New River Bend urban wilderness areas located immediately north of the proposed project boundary and the South New River Canal. These areas will not be directly impacted. Indirect impacts on the urban wilderness areas from fugitive dust emissions and noise will not cause adverse effects since these areas are more than 3,600 ft from the primary areas of construction.

4.8 IMPACT ON ARCHAEOLOGICAL AND HISTORIC SITES

Since no known archaeological or historic sites exist on the Lauderdale Plant site or are likely to exist within the project boundary, no impacts are expected to occur. The east construction and laydown areas were previously surveyed as part of the Port 95 Commerce Park DRI application, and no archaeological sites were found. In addition, only about 3.5 acres not previously affected by ongoing power plant activities will be impacted by construction activities. In the event that an archaeological find is uncovered during the construction period, FPL will stop construction activities in the area directly impacting the archaeological find, and a professional archaeologist will be contacted to evaluate the significance of the find. DHR will be contacted with information on the find. Construction activities in the immediate area will continue after DHR review.

4.9 SPECIAL FEATURES

The Lauderdale Repowering Project includes the use of an existing site, as well as existing equipment, to provide new electrical generation. From an environmental impact standpoint, the repowered project substantially decreases environmental impacts relative to the construction of new facilities located on undisturbed sites. However, because there are existing facilities, integration of new and repowered facilities will require removal or renovation of some of the existing structures. The structures that will be removed include the steam generators for Units 4 and 5, lunch pavilion, and No. 4 light-oil tank and foundation. The interior of existing Units 1 through 3 building will be partially renovated for office space. Some of these structures have been identified as containing asbestos which will have to be removed. Any removal of asbestos will be performed pursuant to the following applicable state and federal regulations:

1. FDER:
   - Chapter 17-2.670 National Emission Standards for Hazardous Air Pollutants
2. Florida Department of Professional Regulation (FDPR):
   - 455 Florida Statutes Licensing of Asbestos Consultants and Contractors
3. EPA:
   - 40 Code of Federal Regulations (CFR) Part 61, Subpart A, NESHAPs General Provisions
4. OSHA:
   - 29 CFR Part 1910, Section 1001, and 29 CFR Part 1926 Section 58, Occupational Exposure to Asbestos (trenelite, anthophyllite, and actinolite)
   - 29 CFR Part 1910, Section 134, Respirator Protection
   - 53 Federal Register (FR) 35610, Excursion Limit for Short-Term Exposure to Asbestos
5. U.S. Department of Transportation:
   - 49 CFR Parts 171 and 172, Transportation of Hazardous Materials

FPL will notify the agencies delegated to implement these regulations (i.e., FDER and BCEQCB).

4.10 BENEFITS FROM CONSTRUCTION

The construction phase of the Lauderdale Repowering Project will contribute both short- and long-term economic benefits to the surrounding region. Construction benefits will include the employment of construction workers, increased activity with local businesses catering to the needs of the construction work force, an increase in building materials purchases, and purchase or lease of equipment from businesses within the local economy. During the peak construction year of 1992, the Lauderdale Repowering Project is expected to generate a total of 334 basic construction jobs. Chapter 7.0, Economic and Social Effects of Plant Construction and Operation, identifies specific details of the economic benefits generated from this project.

4.11 VARIANCES

As discussed in Section 4.6.1, Noise Impacts, the limits established by the Broward County noise regulations may be exceeded during construction. Because there is no practical means to mitigate construction noise to levels below the standards, a variance is needed. The specific regulations for which a variance is sought are the following sections of the BCEQCB regulations:

1. Section 27-200(a), Sound Levels by Receiving Land Use--55 dBA for residential land use district,
2. Section 27-200(b)(1) and (2)., Maximum Sound Level--sound level limits of 10 dBA above 55 dBA for residential land use district from 7 a.m. to 10 p.m. and 5 dBA above 55 dBA for residential land use district from 10 p.m. to 7 a.m., and
3. Section 27-201(c), Specific Prohibitions--construction and demolition between the hours of 7 p.m. and 7 a.m.

The variance is requested since the construction activities may not comply with the above-cited regulations at all times. There is no known practical means of attaining compliance with the regulations at all times.

For most large noise sources, a barrier is the only means of effective control. A barrier can consist of a wall or vegetative material. The latter is not practicable at the Lauderdale Plant site since there is not sufficient time to grow an effective vegetative barrier prior to construction and, most importantly, there is not sufficient area for a vegetative barrier between the proposed units and the Dania Cut-Off Canal. An effective vegetative noise barrier must be about 100 ft wide to attenuate noise.

A wall must have an areal density of 4 pounds per square foot (lb/ft^2) to be effective and must be placed between the noise source and receiver. Materials with this areal density or greater include concrete block, prefabricated concrete panels, poured concrete walls, and steel panels. A wall produces a shadow zone of attenuated sound on the receiver side of the barrier. This area of reduced noise is most effective when the distance from the source to the wall is as small as possible and the distance from the wall to the receiver is as great as possible. In addition, the height of the noise source and wall are important factors in determining overall noise reduction effectiveness.

Construction of a temporary or permanent noise reduction wall is not practicable for the proposed repowered units. For the wall to be effective it would have to be 15 ft high or more for ground level construction equipment (e.g. air compressors, dozers and scrappers). Since the CT enclosure and HRSGs will be constructed to heights of 75 ft and 61 ft, respectively, a wall would have to be of similar height to block noise from the source to receiver. Constructing a wall to a height of 75 ft and about 300 ft long is not possible at the site due to foundation and space limitations. Also, if constructing such a wall were possible, the cost would be prohibitively expensive and noise associated with constructing a wall would likely exceed the noise limits.

The variance is requested for the construction period of the repowered units and the demolition period for removing the stacks and steam generators for Units 4 and 5. The duration of these activities will be less than 3 years. After construction and demolition is complete, the repowered units are predicted to meet the Broward County noise regulations (see Section 5.7).

During the period of the variance, "construction practices" will be implemented, as practicable, to mitigate noise generation and impacts to the residential land use. These practices will include:

1. Locating stationary equipment, such as air compressors, as far as practicable from the residential areas;
2. Operating large construction machinery primarily during daytime hours;
3. Requesting contractors to use only well maintained equipment that incorporates the latest noise attenuation;

4. Performing most land clearing and site preparation primarily during daytime hours;
5. Limiting nighttime construction activities generally to the use of a minimum of heavy equipment; and
6. Replacing, wherever practicable, internal combustion engine-driven equipment with electrical motor-driven equipment.

These proposed practices will mitigate impacts to the residential areas. As noted in Section 4.6.1, there are relatively high existing noise levels in the area due to aircraft taking off and landing at the nearby Fort Lauderdale-Hollywood International Airport. With the use of proper construction practices, the predicted noise levels during construction will not be significantly higher or more disruptive than those currently existing in the area.

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American National Standards Institute (ANSI). 1978. American National Standard Method for the Calculation of the Absorption of Sound by the Atmosphere. ASA23-1978.

Institute of Transportation Engineers. 1985. Highway Capacity Manual.

New York State Department of Public Service (NYSDPS). 1986. NOISECALC: A Computer Program for Sound Propagation Calculations. Office of Energy Conservation and Environmental Planning.

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Lauderdale Repowering Project

Site Certification Application

Chapter 5

Effects Of Plant Operation

TABLE OF CONTENTS

TABLE OF CONTENTS
(Continued)

TABLE OF CONTENTS
(Continued)

LIST OF TABLES

LIST OF TABLES
(Continued)

LIST OF TABLES
(Continued)

LIST OF FIGURES

5.0 EFFECTS OF PLANT OPERATION

5.1 EFFECTS OF THE OPERATION OF THE HEAT DISSIPATION SYSTEM

5.1.1 Temperature Effects on Receiving Water Body

5.1.1.1 Introduction

The Lauderdale Repowering Project will utilize the existing cooling canal/pond system (hereafter referred to as the cooling system). Condenser cooling water is withdrawn from the Dania Cut-Off Canal and flows into a non-recirculating cooling canal/pond system which subsequently discharges into the South Fork New River (see Section 3.5.1 for heat dissipation system design details). The cooling system consists of two connected ponds and several connecting canals which were created from limerock excavation. The cooling pond discharges to the South Fork New River and has a total surface area of approximately 185 acres. Details of the cooling pond characteristics are presented in Section 2.3.4.

The operation of existing Lauderdale Plant thermal release is authorized under federal, state and county permits (see Appendix 10.4). The NPDES permit (Number FL0001503) issued April 1987 by EPA addresses Section 316 (a) and (b) requirements of the Clean Water Act as follows:

1. A 316 (a) variance was not requested. Thermal discharges do not violate Florida Water Quality Standards for thermal pollutants, and
2. The intake structure reflects best available technology to minimize adverse environmental impacts.

FDER permit (Number: I006-158722) specifies that the thermal release is regulated in accordance with Chapter 17-3.050, F.A.C. (see Section 5.1.1.3 for definition). BCEQCB authorizes the thermal release under License No. IWH-102-89.

In all permits, the location of discharge to the receiving body of water (RBW) is the box culverts under State Road 84. This connects the cooling system to a canal connected to the South Fork New River.

The following portions of this section present the alternative plant operation scenarios, the regulatory discharge criteria, an overview of the assessment methodology, presentation of the assessment results, and a discussion of potential impacts.

5.1.1.2 Alternative Plant Operation Scenarios

In considering the thermal impacts of plant operations, three conditions (normal base load operations, normal daily cycling, and a transitory steam dump) were evaluated and compared to the existing facility. The existing and proposed operational scenarios are:

Base Case (i.e., existing plant design)

Condenser cooling water flow	517 cfs
Auxiliary cooling water flow	13 cfs
Temperature rise	13.2°F

Case 1 (existing condenser system with modified auxiliary cooling water system; continuous operation)

Condenser cooling water flow	517 cfs
Auxiliary cooling water flow	45 cfs
Temperature rise	13.2°F

Case 2 (transitory steam dump utilized to route steam produced in the HRSG when the CT is in operation but the steam turbine is not; the HRSG must produce steam with CT exhaust flow going through it in order to not damage heat transfer surfaces)

Condenser cooling water flow	517 cfs
Auxiliary cooling water flow	45 cfs
Temperature rise	23°F
Duration	15 hrs per day for up to 8 consecutive days

Case 3 (cycling of units to provide power during daytime peak hours only)

Condenser cooling water flow	517 cfs
Auxiliary cooling water flow	45 cfs
Temperature rise	23°F
Duration	2 hours per day with units shut down 8 hours per day and running Case 1 the remaining 14 hours per day

5.1.1.3 Regulatory Discharge Criteria

The current NPDES permit for the heat dissipation system at the Lauderdale Plant includes monitoring of flow and water temperature rise at the condenser outflow only (i.e., as the water enters the cooling pond, not as it discharges to the South Fork New River). The permitted temperature rise across the condenser (ΔT) is 13.2°F (30-day average); flow volume is not specifically limited.

The State of Florida thermal criteria for surface waters are presented in Chapter 17-3.050, F.A.C. The portion of the chapter that applies to the Lauderdale Repowering Project is Chapter 17-3.050(1), F.A.C., which states:

(a) Heated water discharges existing on July 1, 1972:

1. Shall not increase the temperature of the RBW so as to cause substantial damage or harm to the aquatic life or vegetation therein or interfere with beneficial uses assigned to the RBW.

BCEQCB regulations establish a 90°F thermal water quality standard. As applied to the Lauderdale Plant's BCEQCB license, this thermal standard is measured 800 meters from the discharge point in the direction of normal flow.

5.1.1.4 Assessment Methodology

A quantitative assessment of thermal effects of the cooling pond operation was conducted using an analytical model to determine water temperature at the point of discharge (POD). Details of the analytical models are presented in Section 5.1.5.1. A summary of the models is as follows:

1. For estimated cooling pond equilibrium temperature (i.e., water temperature without plant cooling water discharges), strict and modified heat budget approaches were used. The strict heat budget approach, as presented by Patterson et al. (1971), is based on the principle of the conservation of energy. An alternative means of estimating equilibrium temperature is presented in EPA (1978). This approach uses a modified heat budget model where the heat loss terms are combined into a function of the thermal exchange coefficient.
2. The cooling pond performance was evaluated using analytical steady-state models for flow-through systems. The models used are as follows:
   a. Model 1--[EPA (1973) and Patterson (1971)] provides an estimate of cooling pond performance assuming that heat loss is a surface area function only.
   b. Model 2--[Jirka and Watanabe (1980)] provides estimates of performance assuming a vertically well-mixed pond with longitudinal dispersion.
   c. Model 3--[Jobson (1973)] provides estimates of performance for vertically well-mixed cooling ponds assuming that depth and heat rejection are independent downstream in the system.

Assessment of the thermal effects in the RBW were made using RECEIV-II, a two-dimensional, linked node, numerical model. The model can simulate hydrologic and water quality processes in tidally affected systems and accounts for the interconnected canals surrounding the Lauderdale Plant site. A detailed description of the RECEIV-II Model is presented in Section 5.1.5.1.

5.1.1.5 Assessment Results

COOLING CANAL/POND SYSTEM PERFORMANCE ASSESSMENT

The cooling system models described in Section 5.1.1.4 were run for the two plant flow and temperature scenarios presented in Section 5.1.1.2. The results of the modeling efforts for the Base Case and Case I are summarized in Table 5.1-1. As noted in this table, the discharge temperature does not vary by more than 0.3°F when comparing the Base (existing) Case with the repowered conditions in Case 1. The heat discharge (Btu/hr) to the RBW (also shown in Table 5.1-1) shows a minimal change when comparing Case 1 and the Base Case. The heat discharge rate increases between 8.1 and 8.8 percent for Case I, depending on the month.

Pond modeling of the steam dump operations was not conducted. As stated previously, the pond models are analytical steady-state models. Due to its transitory nature, the steam dump does not fit the models' assumption of a constant discharge. The steam dump operations were simulated using the RECEIV-II model, and the results are presented in the following section.

Modeling during the cycling mode of operation was not performed. This case has less impact than the base load case because it produces a lower daily heat load on the pond. In addition, because of its duration, it has less impact than the transitory steam dump case. For this reason, the cycling case was not simulated using the RECEIV-II model.

RECEIVING BODY OF WATER (RBW) ASSESSMENT

Numerical modeling of plant operations was conducted for both the existing and repowered conditions using the RECEIV-II model. The model was developed by EPA and can simulate water quality processes in tidally affected streams. A summary description of the model is presented in Section 5.1.5.1; a detailed description is presented in Appendix 10.5.2.

The model source code as supplied from EPA does not consider thermal inputs. However, it was modified to include heat exchange and thermal mixing by adding the EPA heat loss equation previously described in

Table 5.1-1. Summary of Cooling System Performance Modeling

		Existing Pond Configuration			
Month	Equilibrium Termperature (°F)	Temperature Increase (°F) at RBW		Heat Rejected from Cooling System (10^8 Btu/hr)	
		Base	Case 1	Base	Case 1
January	66.6	8.1	8.3	9.66	10.5
February	67.5	7.8	8.1	9.31	10.2
March	71.2	7.5	7.7	8.85	9.68
April	74.2	7.1	7.4	8.45	9.26
May	78.1	7.2	7.5	8.58	9.40
June	83.9	7.3	7.5	8.62	9.44
July	86.1	7.3	7.5	8.62	9.44
August	86.5	7.3	7.5	8.64	9.46
September	82.8	7.4	7.6	8.71	9.53
October	76.2	7.4	7.7	8.80	9.63
November	70.3	7.8	8.1	9.30	10.1
December	66.4	8.3	8.5	9.80	10.7
Average		7.5	7.8	8.95	9.78
Maximum		8.3	8.5	9.77	10.6
Minimum		7.1	7.4	8.45	9.27

Modeling Conditions:

Parameter	Base	Case 1
Flow (cfs)	530	562
Temperature Rise (°F)	13.2	13.2

Section 5.1.1.4. With this modification, the model can adequately simulate the plant thermal discharge into both the cooling canal/pond system and the receiving waters. A description of the modifications made to the model to account for heated water inputs is presented in Appendix 10.5.2.

As noted previously, the surface waters at the Lauderdale Plant site vicinity consist of a series of tidally affected interconnected canals. To reflect this geometry and driving forces, the model consisted of 91 nodes and 100 channels including South Fork New River, North Fork New River, South New River Canal, Dania Cut-Off Canal, the Intracoastal Waterway, Port Everglades, and the cooling canal/pond system (Figure 5.1-1). The model was calibrated using tide, current, salinity and temperature data collected May 1 through May 3, 1989. Details and results of the model calibration procedure are presented in Appendix 10.5.2.

Five scenarios were simulated for various plant operation and seasonal conditions. Table 5.1-2 shows the environmental parameters for each scenario. An average tide range of 2.6 ft was used at ocean tidal boundaries, and the USGS long-term average flow data in August and January were used as upstream freshwater inflow for summer and winter conditions, respectively. Salinity, temperature, and conservative substances were simulated for each model scenario.

The model predicts tidal elevation, current velocity, vertical average temperatures, and salinity at every model node. Since RECEIV-II is a two-dimensional, dynamic model, it predicts the time-varying temperature and salinity according to the tidal phases. Thus, the values presented in this discussion are depth and tidal cycle average values, and therefore instantaneous values may be slightly different, depending on the tide phase.

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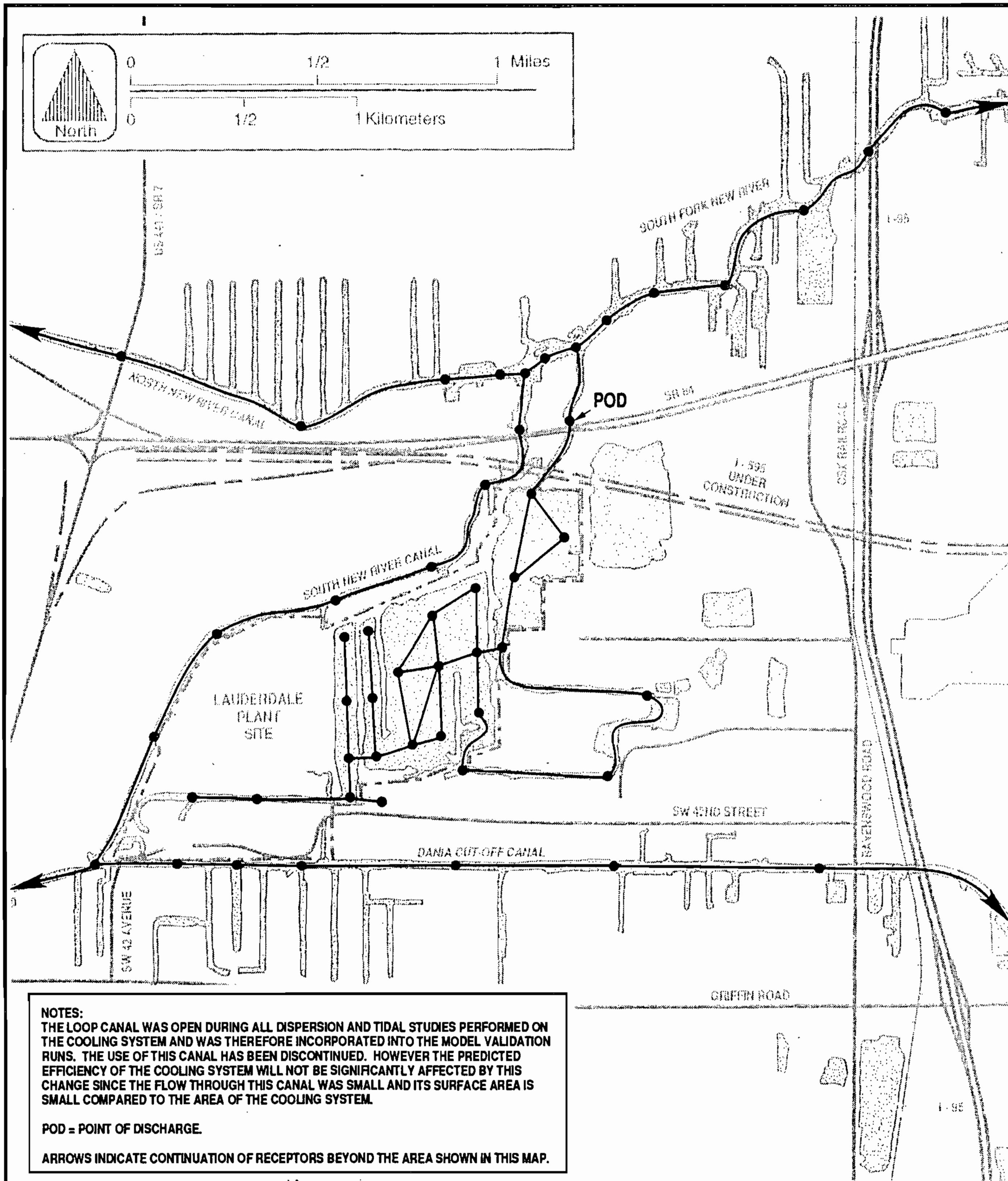

NOTES:
THE LOOP CANAL WAS OPEN DURING ALL DISPERSION AND TIDAL STUDIES PERFORMED ON THE COOLING SYSTEM AND WAS THEREFORE INCORPORATED INTO THE MODEL VALIDATION RUNS. THE USE OF THIS CANAL HAS BEEN DISCONTINUED. HOWEVER THE PREDICTED EFFICIENCY OF THE COOLING SYSTEM WILL NOT BE SIGNIFICANTLY AFFECTED BY THIS CHANGE SINCE THE FLOW THROUGH THIS CANAL WAS SMALL AND ITS SURFACE AREA IS SMALL COMPARED TO THE AREA OF THE COOLING SYSTEM.

POD = POINT OF DISCHARGE.

ARROWS INDICATE CONTINUATION OF RECEPTORS BEYOND THE AREA SHOWN IN THIS MAP.

Figure 5.1-1 RECEIV-II MODEL SEGMENTATION

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Table 5.1-2. Parameters Used for RECEIV-II Model Simulations

Plant Operation	Plant Discharge (cfs)	Season	Equilibrium Temperature (°F)	Heat Transfer Coefficient (Btu/ft^2/day/°F)
Existing[a]	530	Summer	86.5	174
Existing[a]	530	Winter	66.5	140
Repowered[a]	562	Summer	86.5	174
Repowered[a]	562	Winter	66.5	140
Steam-Dump[b]	562	Summer	86.5	174

[a]Continuous plant operation with ΔT = 13.2°F.
[b]Transitory plant operation with the following conditions:

Unit 4 Condenser
- Flow = 304 cfs
- ΔT = 13.2°F
- Duration = continuous

Unit 5 Condenser
- Flow = 258 cfs for 15 hours and 129 cfs for 9 hours
- ΔT = 23°F for 15 hours and 0°F for 9 hours
- Duration = 8 consecutive days

Tables 5.1-3 and 5.1-4 summarize the temperature simulations and incremental temperature increases, respectively, for all model scenarios. As expected, the maximum temperature increase occurred in winter under the repowered plant conditions. In this instance, the average temperature increase at the point of discharge was 5.1°F above equilibrium temperature (66.5°F). In contrast, the average temperature increase for the existing plant conditions is predicted to be 4.8°F. Thus, operation of the repowered Lauderdale Plant is predicted to increase the temperature of the discharge to the RBW by no more than 0.3°F from existing winter conditions.

Under summer repowered conditions, the predicted average temperature increase at the point of discharge was 4.0°F above equilibrium temperature (86.5°F). A plot of the summer receiving water conditions is shown in Figure 5.1-2. This average temperature increase compares with the 3.8°F increase predicted for the existing plant conditions. Thus, operation of the repowered plant is predicted to increase the temperature of the discharge to the RBW by no more than 0.2°F from existing summer conditions.

Under both the existing and repowered conditions, a small increase (0.1°F for summer and 0.7°F for winter) above equilibrium temperature is predicted at the plant intake. This increase is due to recirculation of the water created by the intake flow demand dominating the flow regime in the canal systems. The recirculation phenomenon was observed during both the February dye study and the May synoptic current studies.

It is also of note that the cooling system discharge temperatures predicted by the RECEIV-II model are consistently lower than the values estimated by the analytical analysis (see Tables 5.1-1 and 5.1-4 for comparison). This difference is due to the fact that the cooling system receives cooler ocean water with every flood tide; an event which RECEIV-II can simulate but the analytical model cannot. The RECEIV-II model results can be verified by checking them against the cooling system thermograph results (presented in Section 2.3.4). In this comparison, the RECEIV-II predicted temperatures are consistently higher than the measured values; an expected result due to

Table 5.1-3. Summary of Maximum Temperature (°F) Results

Location	Existing Summer	Repowered Summer	Existing Winter	Repowered Winter
Plant Condenser Outlet	99.7	99.8	80.2	80.3
Point of Discharge (POD)	90.3	90.5	71.3	71.6
South Fork New River				
Downstream[a]				
600 ft	89.2	89.5	70.5	70.9
1,200 ft	88.9	89.2	70.2	70.5
2,200 ft	88.7	88.9	69.8	70.1
4,400 ft	88.5	88.7	69.6	69.9
5,800 ft	88.5	88.7	69.5	69.8
Upstream[a]				
400 ft	88.5	88.8	70.3	70.7
800 ft	87.2	87.3	69.7	70.1
2,600 ft	86.9	87.0	69.1	69.4
5,200 ft	86.9	87.0	68.8	69.1
9,200 ft	86.8	86.8	68.3	68.6
Dania Cut-Off Canal				
Plant Intake	86.6	86.6	67.1	67.2
Downstream of Intake				
1,000 ft	86.5	86.5	66.5	66.5
2,000 ft	86.5	86.5	66.5	66.5
4,200 ft	86.5	86.5	66.5	66.5
Upstream of Intake				
1,200 ft	86.6	86.7	67.3	67.5
2,000 ft	86.5	86.5	66.5	66.5

[a]From the confluence of South Fork New River and cooling pond outlet canal, which is approximately 1,250 ft from POD.

Table 5.1-4. Excess Temperature Above Equilibrium Temperature (°F)

Location	Existing Summer	Repowered Summer	Existing Winter	Repowered Winter
Plant Condenser Outlet	13.2	13.3	13.7	13.8
Cooling Pond Outlet	3.8	4.0	4.8	5.1
South Fork New River				
Downstream[a]				
600 ft	2.7	3.0	4.0	4.4
1,200 ft	2.4	2.7	3.8	4.0
2,200 ft	2.2	2.4	3.3	3.7
4,400 ft	2.0	2.2	3.1	3.4
5,800 ft	2.0	2.2	3.0	3.3
Upstream[a]				
400 ft	2.0	2.3	3.8	4.2
800 ft	0.7	0.8	3.2	3.6
2,600 ft	0.4	0.5	2.6	2.9
5,200 ft	0.4	0.5	2.3	2.6
9,200 ft	0.3	0.3	1.8	2.1
Dania Cut-Off Canal				
Plant Intake	0.1	0.1	0.6	0.7
Downstream of Intake				
1,000 ft	0.0	0.0	0.0	0.0
2,000 ft	0.0	0.0	0.0	0.0
4,200 ft	0.0	0.0	0.0	0.0
Upstream of Intake				
1,200 ft	0.1	0.2	0.8	1.0
2,000 ft	0.0	0.0	0.0	0.0

[a]From the confluence of South Fork New River and cooling pond outlet canal, which is approximately 1,250 ft from POD.

Note: Summer equilibrium temperature = 86.5°F.
Winter equilibrium temperature = 66.5°F.

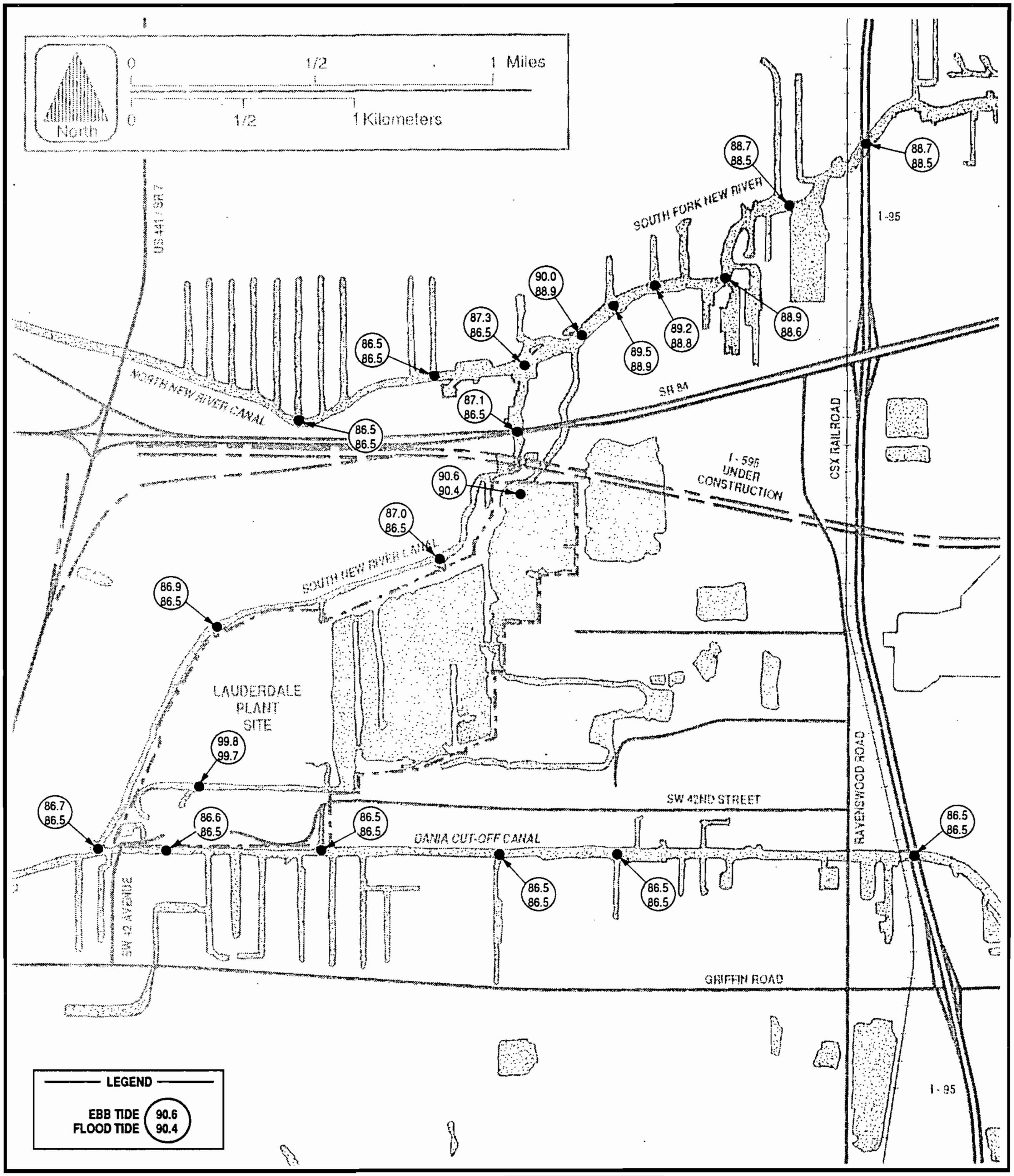

Figure 5.1-2 SYNOPTIC REPRESENTATION OF SIMULATED TEMPERATURE (°F) — REPOWERED SUMMER CONDITION

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the cycling nature of plant operations during the study period versus the simulated continuous operations.

The final plant operating condition that was modeled was the steam dump mode. The steam dump is an unplanned transitory operating condition which would occur when the steam turbine for a given unit is unavailable for service (e.g., maintenance outage) but the CT is on-line to meet electrical demand. During steam dump operations, one unit would be operating in the normal base load mode while the other unit would be cycling. The water requirements and thermal discharge rates for the steam dump operating mode are presented in Table 5.1-2. The steam dump mode is most likely to occur during the summer months.

Analysis of the steam dump was performed using the RECEIV-II model. The input environmental conditions for the steam dump modeling were the output from summer repowered operations presented in Figure 5.1-3. With the steam dump conditions (Table 5.1-2), the average temperature at the cooling pond outlet increases from 89.5°F to 90.6°F over the 8-day period (Figure 5.1-3.) The temperature rise in the receiving water at a point 2,500 ft downstream (see Figure 5.1-4) of the cooling pond outlet is less pronounced, with the average temperature increasing from 88.2°F to 88.9°F. Thus, during the transitory (i.e., 8-day duration) steam dump condition, the temperature increase at the cooling pond outlet is estimated to be a maximum of 1.3°F above the existing cooling pond temperature.

When comparing the modeling results (for either the continuous operations or steam dump condition) to the applicable regulations, the following conclusions can be drawn:

1. The discharge is and will be in compliance with the state of Florida thermal criteria presented in Chapter 17-3.050(1), F.A.C. The rationale behind this conclusion is that the existing discharge has been approved by FDER (i.e., it does not cause substantial damage or harm to the aquatic life or interfere with

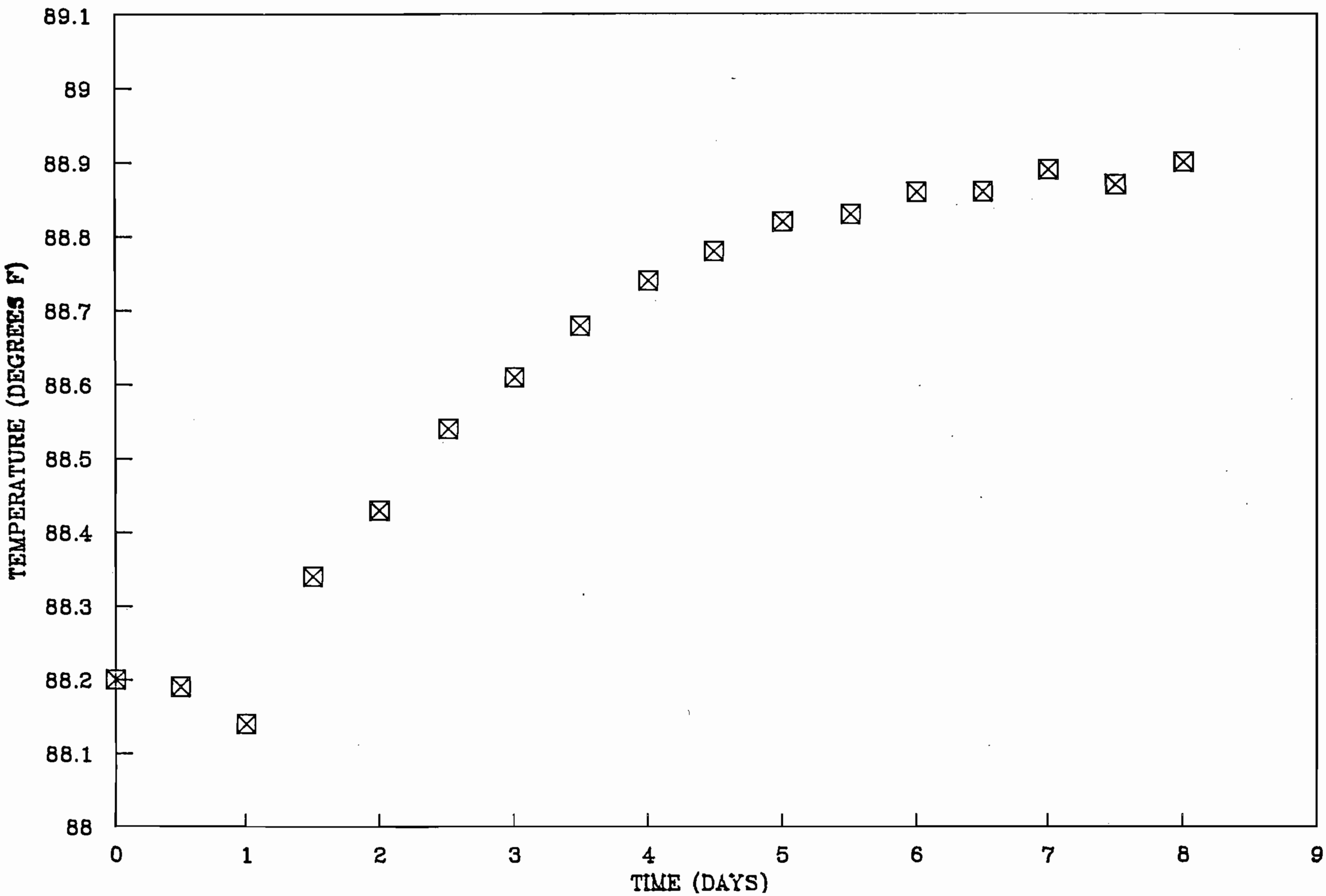

Figure 5.1-4 SIMULATED TEMPERATURE RESPONSE AT 2,500 FT DOWNSTREAM IN SOUTH FORK NEW RIVER UNDER STEAM DUMP CONDITION

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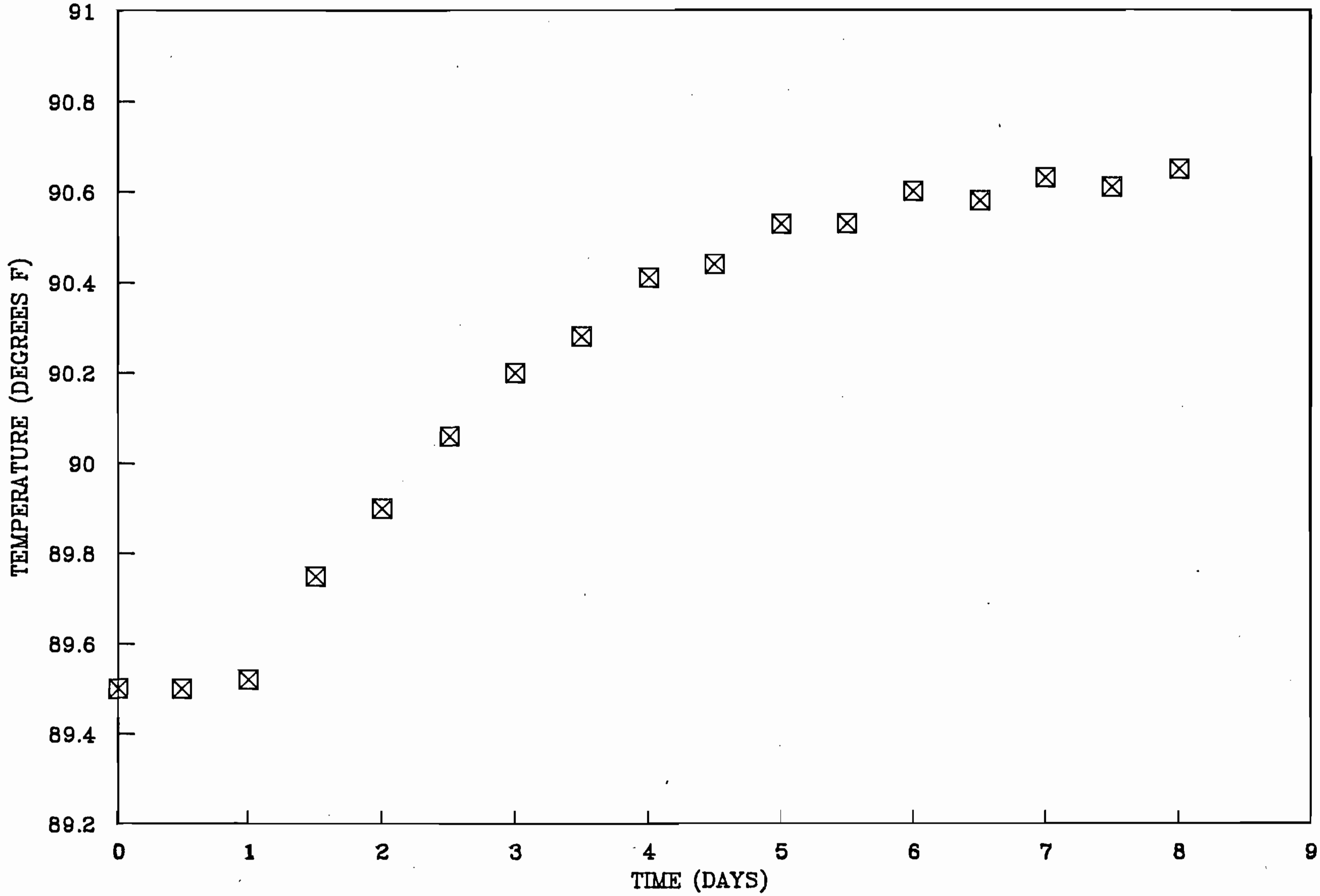

Figure 5.1-3 SIMULATED TEMPERATURE RESPONSE AT THE POINT OF DISCHARGE UNDER STEAM DUMP CONDITION

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the beneficial uses) and the repowered impacts will be only 0.2 to 0.3°F higher than existing.

2. The discharge will be in compliance with Broward County Effluent Standards B.C.C. Section 27-5.081(32) because the temperature at the point of discharge will be less than 95°F and/or less than a 10°F increase over ambient.
3. The discharge plume in the RBW will normally be in compliance with the Broward County Water Quality Standard for Marine Waters [B.C.C. Section 27-5.071(29)] of 90°F at the end of an 800-meter mixing zone. This standard cannot be met during the periodic occurrences of the receiving water naturally being near or above 90°F.

5.1.2 <u>Effects on Aquatic Life</u>

5.1.2.1 Thermal Impacts

The proposed Lauderdale Repowering Project will not significantly alter existing water temperatures in the receiving waters. Significant changes in heat rejection and cooling water flow will not occur. Data collected over the course of the 1988-1989 program indicate that water temperatures where the cooling pond discharge enters the South Fork New River (Station 6) are elevated by about 2 to 4°F during current periods of plant operation. Under repowered conditions, the water temperature at the cooling pond outlet is estimated to increase a maximum of 0.3°F above these existing levels.

The Lauderdale Plant has been operational under conditions similar to the proposed operating mode for over 30 years. Resident aquatic organisms in the vicinity of the plant are adapted to current and proposed operational conditions. Temperature increases in the South Fork New River will be minor and are not expected to cause substantial damage or harm to aquatic life or vegetation.

5.1.2.2 Impingement and Entrainment

Repowering of the Lauderdale Plant will only increase cooling water requirements by 8.6 percent. This increase will increase impingement or entrainment proportionally. Biological investigations conducted in 1974-1975 (ABI, 1976) and 1988-1989 (see Section 2.3.6) indicate that current rates of impingement and entrainment do not significantly affect the structure of aquatic biological communities. Given the marginal increase in cooling water flow and the current conditions at the site, adverse impacts to the aquatic communities will not occur.

5.1.2.3 Thermal Shock

Thermal shock may result from short-term increases or decreases in water temperature. Increases in water temperatures during periods of plant operation may affect sensitive aquatic species. Temperature increases are most likely to impact biota during the summers when water temperatures are highest and many organisms are living at temperatures approaching their upper tolerance limits. Thermal shock may also result from temperature decreases when the plant goes off-line. Thermal shock as a result of temperature decrease is most likely to occur during winter cold spells when aquatic organisms tend to congregate in the vicinity of warm water discharges. Because the Lauderdale Plant site is located in a semitropical environment, indigenous species are not dependent upon the warm water discharge for survival and neither have been nor will be adversely impacted after repowering. Currently, resident species are adapted to the Lauderdale Plant's intermittent discharge. To date, evidence of thermal shock impacts to aquatic biota has not been documented.

The West Indian manatee congregates in the vicinity of the power plant outfall. Surveys of manatee usage of the Lauderdale Plant site have been made since 1977. The site has the lowest number of sightings of the five FPL power plants that have been surveyed. Over a 12-year period, an average of 25 manatees (range 6 to 52 individuals) has been observed at the Lauderdale Plant site (Reynolds, 1988, 1989). The lower numbers at the plant are attributed to the periodic operational schedule of the plant (Reynolds and Wilcox, 1986).

In general, manatees congregate in the thermal effluents during cold periods in the winter (Shane, 1984; Reynolds and Wilcox, 1986). In some years, manatee abundance at the Lauderdale Plant site has not been related to ambient air temperatures (Reynolds and Wilcox, 1986).

The lower thermal tolerance limit for manatees is believed to be about 59°F (15°C) (Husar, 1977). The repowered plant will operate within the same range of thermal conditions as the existing plant. Because acute thermal tolerance levels are not approached, no impacts to manatees are anticipated. If the schedule of operation of the new plant is more constant than that of the existing plant, it is likely that manatee use of the plant discharge canals will increase.

Consistent with designations at other wintering congregation areas, FPL proposes to promote manatee safety at the site by requesting that FDNR designate the cooling system as a "No Entry" zone. Such a designation would prevent harassment of the manatees by preventing recreational and non-essential boating. The designation is not intended to prevent ongoing dredging or maintenance activities conducted by FPL or their lessees/ contractors.

Additionally, recently conducted bathymetric surveys indicate that typically the depths in the pond system average 30 ft. Because manatees prefer shallow waters in which to rest, and because the area is expected to be declared "No Entry" to boats, FPL proposes to enhance the habitat for manatees by establishing an experimental resting shelf in an area on the edge of the pond where manatees can rest in shallow, calm, and warm waters. Future aerial surveys would include documentation of the frequency/density of use by manatees.

5.1.3 Biological Effects of Modified Circulation

The Lauderdale Repowering Project will not result in significant changes to circulation in waters surrounding the Lauderdale Plant. No biological effects associated with altered circulation are expected to occur.

5.1.4 Effects of Offstream Cooling

This section is not applicable since the repowering project does not include offstream cooling. Thermal impacts from use of the cooling system are discussed in Section 5.1.1.

5.1.5 Measurement Programs

5.1.5.1 Surface Water

COOLING CANAL/POND SYSTEM ASSESSMENT

The temperature of a given body of water can be analytically estimated by quantifying the energy transfers within the system. For a cooling pond, the primary energy transfers occur within the air-water interface. Heating processes across the boundary include absorption of shortwave solar and atmospheric radiation, absorption of longwave atmospheric radiation, and heat rejected to the cooling system by the condenser. Cooling processes include reflected shortwave and longwave radiation by the water, longwave radiation emission, evaporative heat losses, and conduction of sensible heat.

The initial step in determining the cooling system temperature is to calculate the theoretical temperature of the water body in the absence of the power plant. The theoretical water temperature (referred to as the equilibrium temperature) is a function of local climatological conditions. There are several means of estimating the equilibrium temperature; the most frequently used are strict and modified heat budget approaches. The strict heat budget approach, as presented by Patterson et al. (1971), is based on the principle of the conservation of energy. An alternative means of estimating equilibrium temperature is presented in EPA (1980). This approach uses a modified heat budget model where the heat loss terms are combined into a function of the thermal exchange coefficient.

The form of the conservation of heat equation as presented in Patterson <u>et al</u>. (1971) is:

$$H_s + H_a - H_{sr} - H_{ar} - H_{br} \pm H_c - H_e = 0$$

where: H_s = Absorption of short-wave solar and atmospheric radiation,
H_a = Absorption of long-wave atmospheric radiation,
H_{sr} = Reflected short-wave solar radiation,
H_{ar} = Reflected long-wave atmospheric radiation,
H_{br} = Long-wave radiation emitted by the water,
H_c = Conduction of sensible heat to the atmosphere, and
H_e = Evaporative heat loss.

Solution of the above equation is an iterative process based on the reliance of several terms (i.e., H_{br}, H_c, and H_e) on the equilibrium water temperature. Alternative values of the equilibrium temperature are introduced into the equation until the condition $\Sigma H_x = 0$ is satisfied. Table 5.1-5 shows details of equilibrium water temperature calculations using this method.

The form of the modified heat budget equation as presented in EPA (1980) is:

$$T_E = -(0.05T_E^2/K) + [(H_R-1801)/K] + [(K-15.7)/(0.26K+KB)]*(e_a-C(B)+0.26T_a)$$

where: T_E = Equilibrium temperature (°F),
K = Thermal exchange coefficient (Btu/ft2/day/°F),
H_R = Net incoming short-wave and long-wave radiation, (Btu/ft^2/day),
T_a = Air temperature (°F),
e_a = Water vapor pressure of ambient air at air temperature (mm Hg),
B = Proportionality coefficient (mm Hg/°F), and
C(B) = Value dependent on B (mm Hg).

Table 5.1-5. Calculation of Equilibrium Water Temperature Using Patterson et al. (1971) Methodology

Month	Air Temp (°F)	Relative Humidity (%)	Water Vapor Pressure (mm Hg)	Barometric Pressure (mm Hg)	Windspeed (mph)	Cloud Cover (%)	Heat Inputs to Pond (Btu/ft^2/day)		Heat Losses from Pond (Btu/ft^2/day)				Equilibrium Water Temp (°F)
							Short[a]	Long[b]	Reflected[c]	Long[d]	Evap[e]	Cond[f]	
January	67.2	73.8%	12.5	765	9.3	50%	1,291	2,522	140	3,100	596	(15)	66.8
February	67.8	70.3%	12.2	764	10.0	46%	1,536	2,505	152	3,126	762	4	67.9
March	71.3	70.0%	13.7	764	10.3	47%	1,809	2,629	169	3,237	987	46	72.5
April	75.0	68.3%	15.1	763	10.6	49%	1,998	2,760	183	3,330	1,202	51	76.3
May	78.0	73.3%	17.9	762	9.4	54%	2,046	2,938	190	3,443	1,256	103	80.8
June	81.0	78.5%	21.1	762	8.2	62%	1,968	3,152	193	3,549	1,248	135	84.9
July	82.3	76.8%	21.5	763	7.8	61%	1,968	3,189	194	3,572	1,282	119	85.8
August	82.9	77.5%	22.2	762	7.7	58%	1,869	3,204	190	3,575	1,206	101	85.9
September	81.7	79.5%	21.9	760	8.2	62%	1,628	3,192	177	3,525	1,032	80	84.0
October	77.8	77.3%	18.7	761	9.3	58%	1,421	2,982	161	3,383	845	22	78.4
November	72.2	73.5%	14.8	763	9.4	52%	1,306	2,706	146	3,210	680	(30)	71.4
December	68.3	71.8%	12.7	764	9.0	52%	1,169	2,556	135	3,096	553	(62)	66.6

[a]Short-wave solar radiation.
[b]Long-wave atmospheric radiation.
[c]Reflected short-wave solar and long-wave atmospheric radiation by water.
[d]Long-wave radiation emitted by water.
[e]Evaporative heat losses.
[f]Conduction of sensible heat to atmosphere.

Note: Climatological data (i.e., air temperature, relative humidity, windspeed, cloud cover, barometric pressure, and shortwave solar radiation) obtained from the NOAA weather summaries for the Miami International Airport weather station.

The modified heat budget equation is also solved using an iterative process; alternative values of T_E are selected until both sides of the equation balance. Table 5.1-6 shows details of equilibrium temperature calculations using this method.

A comparison of the results of the equilibrium temperature estimations using these two methods is presented in Table 5.1-7. The two methods give similar results (i.e., $\pm$1°F) during the winter and summer months. Predicted temperatures during the spring and fall tend to diverge, with the Patterson equation predicting warmer temperatures. The Patterson values are closer to observed values in the Dania Cut-Off Canal; however, this could be due to a warmer than average fall rather than predictive accuracy. Given the uncertainty as to which method is more accurate overall, an average of the two values was used in further analyses. Use of the average equilibrium temperature values is not expected to affect the accuracy of the results because relative temperature increases (rather than absolute values) are used as the means of comparison between existing and proposed conditions.

The cooling system performance was evaluated using analytical steady-state models for flow-through systems. A summary description of the models is as follows:

1. Model 1--[EPA (1973) and Patterson (1971)] provides an estimate of cooling system performance assuming that heat loss is a surface area function only.
2. Model 2--[Jirka and Watanabe (1980)] provides estimates of cooling system performance assuming a vertically well-mixed pond with longitudinal dispersion.
3. Model 3--[Jobson (1973)] provides estimates of cooling system performance for vertically well-mixed ponds assuming that depth and heat rejection are independent downstream in the pond.

It should be noted that two of the assumptions included in the model development are that pond geometry is fairly uniform and that cooling is

Table 5.1-6. Calculation of Equilibrium Water Temperature Using EPA (1980) Methodology

Month	Air Temp (°F)	Relative Humidity (%)	Water Vapor Pressure (mm Hg)	Wind-speed (mph)	Cloud Cover (%)	Solar Radiation (Btu/ft²/day) Short[a]	Long[b]	Equilibrium Water Temp (°F)
January	67.2	73.8	12.5	9.3	50	1,291	2,522	66.5
February	67.8	70.3	12.2	10.0	46	1,536	2,505	67.0
March	71.3	70.0	13.7	10.3	47	1,809	2,629	69.8
April	75.0	68.3	15.1	10.6	49	1,998	2,760	72.0
May	78.0	73.3	17.9	9.4	54	2,046	2,938	75.4
June	81.0	78.5	21.1	8.2	62	1,968	3,152	82.8
July	82.3	76.8	21.5	7.8	61	1,968	3,189	86.4
August	82.9	77.5	22.2	7.7	58	1,869	3,204	87.0
September	81.7	79.5	21.9	8.2	62	1,628	3,192	81.6
October	77.8	77.3	18.7	9.3	58	1,421	2,982	74.1
November	72.2	73.5	14.8	9.4	52	1,306	2,706	69.2
December	68.3	71.8	12.7	9.0	52	1,169	2,556	66.3

[a]Short-wave solar radiation.
[b]Long-wave atmospheric radiation.

Note: Climatological data (i.e., air temperature, relative humidity, windspeed, cloud cover, and short-wave solar radiation) obtained from the NOAA weather summaries for the Miami International Airport weather station.

Table 5.1-7. Comparison of Equilibrium Temperature Calculated by EPA (1980) and Patterson (1971) Methodologies

Month	Equilibrium Temperature (°F)		
	EPA	Patterson	Average
January	66.5	66.8	66.6
February	67.0	67.9	67.5
March	69.8	72.5	71.2
April	72.0	76.3	74.2
May	75.4	80.8	78.1
June	82.8	84.9	83.9
July	86.4	85.8	86.1
August	87.0	85.9	86.5
September	81.6	84.0	82.8
October	74.1	78.4	76.2
November	69.2	71.4	70.3
December	66.3	66.6	66.4

through the water-air interface only. While neither of these assumptions is met in the Lauderdale cooling pond, means of working around these theoretical differences were developed and are discussed below.

The algorithms used for the cooling system are as follows:

1. Model 1:

$$\Delta T_o = \Delta T_c e^{-r}$$

where: ΔT_o = Temperature differential between cooling pond outlet and receiving water,

ΔT_c = Temperature rise across the condenser,

r = Cooling pond capacity, and

= $KA/\rho C_p Q$.

where: K = energy exchange coefficient,

A = pond area,

ρ = water density,

C_p = specific heat of water, and

Q = cooling water flow.

2. Model 2:

$$\Delta T_o = \Delta T_c \{4ae^{0.5E^*}/[(1+a)^2 e^{0.5aE^*} - (1-a)^2 e^{-0.5aE^*}]\}$$

where: E^* = E_L/UL,

E_L = Longitudinal dispersion coefficient,

U = Mean velocity,

L = Flow distance through pond, and

a = $(1+4rE^*)^{0.5}$.

3. Model 3:

$$\Delta T_o = \Delta T_c e^{-(Dx/UZ)}$$

where: D = Surface transfer coefficient for excess heat,
= $(7+4u_a)e^{(0.035T)}$,
u_a = windspeed,
T = equilibrium temperature.
x = Distance downstream in pond, and
Z = Pond depth.

Application of the above models to the Lauderdale cooling canal/pond system was accomplished using the available site data, plant operational data, and meteorological data. The various models were calibrated using observed cooling system thermal conditions for late summer and early winter. The input conditions for the calibrated model are presented in Table 5.1-8. Setup and calibration of the models was accomplished as follows:

1. Model 1--As noted earlier in this section, the theoretical basis for this model includes cooling as a surface phenomenon only. To account for the additional cooling which occurs in the cooling canal/pond system due to groundwater and tidal inflows, the surface area of the cooling system was corrected (i.e., increased). By increasing the cooling canal/pond system area, the simulated cooling actually achieved by mixing was mathematically transformed to a surface cooling process. The net result of this calibration was that the cooling canal/pond system area was increased by 45 acres and the predicted outlet temperature increases were approximately 0.25°F of observed.
2. Model 2--This model was developed for the cases where the cooling canal/pond system has a regular rectangular geometry with length greater than width. The surface geometry of the Lauderdale cooling canal/pond system was mathematically transformed into this idealized geometry by solving the following set of simultaneous equations:

Table 5.1-8. Calibration of Cooling Pond Outlet Temperature Models Existing Pond Design - Existing Flow and Thermal Conditions

Discharge Flow Rate	302	Cubic feet/sec
Temperature Rise	13.2	°F
Effective Pond Area	145	Acres
Effective Flow Length	5,600	Feet
Effective Flow Width	1,130	Feet
Effective Pond Depth	9.0	Feet
Average Flow Velocity	0.03	Feet/sec
Average Residence Time	52.4	Hours
Longitudinal Dispersion Coefficient	223	Ft^2/sec

Month	Equilibrium Temperature (°F)	Heat Exchange Coefficient (BTU/ft^2/day/°F)	Estimated Pond Outlet Temperature (°F)			
			Method 1	Method 2	Method 3	Average
January	66.6	157	5.9	5.7	5.8	5.8
February	67.5	170	5.6	5.4	5.4	5.5
March	71.2	187	5.1	5.1	4.9	5.0
April	74.2	204	4.7	4.7	4.5	4.6
May	78.1	197	4.8	4.9	4.6	4.8
June	83.9	195	4.9	4.9	4.7	4.8
July	86.1	194	4.9	4.9	4.6	4.8
August	86.5	193	4.9	4.9	4.7	4.8
September	82.8	191	5.0	5.0	4.8	4.9
October	76.2	189	5.1	5.0	4.9	5.0
November	70.3	170	5.6	5.4	5.4	5.5
December	66.4	152	6.1	5.8	5.9	5.9

Notes:
1. Cooling pond area correction = 45 acres.
2. Method 1 is an estimate of cooling pond performance assuming it is a surface area function only; EPA (1973), and Patterson (1971).
3. Method 2 estimates cooling pond performance assuming a vertically well mixed cooling pond with longitudinal dispersion; Jirka and Watanabe (1980).
4. Method 3 estimates cooling pond performance for vertically well mixed systems assuming that depth and heat rejection are independent of distance downstream; Jobson (1973).

Length x Width = 145 acres

Width x Depth = Cross-sectional area

Cross-sectional area x Velocity = 517 cfs

Length/Velocity = Residence Time (30 hours)

The flow length through the cooling canal/pond system was measured to be approximately 5,600 ft; given this value, an effective cooling canal/pond system width of 1,130 ft and an effective depth of 9.0 ft was calculated. These dimensions fit the velocity and residence time for the cooling canal/pond system measured during the dye study and provide a reasonable simulation of cooling canal/pond system geometry. Given the above dimensions, the longitudinal dispersion coefficient for the cooling canal/pond system was calculated using the methodology presented in Fischer et al. (1979).

This model was calibrated by varying the longitudinal dispersion coefficient. A best fit (i.e., predicted outlet temperature increases were approximately 0.25°F of observed) was achieved when the calculated longitudinal dispersion coefficient was reduced by a factor of 0.4815. This correction factor is within ±4x range noted in Fischer between calculated and observed longitudinal dispersion coefficients.

3. Model 3--This model was developed assuming a geometry as noted for Model 2; as such, the effective cooling system dimensions presented above were used for this model. Calibration runs for this model were not necessary since test conditions met the selected criteria (i.e., predicted outlet temperature increases were approximately 0.25°F of observed).

RECEIVING BODY OF WATER (RBW) ASSESSMENT

The water quality model RECEIV-II was used to simulate the hydrology and water quality in the cooling canal/pond system and the South Fork New River. RECEIV-II is a two-dimensional receiving water model for streams, rivers, estuaries, lakes, and reservoirs. The model represents the physical processes of advection, dispersion, and dilution, and it can simulate flows, tidal movements, and water surface changes in a link-node network which allows up to 225 channels and 100 junctions to be modeled. Coupled and non-coupled chemical reactions can be simulated, and dissolved oxygen, BOD, coliforms, nutrients, salinity, conservative constituents, chlorophyll-a, and nonconservative constituents with first-order decay can be modeled.

RECEIV-II is a modification of the receiving water module of the Storm Water Management Model (SWMM) developed by Water Resource Engineers, Metcalf and Eddy, and the University of Florida. From a mathematical viewpoint, the only difference between RECEIV-II and the SWMM Receiving Water Block is in the water quality constituents modeled and the mathematical relationships describing the behavior of those constituents. It is based on deterministic assumptions and uses finite difference methods as a solution technique. Instantaneous mixing is assumed throughout each junction, and a two-dimensional channel network is used to simulate two-dimensional flow and transport.

RECEIV-II is composed of two major components: a quantity and a quality block. The quantity block simulates the hydrodynamics in tidal estuaries, and the quality block simulates the transport, mixing, physical, chemical, and biological processes in the water column. Input to the model for initial setup and calibration includes the following:

1. Constant headwater inflow rates;
2. Flow rate for each inflow (discharge, tributary, etc.) or withdrawal;
3. Tidal cycles and heights at the seaward boundary;
4. Widths and depths of each channel;
5. Initial flow velocities and water surface elevations throughout the system;
6. Initial constituent concentrations throughout the system;
7. Residual loading rates from discharges, tributaries and headwaters
8. Tidal exchange coefficients;

9. Meteorological data (windspeed, rainfall and daily solar radiation); and
10. First order decay rates for constituents.

Input for verification of the model includes net flow and velocities for each channel, a data record of constituent concentration throughout the modeled system, and salinity data to establish concentration inputs at the seaward boundary.

The basic conceptual framework used in RECEIV-II to describe the waterway being modeled is the same as in SWMM, in which the portion of the waterway being modeled is represented by a network of nodes (also called junctions) linked together by channels. This approach is adopted to permit the numerical solution of the partial differential equations that describe flow and constituent concentration in the waterway.

The Lauderdale Plant removes water from the Dania Cut-Off Canal and releases it to the cooling canal/pond system and eventually discharges it to the South Fork New River downstream from a junction of the South New River Canal and the North New River Canal. Flow regimes were set up based on the flow record at the USGS stream gauge on the South Fork New River upstream of the Lauderdale Plant site. Flow in the river reflects tidal influences, water withdrawals by the plant, and releases of fresh water from control structures upstream.

A restriction of the RECEIV-II coding requires that there be only one channel directly connecting any two nodes, and an essential assumption of the approach is that each node is vertically well-mixed. All mass (water or water quality constituent) entering or leaving the portion of the waterway being modeled is assumed to do so at a node. Typical discharges include tributary streams, portions of the headwaters not being modeled, industrial discharges, municipal treatment plants, and storm sewers. Examples of withdrawals are municipal water supplies, industrial cooling or process water removals, and losses to intersecting aquifers.

The basic equations of the hydraulic model are the equation of motion and the continuity equation. Solution of these is performed iteratively using the finite difference forms of the equations, with the equation of motion applied to the channels and the continuity equation applied to the nodes. RECEIV-II was modified to add the ability to simulate temperature for the Lauderdale Repowering Project water quality assessment. Details of the algorithms used for the thermal component of the model are discussed in Section 5.1.5; these algorithms are based on both strict (Patterson et al., 1971) and modified (EPA, 1980) heat budget approaches.

The model produces a tabular printout of maximum, minimum and average constituent concentrations and temperature in each channel and water depth at each junction at specified time intervals. Hydrodynamic output (especially channel velocities) can be written onto disk or magnetic tape.

5.1.5.2 Biological Monitoring

FPL will continue its manatee monitoring program, which involves winter surveys of manatees at its facilities, including the Lauderdale Plant. These surveys will provide information on manatee status at the Lauderdale Plant.

5.2 EFFECTS OF CHEMICAL AND BIOCIDE DISCHARGES

5.2.1 Industrial Wastewater Discharges

5.2.1.1 Surface Water Discharges

The two wastewater discharges to surface waters are cooling water and treated process wastewaters. The cooling water (i.e., condenser and auxiliary cooling water) has a thermal component only; see Section 5.1.1 for a discussion of potential impacts. The process wastewaters to be treated and released to the cooling system include reverse osmosis concentrates, demineralizer regeneration wastes, battery room wastes, sampling system effluents, oily waste, combustion turbine wash water, HRSG chemical cleaning rinse waters, and chemical laboratory wastes. The above sources are continuous except for battery room wastes and combustion turbine wash waters. A discussion of the wastestreams and the process wastewater treatment system is provided in Section 3.5 and Section 3.6, respectively.

The predominant wastestreams (in terms of volume) are the reverse osmosis concentrates and demineralizer regeneration wastes. The significant contaminants in these streams (and the process wastewater treatment system effluent) are major cations and anions (e.g., sodium, bicarbonate, chloride, and sulfate). Table 5.2-1 presents the expected concentrations in the process wastestream based on the individual stream components (see Table 3.5-7).

The wastewater treatment system effluent will be released to the cooling system near the condenser cooling water release point. The process treatment system maximum flow is 781 gpm, compared to a minimum cooling water discharge rate of 252,000 gpm. Thus, significant dilution with the brackish surface waters will be achieved immediately and will result in minimal increases of the major ion concentrations over background conditions. As seen in Table 5.2-1, the largest incremental increase in concentration for any parameter is 37.4 mg/L for total dissolved solids (TDS). Given the brackish nature of the surface waters at the site, these small increases are not expected to create any significant impacts.

Table 5.2-1. Characteristics of Wastewater Effluent and Combined Discharge

Parameter	Concentration in Effluent[a]	Incremental Increase in Concentration at the Point of Discharge[b]	Most Stringent Water Quality/Effluent Standard
Flow (gpm)	781	--	--
Calcium	395	1.22	--
Magnesium	363	1.12	--
Sodium	3,547	11.0	--
Potassium	0.0	0.00	--
Ammonia	0.0	0.00	--
Carbonate	1.7	<0.01	--
Bicarbonate	567	1.76	--
Chloride[c]	5,601	17.4	+10 percent
Sulfate	1,455	4.51	--
Phosphate	<0.17	0.00	10 mg/L[d]
Silica	38	0.12	--
Iron[e]	<0.001	0.00	0.3
Copper[e]	<0.001	0.00	0.015
Carbon Dioxide[f]	93	0.28	110 percent
Oil and Grease[e]	0.85	0.00	1.0
Organics (TOC)	0.17	0.00	--
TDS	12,058	37.4	500 mg/L[g]
TSS[e]	0.9	0.00	None
pH[e]	7.0	--	6.5 - 8.5

[a]All units are in mg/L as listed ion, except for pH which is in standard units.

[b]Concentrations at the POD are the average incremental increase above ambient concentrations based on the 252,000 dilution flow.

[c]The minimum observed chloride concentration at the POD (i.e., Station 4) is 214 mg/L. The incremental increase of 19.8 mg/L is a less than 10 percent increase over ambient. Therefore, no exceedance of the chloride standard is expected.

[d]As phosphorus.

[e]No exceedances of the iron, copper, oil and grease, suspended solids, or pH water quality standards are expected from plant operations.

[f]Carbon dioxide concentrations in the receiving waters are expected to be greater than 5 mg/l (based on typical water temperature, pH, and alkalinity observations). However, the 0.33-mg/L incremental increase will not cause the water quality standard (110 percent of saturation) to be exceeded.

[g]Excluding natural salts of sea water.

Also included in Table 5.2-1 is a comparison of the expected incremental concentration increases at the POD with the most stringent water quality/effluent standard. Based on the data presented in the table, the following conclusions can be made regarding compliance with FDER and Broward County water quality standards:

1. No exceedances of the iron, copper, oil and grease, suspended solids, phosphorus, TDS, or pH water quality standards are expected from plant operations.
2. The minimum observed chloride concentration at the POD (i.e., Station 4) is 214 mg/L. The incremental increase of 19.8 mg/L is a less than 10 percent increase over ambient. Therefore, no exceedance of the chloride standard is expected.
3. Carbon dioxide concentrations in the receiving waters are expected to be greater than 5 mg/L (based on typical water temperature, pH, and alkalinity observations). Thus, the 0.33-mg/L incremental increase will not cause the water quality standard (110-percent saturation) to be exceeded.

In addition to the mass balance analysis, numerical modeling of process wastewater treatment system effluent discharges to surface waters was conducted in conjunction with the thermal modeling efforts (see Sections 5.1.1 and 5.1.5.1). The results of the dilution modeling are presented in Table 5.2-2. The dilution ratios shown in the table assume that the 300:1 mixing with the condenser cooling water occurs very rapidly; thus the values presented in Table 5.2-1 represent a base case dilution ratio of 1:1. Moving downstream from the cooling system POD, some additional dilution is afforded; the higher dilution ratios in the summer are due to higher freshwater flow rates.

Table 5.2-2. Summary of Cooling Water Flow Dilution For Conservative Substances

Location	Repowered Summer	Repowered Winter
Condenser Outlet	1.0	1.0
Point of Discharge (POD)	1.0	1.0
South Fork New River		
Downstream[a]		
600 ft	1.3	1.2
1,200 ft	1.4	1.2
2,200 ft	1.5	1.3
4,400 ft	1.5	1.3
5,800 ft	1.5	1.3
Upstream[a]		
400 ft	1.7	1.2
800 ft	4.6	1.4
2,600 ft	7.0	1.7
5,200 ft	7.9	1.8
9,200 ft	9.6	2.1
Dania Cut-Off Canal		
Plant Intake	18.9	5.6
Downstream of Intake		
1,000 ft	15.1	17.4
2,000 ft	14.8	17.2
4,200 ft	14.5	16.7
Upstream of Intake		
1,200 ft	20.5	4.2
2,000 ft	--	--

[a]From the confluence of the South Fork New River and cooling pond outlet canal, which is approximately 1,250 ft from POD.

5.2.1.2 Groundwater Discharges

No new industrial wastewater will be discharged to groundwater, and existing groundwater discharges at the facility will be eliminated. The new equalization basin will be lined, and the existing solid settling basins and evaporation/percolation pond in the eastern portion of the site will be eliminated. The stub canal percolation pond and the proposed runoff pond will be the only remaining ponds, receiving only stormwater runoff.

All other industrial process wastewater is to be treated at the wastewater treatment facility which discharges to surface water. Minor sources of discharges to groundwater at the site will include five remaining septic tanks, which serve various facilities across the site and discharge an average of 1,000 gpd. These septic tanks are located in isolated areas of the site (see Section 3.5.2); the use of all other septic tanks will be replaced by connection to the Hollywood sewer system.

5.2.2 <u>Cooling Tower Blowdown</u>

There will be no cooling towers at the Lauderdale Repowering Project and, therefore, no cooling tower blowdown.

5.2.3 <u>Measurement Programs</u>

5.2.3.1 Surface Water

Currently, the condenser intake and outlet are measured for temperature. These measurements will continue after the existing Units 4 and 5 are repowered. In addition, the new wastewater treatment facility effluent will be sampled monthly for flow, chloride, phosphate, iron, copper, oil and grease, TDS, and pH. The description of the numerical computer model used to assess the potential impacts of chemical discharges is presented in Section 5.1.5.1.

5.2.3.2 Groundwater

The description of groundwater conditions and the groundwater monitoring programs are presented in Section 2.3.3.1 and 2.3.3.2, respectively. The current groundwater monitoring program will be continued until the use of the SSB/EPP is discontinued. After the use of the SSB/EPP is discontinued, the groundwater monitoring program will be discontinued.

5.3 IMPACTS ON WATER SUPPLIES

5.3.1 Surface Water

The various canals surrounding the Lauderdale Plant site are tidally influenced and characterized as brackish waters. As such, these canals are not suitable as a water supply source for purposes other than industrial cooling. As discussed in Section 2.3.4, salt wedges have been observed in these canals.

Numerical modeling of hydrologic impacts from the withdrawal of water from the Dania Cut-Off Canal was conducted in conjunction with the thermal impact modeling. The results of this modeling are summarized in Table 5.3-1 and shown in Figure 5.3-1. As seen in the table, salt wedge influences are present in all canals during both summer and winter conditions. At the plant intake, the depth-averaged salinity is 6.2 ppt and 9.2 ppt under existing summer and winter conditions, respectively. With the additional surface water withdrawals for auxiliary cooling in the repowered configuration, the depth-averaged salinity will increase by 0.7 ppt in the summer and 0.8 ppt in the winter. These small increases are not expected to significantly impact the existing canal water uses.

5.3.2 Groundwater

5.3.2.1 Consumptive Use Impacts

The present consumptive use of groundwater underlying the site includes the utilization of two water supply wells providing cooling water for various heat exchangers throughout the plant. The two wells, which pump groundwater from the Biscayne aquifer, currently provide approximately 3,000 gpm each to the plant, or 6,000 gpm total. After repowering, an average of only 1,085 gpm will be used as process water makeup. Therefore, no additional impacts to groundwater resources are anticipated.

In addition, the average withdrawal of groundwater from the off-site wells will be reduced from 93 to 0 gpm which will eliminate any future effects to other groundwater users.

Table 5.3-1. Summary of Maximum Salinity (ppt) Results

Location	Existing Summer	Repowered Summer	Existing Winter	Repowered Winter
Condenser Outlet	6.2	6.9	9.2	10.0
Point of Discharge	5.3	5.9	7.9	8.6
South Fork New River				
Downstream[a]				
600 ft	3.9	4.6	7.0	7.7
1,200 ft	3.8	4.4	6.7	7.4
2,200 ft	3.6	4.2	6.4	7.1
4,400 ft	3.5	4.1	6.3	7.0
5,800 ft	3.5	4.1	6.3	7.0
Upstream[a]				
400 ft	3.0	3.7	6.6	7.3
800 ft	1.1	1.3	5.8	6.5
2,600 ft	0.7	0.9	4.7	5.4
5,200 ft	0.6	0.8	4.4	5.0
9,200 ft	0.5	0.7	3.9	4.4
Dania Cut-Off Canal				
Plant Intake	6.2	6.9	9.2	10.0
Downstream of Intake				
1,000 ft	23.6	24.1	25.1	25.5
2,000 ft	23.7	24.2	25.2	25.6
4,200 ft	23.8	24.4	25.4	25.9
Upstream of Intake				
1,200 ft	0.2	0.3	1.9	2.2
3,200 ft	0.0	0.0	0.0	0.0

[a]From the confluence of the South Fork New River and Cooling Pond Outlet Canal, which is approximately 1,250 ft from POD.

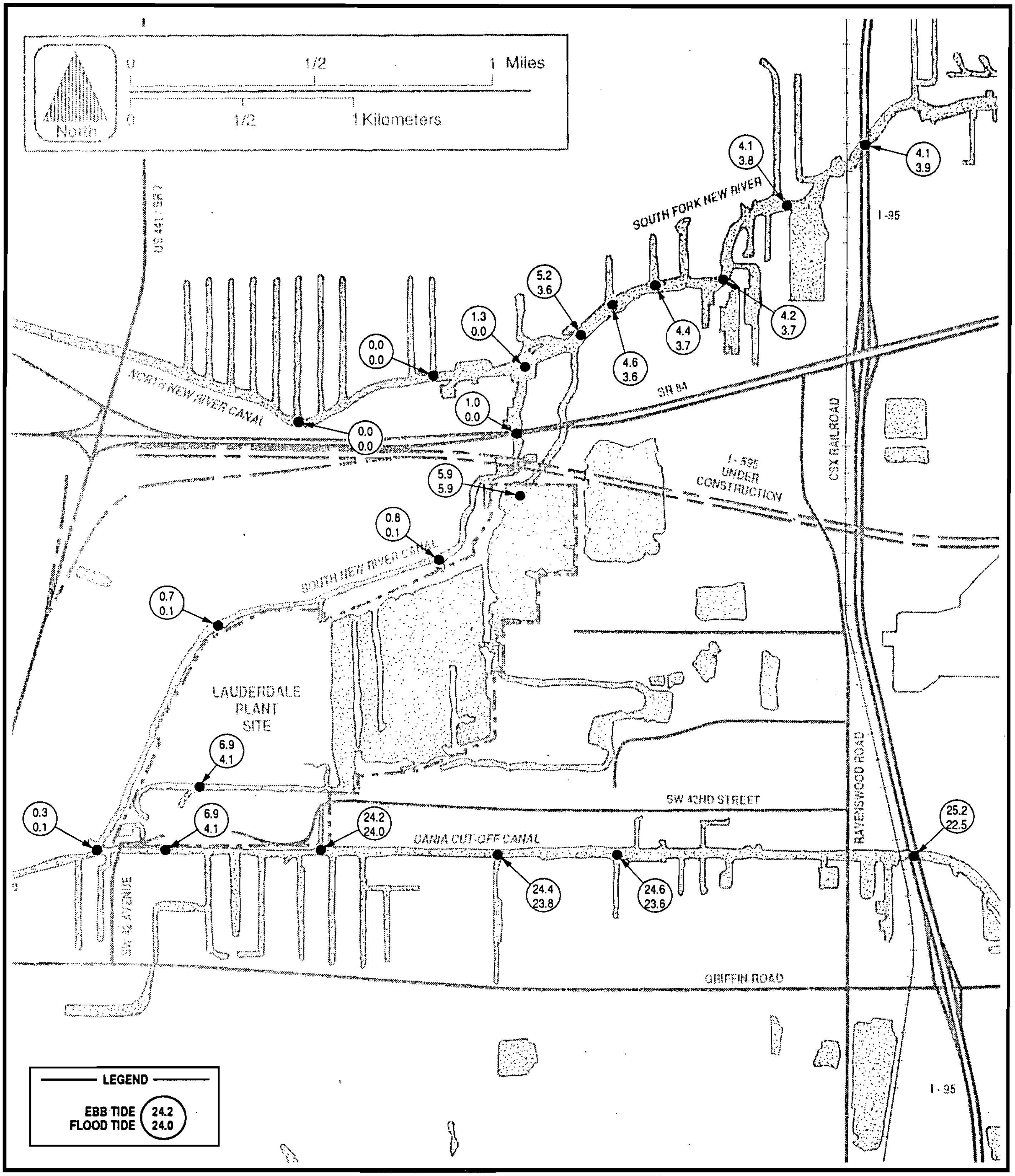

Figure 5.3-1 SYNOPTIC REPRESENTATION OF SIMULATED SALINITY (ppt) — REPOWERED SUMMER CONDITION

Lauderdale Repowering Project

FPL

5.3.2.2 Percolation Pond Impacts

The SSB/EPP at the Lauderdale Plant will be eliminated concurrent with the repowering of Units 4 and 5. The only ponds to remain are the stub canal pond and runoff pond, which will receive stormwater runoff only. Groundwater flow from the stub canal pond would be expected to be toward the South New River Canal under non-pumping conditions, while flowing toward the pumping wells under pumping conditions. As the stub canal pond is directly adjacent to the Discharge and South New River Canals, the influence of groundwater levels on the site from stormwater infiltration through the pond is expected to be negligible, in comparison to the overall rise in water levels expected from the canal system itself.

5.3.3 Drinking Water

The current operation of pumping two on-site wells at 3,000 gpm each does not impact potable water supplies in the area. Because the site is surrounded by canals which serve as constant head boundaries capable of supplying a continuous source of water to the wells, the drawdown effects of the wells do not extend beyond the canals. Pumping two off-site wells (Wells No. 8 and 9) in the highly permeable Biscayne aquifer affects water levels in the immediate vicinity of the pumped wells only. Calculated drawdown equals less than 0.05 ft at 100 ft from the pumped well. After repowering, this drawdown will not occur.

5.3.4 Leachate and Runoff

Proposed construction at the site will eliminate the existing SSB/EPP. The only potential groundwater discharge to remain will be the stub canal and runoff pond, which will receive stormwater runoff. The few remaining septic tanks will still provide a continuous, low-volume source of leachate/percolation as groundwater recharge. Flow from these septic tanks will be toward the on-site wells and surrounding canals.

The oil handling and storage areas have spill containment. Physical and procedural measures for spill containment are identifed in the Lauderdale Plant's existing spill prevention and countermeasure (SPCC) plan.

5.3.5 Measurement Programs

5.3.5.1 Surface Water

The proposed surface water monitoring program is presented in Section 5.2.3.1. The description of the model used to perform the estimates of salinity is presented in Section 5.1.5.1.

5.3.5.2 Groundwater

The groundwater monitoring program will be terminated following closure of the SSB/EPP.

5.4 SOLID/HAZARDOUS WASTE DISPOSAL IMPACTS

5.4.1 Solid Waste

The solid wastes generated from the repowered units will include wastewater treatment sludge and plant refuse. The wastewater treatment sludge will be dewatered (see Section 3.6.1.3) and disposed of in a licensed off-site sanitary landfill. The volume of sludge, i.e., about 1,400 ft^3/day, is small compared to the capabilities of the landfill to handle such wastes. Currently, wastewaters generated from the water treatment processes are disposed of on-site in SSB/EPP. The current disposal methods will be eliminated.

The plant refuse will be collected in dumpsters and disposed of in an approved off-site sanitary landfill. This material includes intake screen scrapings at currently generated levels, and an estimated annual generation of 39 cubic yards of used air inlet filters. There will be no on-site impacts associated with solid waste disposal at the Lauderdale site.

Waste oils are expected to be generated from the new central wastewater treatment facility (see Section 3.7-1). Disposal of this material (about 500 gallons per month) will be via recovery by an off-site oil recycler.

5.4.2 Hazardous Wastes

Potential hazardous wastes that could be generated in connection with the project include non-thermal wastewaters, waste oils containing hazardous constituents, and miscellaneous wastes that may be hazardous such as waste paints and solvents (see Section 3.7.2.2). The generation of hazardous wastes will be minimized through treatment, segregation and waste minimization practices. Any waste identified as hazardous will be handled according to regulatory requirements and transported off-site for disposal at a licensed hazardous waste treatment facility. No on- or off-site impacts will result from any hazardous wastes generated from the Lauderdale Repowering Project.

5.5 SANITARY AND OTHER WASTE DISCHARGES

Currently, the plant uses septic tanks for all sanitary waste disposal. After repowering the majority of the sanitary wastes from the Lauderdale Plant will be routed to the City of Hollywood sewer system (see Section 3.5.2). The use of the majority of these septic tanks will be eliminated. One septic tank located near the plant recreation area will remain. This septic tank will be used only for sanitary wastes generated by employees located at the wastewater treatment facility with intermittent use by persons using the recreation pavilion. Five other septic tanks associated with the existing northern gas turbine site will continue to be used.

5.6 AIR QUALITY IMPACTS

5.6.1 Impact Assessment

5.6.1.1 Introduction

The Lauderdale Repowering Project will have the potential to emit air pollutants above regulatory threshold amounts which will require PSD review under regulations promulgated by FDER and codified in Rule 17-2.500, F.A.C. An air permit application has been prepared to address these requirements and is included as Appendix 10.1.5. This application provides the technical information and analyses required to be addressed by these regulations. This section provides an overview of these analyses.

A significant benefit of the Lauderdale Repowering Project is that the existing steam generators are taken out of service and replaced with CTs and HRSGs. This provides creditable emissions decreases, resulting in lower net emissions and lower net air quality impacts than a new power plant alone. In addition, the expected emission rate from the repowered plant will compare favorably for most pollutants with the level of emissions currently authorized for the existing generating units by current FDER and Broward County air permits.

5.6.1.2 Impact Methodology

The analysis of impacts due to plant operation was performed in conformance with the EPA modeling guideline document (EPA, 1987). The modeling guideline has also been adopted by the FDER (Chapter 17-2.260, F.A.C.). A modeling protocol, which outlined the modeling procedures, was submitted to and subsequently approved by FDER. The modeling analysis included emission inventory data, meteorological data, receptor data, background air quality data, and other basic model input data. The impact analysis must demonstrate compliance with federal and state AAQS and PSD Class I and Class II increments.

The emission inventory included emission characteristics (i.e., emission rates for various averaging times, associated stack parameters or source release characteristics, and source locations) of the repowered units, the existing Lauderdale Units 4 and 5, and other sources located within 50 km of the Lauderdale Plant site. For existing Units 4 and 5, a review of historic fuel usage and actual emissions was conducted to determine the creditable emission reductions achieved by shutting down these sources and replacing them with the repowered units. Creditable emission reductions were based on the actual emissions from Units 4 and 5.

PSD increment-consuming sources, such as the proposed repowered units, and PSD increment-expanding sources (based on historic actual emissions), such as Units 4 and 5 when they are shut down, were identified and modeled. According to EPA/FDER modeling policy, the emissions from Units 4 and 5 were modeled as negative values to determine PSD increment consumption. For short-term averaging times, the creditable emissions were representative of the normal maximum emissions. Since Units 4 and 5 have operated on No. 6 fuel oil for periods of at least 24 hours, maximum emissions for short-term averaging times corresponding to the AAQS, i.e., 3 and 24 hours, were based on oil firing.

Data for non-FPL sources were obtained from FDER. The inventory for non-FPL sources was submitted to FDER Bureau of Air Quality Management (BAQM) for approval prior to use in the modeling. PSD increment-affecting sources were also identified in order to evaluate PSD increment consumption. PSD baseline emissions and parameters were determined for such sources.

Because building downwash analyses have become an integral part of the air quality analyses undergoing regulatory review, building dimensions for the existing and proposed buildings and structures were considered in the analysis. Each stack was evaluated to determine if it was less than Good Engineering Practice (GEP) stack height. If a stack was less than GEP, then building downwash conditions were modeled for that stack. Appropriate building dimensions (i.e., height, length, width) were incorporated in the modeling for each stack, when applicable, based on the location and orientation of the stack with respect to nearby buildings. The methods used in this analysis followed those recommended by the EPA and FDER.

An issue related to building downwash analyses and determination of GEP stack heights is the stack height limitation imposed by Federal Aviation Administration (FAA) regulations for stacks located near airport runway approaches. The current and planned runway approaches available from the Planning Department of the Fort Lauderdale-Hollywood Airport were evaluated to determine the appropriate stack height limitation. The stacks for the repowered units will not exceed this limitation.

Meteorological data used in the modeling analysis consisted of five years of data (1982-1986) from NWS Stations located at the Miami International Airport (for surface observations) and at the West Palm Beach International Airport (for upper air observations). Data from these NWS stations are considered representative of the Lauderdale Plant site and were used in the modeling for the SBCRRP, which is located 0.5 km west of the Lauderdale Plant site.

Receptor locations selected for the modeling were in conformance with EPA guidelines. Appropriate density of receptors was employed to quantify maximum air quality impacts. Areas of the Lauderdale Plant site that are excluded from public access, according to EPA criteria, were not considered in the modeling analysis. These areas were defined, with supporting documentation presented.

Background air quality concentrations for use in the modeling were obtained from the ambient monitoring network and other available air monitoring data. EPA recommended methods were used to quantify the background levels for each pollutant and averaging time.

All methods, databases, and assumptions used in the air impact analysis are documented and incorporated into the PSD application, including results addressing compliance with all air quality standards (refer to Appendix 10.1.5).

The impact analysis required under PSD review also addressed the impacts of emissions from the proposed repowering project upon Air Quality Related Values (AQRVs) of the Everglades National Park Class I area. An impact analysis on AQRVs was performed since the Lauderdale Plant site is located within 100 km of the Everglades National Park. Potential visibility impairment due to operation of the Lauderdale Repowered Project was also evaluated. Methods recommended in the Workbook For Estimating Visibility Impairment (EPA, 1980) were followed.

The additional impact analysis of the impairment to visibility, soils, and vegetation that would occur as a result of associated growth in the area was also addressed. To address such impacts, soil and vegetation types in the vicinity of the Lauderdale Plant site were identified. A literature review was conducted to identify the most recent data concerning threshold effect levels for the soil and vegetation types. An assessment of the impacts of air emissions on these soil and vegetation types was then prepared. The focus of this assessment was on the Everglades National Park and the proposed Pond Apple Slough Park. Effects of growth associated with the repowering project were addressed qualitatively, including impacts due to secondary emissions (i.e., emissions occurring as a result of the general commercial, residential, industrial, and other associated growth).

5.6.1.3 Results

PROPOSED UNITS ONLY

A summary of the maximum predicted impacts of regulated pollutants due to the proposed units only and the offsets afforded by shutting down Units 4 and 5 is presented in Table 5.6-1. These results were based on using the maximum CT emissions and minimum flow rates.

The maximum predicted 3-hour, 24-hour, and annual SO_2 concentrations due to the repowering project only are 259, 36, and 2.3 $\mu g/m^3$, respectively. These maximum impacts are all above the significance levels established by EPA and FDER; therefore, further modeling analysis is required for SO_2 to demonstrate compliance with PSD increments and AAQS.

Table 5.6-1. Results of Modeling Analysis of Lauderdale Repowering Project Only

Pollutant	Averaging Period	Maximum Predicted Concentrations ($\mu g/m^3$)[a] Repowered Units Only	Repowered Units With Offsets	Significance Level
SO_2	3-hour	275	259	25
	24-hour	44	36	5
	Annual	4.8	2.3	1
PM(TSP)	24-hour	3.0	NM[b]	5
	Annual	0.32	NM[b]	1
PM10	24-hour	3.0	NM[b]	5
	Annual	0.32	NM[b]	1
NO_2	Annual	2.3	0.9	1
CO	1-hour	61	NM[b]	2,000
	8-hour	13	NM[b]	500
Pb	Calendar Quarter	0.00032	0.00032	NA

[a]Based upon four CTs/HRSGs operating at maximum load on fuel oil.
[b]NM = not modeled because predicted concentrations due to the proposed units only were less than the significant impact level.

Note: NA = Not applicable.

The maximum predicted 24-hour and annual average PM(TSP) concentrations due to the proposed units only are 3.0 and 0.32 $\mu g/m^3$, respectively. Maximum PM10 impacts are identical to the PM(TSP) impacts. Since these maximum concentrations are below the significance levels for these pollutants, no further modeling analysis is necessary. Because of these very low impacts, the proposed units would not cause or significantly contribute to any exceedances of the PM10 AAQS or the PM(TSP) PSD increments.

The maximum predicted annual NO_2 concentration due to the proposed units only is 0.9 $\mu g/m^3$. This level of impact is below the significance level; therefore, further evaluation of NO_2 impacts is not required.

The maximum predicted 1- and 8-hour average CO concentrations due to the proposed units only are 61 and 13 $\mu g/m^3$, respectively. These maximum impacts are much less than the CO significance levels. Because the maximum predicted impacts due to the proposed units are less than the CO significance levels, additional modeling is not required for this pollutant.

The maximum predicted Pb concentration (calendar quarter average) is predicted to be <0.00032 $\mu g/m^3$.. No significance level has been established for Pb, but an AAQS has been set at 1.5 $\mu g/m^3$, calendar quarter average. Since the predicted impacts due to the repowering project only are well below the AAQS, no further modeling analysis was conducted.

PSD CLASS II INCREMENT ANALYSIS

While the combustion turbines associated with the Lauderdale Repowering Project will consume PSD increment, the shutdown of the existing Units 4 and 5 will provide an increment expansion. The combined effects of these sources, as well as the effects of other PSD increment-consuming sources, were considered in the modeling analysis.

A summary of the maximum SO_2 and NO_2 PSD Class II increment-consumption concentrations predicted from the refined modeling analysis is presented in Table 5.6-2. The maximum 3-hour average SO_2 PSD increment consumption from the refined analysis is predicted to be 322 $\mu g/m^3$, which is 63 percent of the maximum allowable PSD Class II increment of 512 $\mu g/m^3$, not to be exceeded more than once per year.

The maximum 24-hour average SO_2 PSD Class II increment consumption is predicted to be 51 $\mu g/m^3$, which is 56 percent of the maximum allowable PSD Class II increment of 91 $\mu g/m^3$, not to be exceeded more than once per year.

The maximum annual average SO_2 PSD increment consumption is predicted to be 2.3 $\mu g/m^3$, which is 12 percent of the maximum allowable PSD Class II increment of 20 $\mu g/m^3$.

The maximum annual average NO_2 PSD Class II increment consumption from the refined analysis is predicted to be 5.9 $\mu g/m^3$, which is 24 percent of the maximum allowable PSD Class II increment of 25 $\mu g/m^3$.

AAQS ANALYSIS

The maximum total SO_2 and NO_2 concentrations due to all sources and including the background concentration, predicted from the refined analysis, are presented in Table 5.6-3. The maximum 3-hour average SO_2 concentration due to all sources from the refined analysis is predicted to be 1,032 $\mu g/m^3$, which is 79 percent of the AAQS of 1,300 $\mu g/m^3$, not to be exceeded more than once per year. The proposed repowered units contributed less than 31 percent to this maximum 3-hour average concentration.

The maximum 24-hour average SO_2 concentration due to all sources is predicted to be 253 $\mu g/m^3$, which is 97 percent of the AAQS of 260 $\mu g/m^3$, not to be exceeded more than once per year. The proposed repowered units contributed less than 20 percent to this maximum 24-hour average concentration.

Table 5.6-2. Maximum Predicted SO_2 and NO_2 Concentrations from the Refined Analysis for Comparison to PSD Class II Increments

Averaging Period	Maximum Concentration (μg/m³)	Receptor Location[a] Direction (°)	Receptor Location[a] Distance (km)	Period Julian Day	Period Hour Ending	Period Year	PSD Class II Increment
SO_2 Concentrations							
3-Hour[b]	322	232	0.20	322	12	1985	512
24-Hour[b]	51	228	0.20	323	NA	1985	91
Annual	2.3	250	2.0	NA	NA	1983	20
NO_2 Concentrations							
Annual	5.9	90	2.0	NA	NA	1983	25

[a]Relative to the location of the HRSG stacks.
[b]Highest, second-highest concentrations predicted for this averaging period.

Note: Based on four CTs/HRSGs operating at maximum load and burning No. 2 fuel oil with a sulfur content of 0.5 percent.

NA = Not applicable.

Table 5.6-3. Maximum Predicted SO_2 and NO_2 Concentrations from the Refined Analysis for Comparison to AAQS

Averaging Period	Concentration ($\mu g/m^3$) Total	Total due to Modeled Sources	Total due to Background	Receptor Location[a] Direction (o)	Receptor Location[a] Distance (km)	Period Julian Day	Period Hour Ending	Period Year	AAQS
SO_2 Concentrations									
3-Hour[b]	1,032	894	138	232	0.11	322	12	1985	1,300
24-Hour[b]	253	211	42	236	0.11	322	NA	1985	260
Annual	29	24	5	310	5	NA	NA	1982	60
NO_2 Concentration									
Annual	81	55	26	310	5.0	NA	NA	1986	100

[a]Relative to the location of the HRSG stacks.
[b]Highest, second-highest concentrations predicted for this averaging period.

Note: Based on four CTs/HRSGs operating at maximum load and burning No. 2 fuel oil with a sulfur content of 0.5 percent.

NA = Not applicable.

The maximum annual average SO_2 concentration due to all sources is predicted to be 29 $\mu g/m^3$, which is 48 percent of the AAQS of 60 $\mu g/m^3$. The proposed repowered units contributed less than 3 percent to the maximum concentration.

The maximum annual average NO_2 concentration of 81 $\mu g/m^3$ due to all sources is well below the AAQS of 100 $\mu g/m^3$. The proposed repowered units contributed approximately less than 2 percent to the maximum concentration.

CLASS I AREA ANALYSIS

The results of the PSD Class I area modeling analysis for the Everglades National Park are presented in Tables 5.6-4 and 5.6-5 for SO_2 and NO_2, respectively. The modeling analysis evaluated a number of receptors along the boundary of the Class I area. Due to the large distance from the Lauderdale Plant site to the Class I area boundary (approximately 60 km), no refined modeling analysis was conducted.

As shown in Table 5.6-4, total Class I PSD increment consumption concentrations for SO_2 are below the Class I increments for all averaging times. The maximum 3-hour increment consumption is predicted to be 15 $\mu g/m^3$, compared to the Class I increment of 25 $\mu g/m^3$. The maximum predicted 24-hour increment consumption for SO_2 is 4.4 $\mu g/m^3$, which is below the allowable increment of 5 $\mu g/m^3$. These maximum increment consumption values are due to the effects of two increment consuming sources located in Dade County: Tarmac Florida (cement plant) and Dade County Resource Recovery Facility (MSW incinerator). The proposed repowered units do not contribute to these maximum increment consumption values.

The maximum predicted annual increment consumption concentrations in the Class I area are predicted to be less than 0.7 $\mu g/m^3$ for SO_2 and less than 0.3 $\mu g/m^3$ for NO_x (see Table 5.6-5). These values are well below the allowable Class I increments of 2 $\mu g/m^3$ for SO_2 and 2.5 $\mu g/m^3$ of NO_2.

Table 5.6-4. Maximum Predicted SO_2 Concentrations for Comparison to PSD Class I Increments

Averaging Period	Maximum Concentration ($\mu g/m^3$) Lauderdale Repowering Project	All Increment-Consuming Sources	Period Julian Day	Hour Ending	Year	PSD Class I Increment
3-Hour[a]	0.0	15	25	21	1983	25
24-Hour[a]	0.0	4.4	343	--	1983	5
Annual	0.1	0.68	--	--	1982	2

[a]Highest, second-highest concentrations predicted for this averaging period.

Note: Based on four CTs/HRSGs operating at maximum load and burning No.2 fuel oil with 0.5-percent sulfur content.

Table 5.6-5. Maximum Predicted NO_2 Concentrations for Comparison to PSD Class I Increments

Averaging Period	Maximum Concentration ($\mu g/m^3$) Lauderdale Repowering Project[a]	All Increment-Consuming Sources	Year
Annual	<0.15	<0.3	1984

[a]Includes offsets from Units 4 and 5.

Note: Based on four CTs/HRSGs operating at maximum load and burning No. 2 fuel oil with a 0.5 percent sulfur content.

5.6.1.4 Impacts to Soil, Vegetation, Ecology, and Visibility

Air quality impacts of the Lauderdale Repowering Project on soils, vegetation, and visibility, as well as to AQRVs in the Everglades National Park, are addressed in Section 8.0 of the air permit application (see Appendix 10.1.5); the impacts to Pond Apple Slough Park are also evaluated in this section. The results indicate that the project's impact would not adversely affect these resources. Predicted concentrations of SO_2 and NO_2 are significantly lower than the threshold effect concentrations for vegetation and wildlife reported in the literature. Due to the calcareous nature of the soils in the area, and the predicted concentrations, deposition effects would be precluded from occurring. Air quality concentrations near the site and the Everglades National Park will, for the most part, be reduced in many areas. Indeed, with the emissions offsets provided by Units 4 and 5, no short-term averaging time (i.e., 3-hour and 24-hour) PSD increment consumption will occur. Impacts to visibility, even without consideration of the emission tradeoffs, are below the EPA screening criteria. Because the project is at an existing site, impacts due to general residential, commercial, industrial, and other growth associated with the project will be minor.

5.6.2 Monitoring Programs

The air quality and meteorological monitoring program established as part of the PSD monitoring requirements will be resumed for a 1-year duration after both repowered units begin commercial operation. A description of the program is contained in Section 2.3.7.3.

Air pollutant emissions will be measured using the test methods contained in 40 CFR Part 60 Appendix A and adopted by reference by FDER in Chapter 17-2.700(c), F.A.C. The proposed test methods and frequency are summarized in Table 5.6-6. In addition to the emission testing methods, the amount of steam and fuel injected to the combustion turbine will be continuously monitored in accordance with 40 CFR 60.334(a). This information will be used to demonstrate compliance with the NO_x emissions

Table 5.6-6. Proposed Emission Testing Methods for the Lauderdale Repowering Project

Pollutant	Source	Test Method	Fuel	Frequency[a]
Particulate Matter	Combustion Turbine	EPA-9 EPA-5 or 17	Natural Gas No. 2 Fuel Oil	Initial & Annual Initial & Annual[b]
Visible Emissions	Combustion Turbine	EPA-9	No. 2 Fuel Oil	Initial & Annual[b]
Nitrogen Oxides[c]	Combustion Turbine	EPA-20	Natural Gas No. 2 Fuel Oil	Initial & Annual Initial & Annual[b]
	Heat Recovery Steam Generator	EPA-20	Natural Gas	Initial
Carbon Monoxide	Combustion Turbine	EPA-10	Natural Gas No. 2 Fuel Oil	Initial & Annual Initial & Annual[b]
Sulfur Dioxide	Combustion Turbine	Fuel Analysis (ASTM)	Natural Gas No. 2 Fuel Oil	Initial & Annual[b]
Volatile Organic Compounds	Combustion Turbine	EPA-25a[d]	Natural Gas or 18	Initial & Annual
			No. 2 Fuel Oil	Initial & Annual[b]

[a]Initial = startup performance testing.
Annual = annual testing.
[b]Annual sampling will be performed only if oil is used more than 400 hours/year.
[c]Continuous monitoring of steam and fuel consumption will be performed to demonstrate compliance with New Source Performance Standards (40 CFR Part 60 Subpart GG).
[d]Exclusive of methane and ethane as defined by FDER in Rule 17-2.100(223).

the fuel to steam ratio with NO_x emissions. The continuous monitoring equipment will be accurate within 5 percent and will be correlated with NO_x emissions using Method 20.

5.7 NOISE

5.7.1 Impacts to Adjacent Properties

5.7.1.1 Existing and Proposed Noise Sources

The existing and proposed noise sources and their octave band and overall SPLs are listed in Tables 5.7-1 and 5.7-2. Existing sources include: (1) equipment associated with the Units 4 and 5 [i.e., circulating water pumps, intake screens, forced draft (FD) and induced draft (ID) fans, steam generators, steam turbines, electric generators and main transformers]; (2) equipment associated with the substation (i.e., the auto-transformers); and (3) gas turbines (i.e., two banks of twelve). Noise levels of the existing Units 4 and 5 sources and the substation sources were measured using the procedures described in Section 2.3.8.2. Noise measurements taken by International Systems, Inc. (1987) were used to represent SPLs emanating from the gas turbines.

Certain equipment associated with existing Units 4 and 5 (e.g., circulating water pumps, intake screens, electric generators, and steam turbines) will continue to be operated and emit noise after the repowering project is complete. In addition, new equipment will be added which will also emit noise. These new noise sources include the inlet air filters, CTs, HRSGs, stacks and main transformers (see Table 5.7-2). The noise from the CTs will be controlled by placing them in acoustically insulated enclosures. All CT enclosures will be located within an environmental enclosure which will provide further sound attenuation (refer to Figure 3.2-4). The inlet air system will include silencers. Unlike the existing steam generators, the HRSGs do not have ID fans that generate noise; the CT and steam noise will be reduced through the HRSG's thermal insulation.

5.7.1.2 Noise Impact Methodology

The impact evaluation of the CTs was performed using the NOISECALC computer program (NYDPS, 1986). NOISECALC was developed by the New York State Department of Public Service to assist with noise calculations for major power projects. Noise sources are entered as octave band SPLs. Coordinates, either rectangular or polar, can be specified by the user.

Table 5.7-1. Sound Pressure Levels of Major Noise Sources at the Lauderdale Plant Site

Sources[a]	Octave SPL (dB) 31.5	63	125	250	500	1000	2000	4000	8000	16000	SPL (dB)	SPL(A) (dBA)
Circulating Water Pumps (2)[b]	86.9	83.1	80.7	80.7	81.9	84.0	74.4	71.5	61.9	52.3	91.4	86.0
Intake Screens (2)[b]	79.8	77.2	72.7	71.6	70.6	65.2	58.7	56.2	46.9	36.1	82.9	71.1
FD/I.D. Fans (4)	90.8	87.2	86.4	78.0	76.1	72.9	75.4	67.6	62.2	52.8	93.7	80.5
Boilers (4)	95.9	91.2	88.9	83.3	80.4	77.1	76.8	74.9	72.7	66.2	98.1	84.3
Electric Generator (2)[b]	86.9	99.3	83.9	88.5	77.7	76.6	71.2	66.1	57.2	46.7	100.0	83.3
Steam Turbines (2)[b]	90.4	92.5	85.5	81.2	80.5	79.4	74.6	70.3	65.5	56.3	95.6	83.5
Auto Transformers (2)[b]	76.2	89.7	84.4	81.6	80.3	74.0	68.6	62.2	53.9	47.3	91.9	80.7
Gas Turbines (12)[b]	124	120	114	101	97	99	102	103	101	95	125.8	108.9

[a] All sources measured at 1 meter by KBN except gas turbines. Gas turbine measurements based upon International Systems, Inc., on-site noise measurements (2/87); 6 dBs were added to each frequency to account for 12 gas turbines. Parentheses ( ) denote the number of sources.
[b] Sources operating after repowering Units 4 and 5.

Table 5.7-2. Sound Pressure Levels of Proposed Noise Sources Associated with Repowering

Source Description	Octave Band Center Frequency, Hz										Sound Pressure Levels (dB)	Sound Pressure Levels (dBA)
	31.5	63	125	250	500	1K	2K	4K	8K	16K		
Main Transformer[a]	84	88	84	86	79	73	66	60	51	44	92.0	81.1
Inlet Filter[b]	102	98	95	91	88	86	80	75	60	45	104.4	90.6
Combustion Turbine[b]	92	90	82	80	76	74	62	55	50	45	94.6	78.2
Heat Recovery Steam Generator[b]	102	97	90	82	78	75	69	66	58	42	103.4	81.4
Exhaust Stack[b]	90	86	82	78	72	70	60	58	48	44	92.2	75.2

[a]Based upon preliminary engineering design information for proposed new units.
[b]Based upon data collected by KBN Engineering Inc. (3/89); refer to Subsection 2.3.8.2 for discussion of monitoring procedures.

All noise sources are assumed to be point sources; line sources can be simulated by several point sources. Sound propagation is calculated by accounting for hemispherical spreading and three other user identified attenuation options: atmospheric attenuation, path specific attenuation and barrier attenuation. Atmospheric attenuation is calculated using the data specified by the American National Standard Institute's method for the Calculation of the Absorption of Sound by the Atmosphere (ANSI, 1978). Path specific attenuation can be specified to account for the effects of vegetation, foliage and wind shadow. Directional source characteristics and reflection can be simulated using path-specific attenuation. Attenuation due to barriers can be specified by giving the coordinates of the barrier. Barrier attenuation is calculated by assuming an infinitely long barrier perpendicular to the source-receptor path. Total and A-weighted SPLs are calculated. Background noise levels can be incorporated into the program and are used to calculate overall SPLs.

NOISECALC was performed to predict the maximum noise levels produced by the proposed and existing noise sources with and without background noise levels. Only atmospheric attenuation was assumed. The source data used in the analysis are contained in Tables 5.7-1 and 5.7-2. Background and average L_{eq} levels were used to calculate maximum SPLs at each residential area.

The receptors selected for the analysis consisted of the four residential land use areas where ambient noise measurements were taken (see Figure 2.3-35). These residential areas are the closest to the site. The applicable maximum noise level for these areas is promulgated by Broward County; there are no federal or state noise limits applicable to the repowering project. Broward County regulations limit sound levels to 55 dBA as measured at the residential land use and during more than 50 percent of any measurement period. The measurement period must be at least 10 minutes. Maximum sound levels in residential areas cannot exceed 65 dBA from 7 a.m. to 10 p.m. and 60 dBA from 10 p.m. to 7 a.m. (see discussion in Section 2.3.8.1).

5.7.1.3 Results

COMPARISON TO BROWARD COUNTY STANDARDS

Tables 5.7-3 and 5.7-4 present the calculated maximum SPLs of the repowered units at the nearest residential areas using both the background and average L_{eq} SPL values obtained from ambient measurements as baseline conditions. Using the background SPLs, i.e., the SPLs without the influence of the intermittent aircraft noise associated with the Fort Lauderdale-Hollywood International Airport, all maximum predicted noise levels are below the Broward County noise standards. This noise level is appropriate for comparison since aircraft noise is specifically exempted by the regulations [Section 27-7.06(5) of the Broward County Code].

The maximum calculated noise impacts using the average L_{eq} levels as baseline conditions (see Table 5.7-4) numerically exceed the Broward County noise standards due to the contributions from aircraft takeoffs and landings. Indeed, the contributions from the existing and proposed noise sources add 0.1 dBA or less to observed noise levels in the residential areas.

COMPARISON TO EPA CRITERIA

The EPA criteria identify recommended ambient noise levels for activity interference [i.e., an average day-night A-weighted SPL (L_{dn}) of 55 dBA] and hearing loss considerations (i.e., an average 24-hour L_{eq} of 70 dBA). The calculated maximum L_{dn} values with the repowered units using background and average L_{eq} baseline SPLs are presented in Tables 5.7-5 and 5.7-6, respectively. Table 5.7-7 presents a comparison of the baseline L_{dn} values with and without the proposed facility for the four residential areas. Assuming that the background conditions exist at the four residential areas, the maximum calculated L_{dn} value increase from 4.2 dBA at Site A4 to 1.5 dBA at Site A7. All areas except Site A4 were calculated to be within 1 dBA of the EPA-recommended noise level. This condition, however, does not exist due to the nearby aircraft noise. When the average L_{eq} values are used to calculate L_{dn} values, the actual conditions that exist in the area, the impact of the repowered units are 0.5 dBA or less at all

Table 5.7-3. Calculated Noise Impacts of the Lauderdale Plant After Repowering at Nearest Residential Land Uses with Background Sound Pressure Levels (SPLs)

Site	Description	Background Values[a]	Repowered Facility Without Background	Repowered Facility With Background
A2	Residence at 4409 SW 35th Avenue	48.4	44.6	49.9
A4	Residence at Northwest corner of Davis Isles	51.6	51.3	54.5
A7	SW 39th Avenue Southwest of the Plant	50.2	43.7	51.1
A9	SW 42nd Avenue at Southwest Plant Entrance	48.6	45.1	50.4

[a]Background SPLs from Table 2.3-55.

Note: All values dBA.

Table 5.7-4. Calculated Noise Impacts of the Lauderdale Plant After Repowering at the Nearest Residential Land Uses with Average L_{eq} Values (All values dBA)

Site	Description	Background Values[a]	Repowered Facility Without Background	Repowered Facility With Background
A2	Residence at 4409 SW 35th Avenue	68.2	44.6	68.2
A4	Residence at Northwest corner of Davis Isles	66.3	51.3	66.4
A7	SW 39th Avenue South-west of the Plant	66.4	43.7	66.4
A9	SW 42nd Avenue at Southwest Plant Entrance	62.7	45.1	62.7

[a]Average L_{eq} from Table 2.3-55.

Table 5.7-5. Predicted Day-Night Average Sound Pressure Levels Based on Background Values

Site	Description	L_d[a]	L_n[b]	L_{dn}
A2	Residence at 4409 SW 35th Avenue	49.9	48.7	55.3
A4	Residence at Northwest corner of Davis Isles	54.5	52.5	59.3
A7	SW 39th Avenue; Southwest of Plant	51.1	48.3	55.3
A9	SW 42nd Avenue at SW Plant Entrance	50.4	48.9	55.5

[a]From Table 5.7-3.
[b]Impact of proposed facility and night-time background from Monitoring Site P3 (see Table 2.3-55).

Note: All values dBA.

Table 5.7-6. Predicted Day-Night Average Sound Pressure Levels Based on Average L_{eq} Background Values

Site	Description	L_d[a]	L_n[b]	L_{dn}
A2	Residence at 4409 SW 35th Avenue	68.2	50.9	66.6
A4	Residence at Northwest corner of Davis Isles	66.3	53.6	65.5
A7	SW 39th Avenue; Southwest of Plant	66.4	50.8	65.0
A9	SW 42nd Avenue at SW Plant Entrance	62.7	51.1	62.2

[a]From Table 5.7-3.
[b]Impact of proposed facility and night-time average L_{eq} from Monitoring Site P3 (see Table 2.3-55).

Note: All values dBA.

Table 5.7-7. Summary of Calculated L_{dn} Before and After Repowering Using Background and Average L_{eq} Values

Site	Baseline L_{dn} Background	Baseline L_{dn} Average L_{eq}	L_{dn} w/Repowered Units Background	L_{dn} w/Repowered Units Average L_{eq}
A2	53.6	66.5	55.3	66.6
A4	55.1	64.8	59.3	65.5
A7	53.8	64.9	55.3	65.0
A9	53.6	61.8	55.5	62.2

Note: All values dBA.

residential areas. Indeed, the predicted L_{dn} values are approximately equal to the maximum predicted values due to the Fort Lauderdale-Hollywood International Airport (Broward County Aviation Department, 1989).

The maximum calculated average 24-hour L_{eq} values at each residential area with the operation of the repowered units are presented in Tables 5.7-8 and 5.7-9. For all residential areas, the 24-average L_{eq} values are below the recommended hearing loss threshold of 70 dBA.

COMMUNITY NOISE CRITERIA

The potential noise impact of the Lauderdale Plant after repowering was also evaluated against the Community Noise Criteria described in Section 2.3.8.1. The uncorrected community ratings were determined by comparing the predicted octave band noise levels from NOISECALC with the modified CNR curves (see Figure 2.3-32; the highest noise level within a rating curve establishes the modified CNR). The uncorrected ratings developed using the impacts of the repowered units are "e" for Site A4 and "d" for Sites A2, A7, and A9. The uncorrected ratings were adjusted for background noise using the background SPLs observed during the day at each of the sites (see Figure 2.3-33; -3 based on background octave band). The corrected ratings are "a" for Sites A2 and A9 and "b" for Sites A4 and A7. Using the background SPLs observed during the night to correct the initial ratings, ratings of "c" for Site A4 and "b" for Sites A2, A7, and A9 are obtained. The highest rating (i.e., "c") suggests that there would be no community reaction to the repowered units, although the noise would be noticeable (see Figure 2.3-34).

INTERMITTENT NOISE SOURCES

Intermittent noise sources during routine startup, testing and maintenance, and emergency conditions would include steam pipe blowing and steam venting. Both activities, while not normally occurring simultaneously, would last for a short duration. The short term intermittent noise level

Table 5.7-8. Predicted 24-Hour Average Equivalent Sound Pressure Levels (L_{eq}) Based on Background Values

Site	Description	Day-L_{eq}[a]	Night-L_{eq}[b]	24-Hour Average L_{eq}
A2	Residence at 4409 SW 35th Avenue	49.9	48.7	49.5
A4	Residence at Northwest corner of Davis Isles	54.5	52.5	53.9
A7	SW 39th Avenue; Southwest of Plant	51.1	48.3	50.3
A9	SW 42nd Avenue at SW Plant Entrance	50.4	48.9	49.9

[a]From Table 5.7-3.
[b]Impact of proposed facility and night-time background from Monitoring Site P3 (see Table 2.3-55).

Note: All values dBA.

Table 5.7-9. Predicted 24-Hour Average Equivalent Sound Pressure Levels (L_{eq}) Based on Observed Average L_{eq}

Site	Description	Day-L_{eq}[a]	Night-L_{eq}[b]	24-Hour Average L_{eq}
A2	Residence at 4409 SW 35th Avenue	68.2	50.9	66.2
A4	Residence at Northwest corner of Davis Isles	66.3	53.6	64.4
A7	SW 39th Avenue; Southwest of Plant	66.4	50.8	64.4
A9	SW 42nd Avenue at SW Plant Entrance	62.7	51.1	60.8

[a]From Table 5.7-4.
[b]Impact of proposed facility and average Night-time L_{eq} from Monitoring Site P3 (see Table 2.3-55).

Note: All values dBA.

impacts at the nearby residences are summarized in Tables 5.7-10 and 5.7-11. The noise from these sources is specifically exempt from the Broward County noise regulations limits under Sections 27-202(6) and (7) of the Broward County Environmental Regulations. Section 202(6) of the Broward County code exempts noise sources associated with routine maintenance of public utilities; Section 202(7) exempts noise generated in the performance of emergency work. In addition, the maximum noise levels of aircraft measured at the residences are nearly equal to the calculated steam tube blowing values, i.e., 92.4 dBA and 98.7 dBA, respectively. The maximum steam vent noise level (76.2 dBA) is approximately two orders of magnitude lower than the aircraft noise.

5.7.2 Impact to Biota

The calculated noise impact with the operation of the repowered units is not expected to affect the surrounding biota. No sensitive wildlife communities occur near the site. In addition, wildlife in the area would be accustomed to noise in the urban environment and are currently exposed to noise sources that are significantly greater than the proposed repowered units, i.e., major roads and the Fort Lauderdale-Hollywood International Airport.

No adverse impacts to wildlife are anticipated from the operation of the proposed facility. No significant wildlife populations occur on the site. The wildlife in the vicinity of the site (see Section 2.3.6) are acclimated to noise emanating from the existing plant and from other sources, e.g., airplanes. Noise levels off the property (e.g., Pond Apple Slough Park) from the repowered units will be similar to current noise levels. No off-site impacts are anticipated.

Table 5.7-10. Impact Results of Intermittent Noise Sources Using Background Values

Site	Description	Background Values[a]	Steam Blowing Without Background	Steam Blowing With Background	Steam Vents Without Background	Steam Vents With Background
A2	Residence at 4409 SW 35th Avenue	48.4	84.0	84.1	57.1	57.7
A4	Residence at Northwest corner of Davis Isles	51.6	98.7	98.7	76.1	76.2
A7	SW 39th Avenue Southwest of the Plant	50.2	87.2	87.2	61.4	61.7
A9	SW 42nd Avenue at SW Plant Entrance	48.6	87.1	87.1	61.5	61.7

[a]Source: Table 2.3-55.

Note: Octave band sound pressure levels for steam blowing and steam vents were derived from Electric Power Plant Environmental Noise Guide 2nd Edition, Edison Electric Institute, 1983.

All values dBA.

Table 5.7-11. Impact Results of Intermittent Noise Sources Using Average L_{eq} Values (All values dBA)

Site	Description	Background Values[a]	Steam Blowing Without Background	Steam Blowing With Background	Steam Vents Without Background	Steam Vents With Background
A2	Residence at 4409 SW 35th Avenue	68.2	84.0	84.2	57.1	68.5
A4	Residence at Northwest corner of Davis Isles	66.3	98.7	98.7	76.1	76.6
A7	SW 39th Avenue South-west of the Plant	66.4	87.2	87.2	61.4	67.6
A9	SW 42nd Avenue at SW Plant Entrance	62.7	87.1	87.1	61.5	65.1

[a]Source: Table 2.3-55.

Note: Octave band sound pressure levels for steam blowing and steam vents were derived from Electric Power Plant Environmental Noise Guide 2nd Edition, Edison Electric Institute, 1983.

All values dBA.

5.8 CHANGES IN NON-AQUATIC SPECIES POPULATIONS

5.8.1 Impacts

Because the operation of the Lauderdale Repowering Project does not alter existing conditions of non-aquatic species populations, no long-term changes to these populations are expected to result from plant operation. The undeveloped buffers of the site will assure protection for the plants and wildlife that presently occur on the site.

5.8.2 Monitoring

Post-operational monitoring programs are not proposed.

5.9 OTHER PLANT OPERATION EFFECTS

5.9.1 Transportation Impacts

Construction at the Lauderdale Plant site is expected to be completed in early 1993, and the commencement of the plant operation activities will take place immediately thereafter. The analysis of transportation impacts on the external roadway system was conducted to reflect 1993 conditions.

To evaluate 1993 roadway conditions, 1993 background (non-project) traffic was estimated. The analysis of background traffic was conducted using procedures for construction impacts as described in Section 4.6. Project traffic was then added to the background traffic to obtain a 1993 total traffic projection.

Operational employment for the repowering project has been estimated to add 28 new employees at the Lauderdale Plant. It is anticipated that the work schedule will be divided into three overlapping shifts per day, with an equal number of employees working each shift. Based on these data, it was determined that approximately 10 additional employees will be working the normal daytime shift (7:30 a.m. to 4:00 p.m.). Using the 1.12 persons per vehicle occupancy rate, nine additional vehicles will be exiting the site during the p.m. peak hour. The main access to/from the site will be from Griffin Road via SW 42nd Avenue. The directional distribution of operational staff traffic consisted of one-half of the trips traveling eastward and one-half of the trips traveling westward on Griffin Road. The distribution was based on employee origin/destination data from the existing Lauderdale Plant.

In addition, it was assumed that no additional truck traffic will be generated by the Lauderdale Repowering Project during peak hours. This assumption was based on the fact that truck traffic currently serving the Lauderdale Plant site will also serve the repowered facility.
Using background and project traffic estimates and directional distribution, roadway link conditions for 1993 were analyzed.
Table 5.9-1 indicates the results of the analysis and shows that all

Table 5.9-1. 1993 Roadway Link Conditions for Project Traffic

Facility	Link	Direction/ Geometrics	LOS D p.m. Peak-Hour Service Volume[a]	1993 p.m. Peak-Hour Background Traffic Volume	Construction Traffic Volume	Total Traffic Volume	LOS[a]
Florida Turnpike (6-lane expressway)	Griffin Road to SR 84	Northbound/3L	5,570	2,843	--	2,843	B
		Southbound/3L	5,570	2,327	11	1,327	B
SR 7 (4 to 8-lane divided roadway)	Stirling Road to Griffin Road	Northbound/2L	1,720	2,327	--	2,327	F
		Southbound/2L	1,670	1,903	1	1,904	F
	Griffin Road to SR 84	Northbound/3L	2,600	2,163	3	2,166	C
		Southbound/3L	2,530	1,770	--	1,770	C
Ravenswood Road (2-lane undivided roadway)	Stirling Road to Griffin Road	Northbound/1L	880	590	--	590	A
		Southbound/1L	880	720	1	721	A
	Griffin Road to SW 42nd Street	Northbound/1L	890	485	--	485	A
		Southbound/1L	880	398	--	398	A
	SW 42nd Street to SR 84	Northbound/1L	890	429	--	429	A
		Southbound/1L	880	352	--	352	A
I-95 (10-lane freeway)	Stirling Road to Griffin Road	Northbound/5L	9,280	8,505	--	8,505	D
		Southbound/5L	9,280	6,959	1	6,960	C
	Griffin Road to SR 84	Northbound/5L	9,280	8,222	2	8,224	D
		Southbound/5L	9,280	6,727	--	6,727	C
Stirling Road (6-lane divided roadway)	I-95 to SR 7	Eastbound/3L	2,210	1,635	1	1,636	D
		Westbound/3L	2,510	1,998	--	1,998	D
Griffin Road (6-lane divided roadway)	I-95 to SW 42nd Avenue	Eastbound/3L	2,210	1,550	4	1,554	D
		Westbound/3L	2,510	1,894	--	1,894	D
	SW 42nd Avenue to SR 7	Eastbound/3L	2,210	1,328	--	1,382	D
		Westbound/3L	2,510	1,689	5	1,694	D
SR 84 (4-lane divided roadway)	I-95 to SR 7	Eastbound/2L	1,670	914	--	914	C
		Westbound/2L	1,720	1,117	--	1,117	B
I-595 (6-lane freeway)	I-95 to SR 7	Eastbound/3L	5,570	1,117	--	1,117	A
		Westbound/3L	5,570	1,365	--	1,365	A

[a]Based on FDOT Generalized Peak Hour Level of Service Maximum Volumes Tables, January, 1989.

roadway links near the site, except SR 7 from Stirling Road to Griffin Road, will operate at LOS D or better. SR 7 is expected to operate at LOS F in both directions. However, since operational traffic will contribute less than 1 percent of LOS D service volume for this link, impacts on this roadway will be negligible.

An intersection analysis was also conducted for the Griffin Road/SW 42nd Avenue, Ravenwood Road/SW 42nd Street, and SR 84/SW 26th Terrace intersections, in the event operation employees use the SW 42nd Street access (see Appendix 10.5.6). Using the 1985 Highway Capacity Manual computer software programs (Institute of Transportation Engineers, 1985) and projected turning movement volumes at these intersections, 1993 PM peak-hour operating conditions were estimated. The results of this analysis indicated that the Griffin Road/SW 42nd Avenue intersection will operate at LOS D, while the Ravenwood Road/SW 42nd Street intersection will operate at LOS A. In addition, the SR 84/SW 26th Terrace intersection is expected to operate at LOS B. Results of this computer analysis are provided in Appendix 10.5.6.

Based on the results of the roadway link and intersection analyses, traffic generated in the vicinity of the Lauderdale Plant site as a result of the repowering project will have minimal impact on the adjacent roadway system.

5.9.2 Visual/Aesthetic Impacts

The potential for visual impacts of the repowering project are dependent on two primary factors: the visual character and quality of the views or vistas that may be obstructed by structures and the degree of viewer exposure and sensitivity. The visual character is related to the existing visual characteristics in the immediate area of the site. Viewer exposure is related to the number of viewers, the distance from the viewer and the structures, the viewer duration and the areas from which the structures can be viewed.

The proposed structures that potentially influence the visual character of the Lauderdale Plant area include four 150 ft high stacks, the 75 ft high CT enclosure building, and the four (about 60 ft high) HRSGs. The new stacks will be the same height as the two existing stacks associated with the Units 4 and 5. The horizontal dimensions of the CT enclosure building will be 390 ft long and 105 ft wide; the HRSGs will be about 115 ft long and about 40 ft wide. Metal siding will be used for the exterior of the CT enclosure. Neutral color siding will be used to absorb, and not reflect, sunlight. The stacks and the HRSGs will also be a neutral color.

As discussed in Section 2.1, the existing steam generators will be removed once the repowered units are brought into service. These steam generators are not enclosed in a building, resulting in the exposure of the steel beams supporting the boiler, piping and vents, and guard rails. The steam generators are 135 ft high, 71 ft long and 64 ft wide.

The visual character of the area surrounding the structures associated with the repowering project will not be significantly altered. The steam generators and stacks associated with Units 4 and 5 have existed at the site since 1957; structures associated with retired Units 1 through 3 have existed at the site since the mid-1920s. Indeed, some improvement is expected by the removal of Units 4 and 5 steam generator buildings which are higher and aesthetically less desirable than the CT enclosure. The addition of the repowered facilities will be visually consistent with the zoning and the general land use designations of the area. While the area within 1 mile of the site contains many zoning and land use designations, a large parcel of land (about 150 acres) adjacent to the Lauderdale Plant site will be used for similar industrial-type purposes, i.e., the South Broward County Resource Recovery Facility. The structures associated with this facility will include a 195 ft high combined flue stack and a steam generator building about 153 ft high. The landfill area, which will be about 100 acres, will be over 100 ft high at its tallest point.

The potential impacts to viewer exposure will not be increased as a result of the repowering project. Since the number of viewers exposed, the areas of exposure and view duration will not significantly change as a result of the project, overall viewer exposure will not be affected. This is based on the current visual opportunities of Units 4 and 5, and the distance of viewers.

The existing units are currently visible from US Highway 441 to the west and northwest of the plant, portions of SR 84 to the north of the plant and portions of Griffin Road immediately south of the plant. The repowered facility's stacks are expected to be visible from these vantage points. When I-595 is complete, the repowered units will be visible since the highway segment north of the plant will be elevated. The viewer exposure in these areas will be of short duration. The only residential areas that will be able to view the repowered units are those that currently have a view of the Lauderdale plant.

5.9.3 Other Potential Impacts

Potential impacts associated with the demand for service and available infrastructure are presented in Section 7.2. This section addresses long-term external costs (impacts) related to the demands on operation phase, housing, education, medical facilities, firefighting facilities, police protection, recreation, electricity, natural gas, water supply, sewage treatment, and solid waste disposal.

5.10 ARCHAEOLOGICAL SITES

DHR was contacted and requested to identify any known archaeological sites and determine whether a cultural resource survey was necessary. DHR indicated that no significant archaeological sites are recorded or considered likely to be present within the site.

It is highly unlikely that any impact to archaeological sites would occur during the operation of the plant since no excavation or earthwork is planned in order to operate the plant. If there is an archaeological find during the operation of the plant, the chance find procedures described in Chapter 4, Section 4.8, Impact on Archaeological and Historical Sites will be implemented.

5.11 RESOURCES COMMITTED

The major irreversible and irretrievable commitments of state and local resources due to the operation of the repowered units are the use of land, the consumptive use of groundwater, and the PSD increment consumption. The latter two effects will only occur for the duration of operation.

Of the total Lauderdale Plant site (392 acres), only about 2.8 acres not currently affected by existing activities will be used by the repowering project. In contrast to a new generating facility constructed on a green-field site, the Lauderdale Repowering Project will be significantly more effective in the use of land per new MW generated. Indeed, the project's use of land is, for the most part, a reuse of state and local resources.

The use of water by the project will consist of the condenser cooling flow, the auxiliary cooling flow, and the process water requirements. Relative to the amount of electric power produced from the plant, the consumptive use will greatly decrease.

The consumptive use of groundwater will, on the average, decrease by about 6 million gallons per day. The groundwater used will primarily be used for NO_x control.

The use of surface water will increase only for auxiliary cooling; this will increase the use of surface water by less than 9 percent. Auxiliary cooling water is returned to the surface water through the cooling canal/pond system. Use of condenser cooling water, which also returns to the surface water system after passing through the cooling canal/pond system, will remain the same. The lowest quality available will be used for all cooling and process purposes.

The repowered units will consume PSD increment. However, because the existing steam generators will be removed from service, the amount of increment consumed by repowering is substantially offset. As a result, the increment consumed is much lower for repowering than for a new combined cycle facility.

Given the need for the facility, as expressed in Chapter 1.0, the Lauderdale Repowering Project effectively utilizes state and local resources. Benefits of the project are presented in Section 7.1.

5.12 VARIANCES

No variances from federal, state, or local regulations are anticipated for the operation of the Lauderdale Repowering Project.

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Site Certification Application

Chapter 6

Transmission Lines And Other Linear Facilities

6.0 TRANSMISSION LINES AND OTHER LINEAR FACILITIES

No new off-site transmission corridors or substations will be required for the Repowering Project. No other off-site linear facilities are required.

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Chapter 7

Economic And Social Effects Of Plant Construction And Operation

TABLE OF CONTENTS

LIST OF TABLES

7.0 ECONOMIC AND SOCIAL EFFECTS OF PLANT CONSTRUCTION AND OPERATION

The purpose of this chapter is to identify the economic and social effects of construction and operation of the Lauderdale Repowering Project, and to quantify the project benefits and costs to the groups affected in the area surrounding the Lauderdale Plant site, as well as other people and businesses in Broward County, the region, and the state.

Socioeconomic effects can be classified as either direct or indirect effects. Direct effects are those affecting primarily the owners, operators, and customers of the facility; in this case, the costs of constructing and operating a generating plant and the customers who purchase the electrical energy. Indirect costs and benefits affect people and interests in the vicinity of the project who, because of their proximity to the site, may experience changes in their local environment, such as increased spending by project construction and operation personnel. Many of these effects are difficult to measure, and qualitative assumptions must be made to assess the relative values of expected costs and benefits.

This chapter is divided into two parts. Section 7.1 deals with socioeconomic benefits and consists of an analysis of the monetary values of the power generated and sold and plant construction and operational expenditures. Section 7.2 addresses temporary and long-term indirect costs involving the construction and operation personnel's use of private and public services in the vicinity of the site. Baseline data are contained in Section 2.2.

For purposes of the economic analysis, a 30-year operating life for each generating unit was assumed. However, it is recognized that the actual operating life may be different.

7.1 SOCIOECONOMIC BENEFITS

The construction of the Lauderdale Repowering Project will involve the expenditure of about $460 million in capital investment by late 1994. Annual operating expenditures with both units operating will be about

$237 million, of which fuel supply purchases alone will account for nearly $117 million, or 49 percent (1993 prices).

7.1.1 Direct Socioeconomic Benefits

7.1.1.1 Direct Energy Production

The principal direct benefits of the Lauderdale Repowering Project will be those inherent in the increased capacity and efficiency in the production of electrical energy which the project provides to the FPL system. These benefits are summarized in Chapter 1.0.

7.1.1.2 Direct Labor Expenditures

Table 7.1-1 presents the estimated construction labor expenditures based upon a total project construction labor budget of $77,503,000. This construction labor cost was allocated based upon the average weekly labor force levels reported in Table 7.1-2 assuming a 15-percent premium for supervisory personnel. Construction labor costs were increased annually 5 percent to adjust for escalation. Based on this construction cost analysis, approximately $34 million will be expended the first year of project construction (through 1991), and the remaining $43 million will be expended during the remaining years of project construction. Supervisory personnel costs will be about $17 million, and manual labor expenditures will be over $60 million. These direct construction labor costs were used as the basis for calculating indirect income derived from project labor expenditures (see Section 7.1.2.2).

Defining a job as the equivalent of one year's employment or 2,080 man-hours, the construction phase will yield an average of 334 jobs during the peak year of construction and a total direct employment of 822 jobs.

Total labor costs for the operation of the Lauderdale Repowering Project after repowering is complete are shown in Table 7.1-3. Labor costs attributable to the 28 new employees associated with the repowering project are also shown. At startup, the total payroll for the Lauderdale

Table 7.1-1. Construction Phase Labor Costs for the Lauderdale Repowering Project

Year	Manual Labor Cost ($1,000)	Supervisory Labor Cost ($1,000)	Total Labor Cost ($1,000)
Prior to 1990[a]	374.4	105.6	
1990[a]	5,854.5	1,808.5	480.0
1991	20,163.7	5,921.3	26,085.0
1992	24,391.1	7,121.9	31,513.0
1993	6,919.1	1,962.9	8,882.0
1994	2,338.6	541.4	2,880.0
TOTAL COST	60,041.4	17,461.6	77,503.0

[a]Associated with preparatory activities; see also Section 2.3.9.

Note: Construction labor costs represent total wage package rates, including any fringe benefits for manual labor, and complete payroll wage rates, excluding non-payroll markups, for supervisory labor.

Labor costs are escalated to the period designated through the use of past and present local wage agreements for manual labor and historical data for supervisory labor.

Table 7.1-2. On-Site Construction Phase Labor Requirements (Average Annual Employment)

Year	Number of Employees: Manual Labor	Supervisory Labor	Total Labor Force
Prior to 1990[a]	4	1	5
1990[a]	65	16	81
1991	221	56	277
1992	267	67	334
1993	75	19	94
1994	24	7	31

[a]Associated with preparatory activities; see Section 2.3.9.

Note: Total labor force represents the average number of employees employed each week during any given year.

Manual labor includes all craft labor.

Supervisory labor includes contractor supervisory and administrative personnel and construction management personnel.

Table 7.1-3. Operation Phase Labor Requirements and Costs for the Lauderdale Plant After Repowering

Year	Existing Operational Labor	Total Labor Costs (Million Dollars)	New Employees	New Employee Labor Costs (Million Dollars)
1993	157	4.91	28	0.88
1994	157	5.16	28	0.92
1995	157	5.42	28	0.97
1996	157	5.69	28	1.01
1997	157	5.97	28	1.07
1998	157	6.27	28	1.12
1999	157	6.59	28	1.17
2000	157	6.91	28	1.23
2001	157	7.26	28	1.29
2002	157	7.62	28	1.36
2003	157	8.00	28	1.43
2004	157	8.40	28	1.50
2005	157	8.83	28	1.57
2006	157	9.27	28	1.65
2007	157	9.73	28	1.74
2008	157	10.22	28	1.82
2009	157	10.73	28	1.91
2010	157	11.26	28	2.01
2011	157	11.83	28	2.11
2012	157	12.42	28	2.21
2013	157	13.04	28	2.32
2014	157	13.69	28	2.44
2015	157	14.33	28	2.56
2016	157	15.10	28	2.69
2017	157	15.85	28	2.82
2018	157	16.64	28	2.96
2019	157	17.48	28	3.11
2020	157	18.52	28	3.27
2021	157	19.45	28	3.43
2022	157	20.42	28	3.60
2023	157	21.44	28	3.78

Note: Labor costs have been escalated at 5 percent per year.
Assumes Units No. 4 and 5 will begin commercial operation in the fourth quarter of 1992 or the first quarter of 1993.

Repowering Project is estimated to be $5.79 million, of which $880,000 will be attributed to newly added personnel.

7.1.1.3 Direct Capital Investment Expenditures

The construction costs for the Lauderdale Repowering Project, according to the mid-1989 total project budget revision, will be allocated as follows:

Activity	Budget	Percent
Construction Materials	215,955,000	46.9
Construction Labor	77,503,000	16.8
Engineering Services	20,358,000	4.6
Project Support	25,484,000	5.5
Licensing Outside Services	2,100,000	0.5
Administrative Allowance	47,600,000	10.3
Escalation	22,300,000	4.8
Contingency	48,700,000	10.6
	$460,000,000	100.0

Capital cost estimates are based on current (1989) costs of construction, equipment, and labor, with a built-in escalation factor to account for inflation during the construction period.

7.1.1.4 Direct Fuel Supply Expenditures

The repowered units will burn natural gas or light oil (i.e., No. 2 fuel oil) as backup. The preferred fuel will be natural gas, which is estimated to cost $3.63/10^6 Btu the first year of operation in 1993. Repowered Unit 4 is projected to burn 16,800,000 x 10^6 Btu at an annual projected 1993 cost of $60,980,000, based upon assumptions including a 81.9-percent capacity factor, 7,900 Btu/kW-hr heat rate, and an electrical energy production of 2,596 gigawatt-hours annually. Repowered Unit 5 is projected to consume 15,430,000 x 10^6 Btu at an annual projected 1993 cost of $56,030,000, based upon a 78.5-percent capacity factor, 7,900 Btu/kW-hr heat rate, and production of 2,489 gigawatt hours annually.

7.1.1.5 Direct Operating and Maintenance (O&M) Expenditures

Labor and materials to operate the repowered Units 4 and 5 (exclusive of fuel charges) are projected to cost $12.739 million in 1993, when both units are in commercial operation. The plant's regular payroll is estimated to number 185 employees by 1993, of which 28 would be new employees over and above the existing complement. The total annual wage and salary cost is estimated to be $5.79 million (1993 rates), of which $0.88 million would be attributable to the 28 new employees. Wages and salaries are projected to escalate at an annual percentage rate between 3.5 percent and 5.5 percent, depending on the year. They are based on current (1988) labor cost levels and trends in generating-station personnel costs. Labor costs include fringe benefits and employer's contributions, which typically comprise about 30 percent of total labor costs.

Materials and services utilized in operating and maintaining (O&M) the plant comprise about seven-eighths of total O&M costs, with plant labor accounting for the balance. In 1993, with both units in operation, total O&M costs excluding labor are projected to be $7.83 million. Costs are based on current (1988) levels of plant operating costs, and assume a 5-percent annual rate of escalation.

7.1.1.6 Other Direct Expenditures

Other direct costs, which are partly a function of the level of operation of the two units but which also relate to fixed cost elements, include working capital expense, taxes, and insurance. Working capital is required primarily to maintain fuel and maintenance inventories.

The Lauderdale Repowering Project will be subject to property taxes on land, structures, equipment, and fuel inventory, and to a gross receipts tax. The basis for assessing ad valorem property taxes is normally not determined until after completion of the facility and, therefore, only preliminary estimates can be made of the additional revenues local governments (i.e., Broward County and the City of Hollywood) would receive.

Estimated annual taxes (in 1988 dollars for the first year of operation with both units on-line--1993) total $7,148,000 and include $3,670,000 for property taxes and $3,478,000 in state gross receipts tax.

A more detailed analysis of potential tax liabilities is presented in Section 7.1.2.4. As noted earlier, the tax estimates assume that current assessment ratios will remain constant and tax millage rates will increase at historical rates. These parameters are likely to vary significantly over time.

Insurance costs are estimated on the basis of capital invested in the plant. A fixed charge rate of between 0.25 percent and 0.35 percent has been projected, which would yield a premium of between $1.15 million and $1.61 million per year.

7.1.2 Indirect Socioeconomic Benefits

7.1.2.1 Employment

Broward County employment will increase due to the Lauderdale Repowering Project for two reasons. First, there will be a direct employment increase of workers during construction and operation of the repowered units. Second, there will be induced employment from increased demand for goods and services in Broward County and, to a lesser extent, southeast Florida.

Tables 2.2-8 and 2.2-9 (see Chapter 2.0) depict existing and forecasted employment by industry sector for the years 1987 and 1995, respectively. In these baseline employment projections, the durable manufacturing sector, the transportation and public utilities sector, and service industries are projected to experience the most rapid rates of employment growth, in excess of 4 percent annually, during the 8 years between 1987 and 1995. Retail trade and service industries will remain the largest employment sectors, containing more than half the jobs in the Broward County economy.

Employment increases resulting from the Lauderdale Repowering Project's construction and operation phase activities have been estimated using regional multipliers developed by the U.S. Department of Commerce Bureau of Economic Analysis's Regional Input-Output Modeling System (RIMS II). Indirect employment was forecasted with the RIMS II statewide multiplier of 43.3 total jobs per $1 million in construction expenditures. Since the total construction budget is $460 million, the total number of jobs created by the Lauderdale Repowering Project is estimated to be 19,918 (i.e., 43.3 x 460). Of these jobs, 822 are considered direct employment, and the remaining jobs (19,096) are indirectly related to the project's construction.

While the direct employment produced by the construction of the project augments the local employment profile of Broward County, a considerable portion of the indirect, secondary employment may not occur in the State of Florida. The CT and HRSG equipment, which comprise $152 million of the total construction budget, will be manufactured outside Florida. In view of the out-of-state and out-of-county expenditures associated with the project's construction program, about 30 percent of the indirect employment of 19,096 would likely occur in Broward County and possibly 50 percent in southeast Florida.

Indirect employment generated by plant operations using the RIMS II multiplier for utility operation is estimated to be 11.4 jobs per $1 million in gross receipts. Assuming gross revenues from the sale of electrical energy produced by the project are $296 million per year, the total number of jobs created is estimated to be 3,370 (i.e., 11.4 x 296) of which all but 28 represent indirect employment resulting from plant operations.

7.1.2.2 Income

Income in Broward County is expected to increase due to the Lauderdale Repowering Project for two reasons. First, there will be a direct income increase resulting from the wages paid directly to the labor force during the construction and operation phases of the Lauderdale Repowering Project. Second, there will be an induced component to the income increases. As the construction- and operation-phase employees and their dependents spend that income in Broward County, the demand for goods and services will increase.

Direct income increases are composed of construction wages, which average $38.8 million annually, and wages paid to the additional operating personnel. The latter wages amount to $0.88 million the first year of operation in 1993 and average $2.04 million annually over the next thirty years. The project work force will likely be drawn from a three-county area that includes Broward, Dade, and Palm Beach. For construction, three-quarters of the on-site workforce is assumed to reside in Broward County. For operational employees, who routinely do not commute as far as construction workers, it is assumed that 80 percent reside in Broward County. With these workforce origin assumptions, the direct income increase from the project attributable to Broward County is estimated at $107.2 million over the construction and operation periods. The remainder, $31.6 million, would likely be attributable to Dade and Palm Beach Counties.

Indirect income induced from construction was estimated to increase using the RIMS II model's regional earnings multiplier for electric power plant construction. Based on a total construction budget of $460 million and the RIMS II regional household earnings multiplier of 0.7178, the total increase in income from construction of the repowering project is estimated at $303.2 million. By deducting the total direct construction income estimate of $77.5 million for construction labor, the indirect income is estimated to increase by $253 million over the construction period. As previously discussed, a portion of this indirect income (i.e., about $103 million) would be generated out-of-state due to equipment purchases. A majority of the remainder, $150 million, would likely be attributable to Florida; Broward County is assumed to receive about 30 percent of this indirect income (i.e., $45 million).

Indirect income induced from operation was also estimated to increase using the RIMS II model's regional earnings multiplier for electric power plant operations. Based upon an annual operating O&M expenditure of $12.7 million and the RIMS II regional household earnings multiplier of 0.2491 for southeast Florida, the total induced income increase assignable to the operation of the repowered Units 4 and 5 is estimated to be about $3.2 million in 1993. By deducting the total direct operations income estimate of $0.88 million and assuming 30 percent of the induced income would occur in Broward County, the county's indirect income increases are estimated at $1.8 million.

Broward County personal income impacts are presented in Table 7.1-4. Direct and induced personal income impacts due to construction activities are presented in Column 3 of this table. Income generated due to construction activities is expected to peak in 1992 at a level of $40.6 million, of which $31.5 million represents direct income impact.

Direct and induced income generated due to operation-phase activities will first appear in 1993 when the repowered units begin commercial operation. In Table 7.1-4, Column 4 presents operational phase personal income, which is assumed to increase at a rate of 5 percent annually. By the year 2023, the income generated by operation of the repowered units is projected to exceed $21.4 million.

Total personal income impacts are forecast to peak in 1992, when the increase over the baseline case is expected to be around 0.3 percent. Thereafter, total personal income impact as a percentage of Broward County's baseline income projection should level off just under 0.1 percent.

7.1.2.3 Public Finance

Construction and operation of the Lauderdale Repowering Project will generate an increased level of tax revenues for local governments (i.e., Broward County and the City of Hollywood) and for the State of Florida. As a utility, FPL is exempt from state and federal income taxes, but the utility does pay property and gross receipts taxes. Also, any fuels

Table 7.1-4. Construction and Operation Phase Income Impacts (in millions of 1988 dollars) for the Lauderdale Repowering Project

Year (1)	Broward County Personal Income Projection (2)	Personal Income Impact Due to Construction Phase (3)	Personal Income Impact Due to Operation Phase (4)	Total Personal Income Impact (5)	Broward County with Lauderdale Project Personal Income Projection (6)	Percent Change from Baseline Case (7)
Prior to 1990[a]	12,070	0.6	0.0	0.6		
1990[a]	12,674	9.9	0.0	9.9		
1991	13,308	33.6	0.0	33.6	13,342	0.3
1992	13,973	40.6	0.0	40.6	14,014	0.3
1993	14,672	11.4	4.7	16.3	14,688	0.1
1994	15,405	3.7	5.2	8.9	15,414	0.1
1995	16,176	0.0	5.4	5.4	16,181	<0.1
1996	16,984	0.0	5.7	5.7	16,990	<0.1
1997	17,834	0.0	6.0	6.0	17,840	<0.1
1998	18,725	0.0	6.3	6.3	18,731	<0.1
1999	19,662	0.0	6.6	6.6	19,669	<0.1
2000	20,645	0.0	6.9	6.9	20,652	<0.1
2005	26,349	0.0	8.8	8.8	26,358	<0.1
2010	33,628	0.0	11.3	11.3	33,639	<0.1
2015	42,919	0.0	14.3	14.3	42,933	<0.1
2020	54,777	0.0	18.5	18.5	54,796	<0.1
2023	63,412	0.0	21.4	21.4	63,433	<0.1

[a]Associated with preparatory activities; see Section 2.3.9.

Note: The personal income of Columns 3, 4, and 5 includes direct and induced income changes. Assumes Broward County recipient of 75 percent of construction-phase and 80 percent of operation-phase income from period.

Source: Florida Statistical Abstract, 1988.
U.S. Department of Commerce, 1986.

inventory that may be maintained at the plant will be exempt from property taxes. In addition, the FPL distribution system also generates sales tax on electric power sold to its consumers. The project will result in a recalculation for determining real property taxes and personal property taxes as well as the gross receipts tax. Ad valorem taxes on the land, structures, and equipment of the project in the form of real and personal property taxes will be the source of additional revenues for the local school board and county government, while the gross receipts tax will be the main source of new state taxes.

The exact amount of taxes that will be paid in the future by the Lauderdale Repowering Project must be estimated from current tax ratios. The reasons are:

1. The basis for assessing the value of the land and improvements at the proposed site has not been established,
2. The price of the electrical energy to be sold to FPL customers is subject to change from the current level of 0.0456 per kWh, and
3. Tax rates for future years may change.

Accordingly, the general order of magnitude of various tax revenues can be estimated; however, future tax rules and rates may effect these estimates.

7.1.2.4 Property Taxes

This analysis is focused upon the differential property taxes generated by the repowering project versus the existing fossil steam units. Results are summarized in Table 7.1-5.

In estimating a net taxable value for the project, several assumptions were required. Since it is uncertain how much of the projected capital cost (or other basis) of the project will be assessed for real and personal property taxes, the initial capital investment of $460 million to construct the project was allocated as follows: $382 million to personal property and $78 million to real property.

Table 7.1-5. Estimated Property Taxes (in millions of dollars beginning 1994) for the Lauderdale Repowering Project

Units	Estimated Property Taxes[a]				
	1994	1999	2009	2019	2023
Repowered Units 4 and 5					
Net Assessed Value[b]	$ 188.70	$ 188.70	$ 188.70	$ 188.70	$ 188.70
Less Accumulated Depreciation[c]	0.00	28.05	84.15	118.50	137.46
Net Taxable Value	188.70	160.65	104.55	70.20	51.24
Existing Units 4 and 5[d]					
Net Assessed Value	54.15	54.15	54.15	54.15	54.15
Less Accumulated Depreciation	1.51	6.98	17.48	24.60	27.25
Net Taxable Value	52.64	47.17	36.67	26.90	26.90
Net Taxable Value Difference	136.06	113.48	67.88	43.30	24.34
Total Property Tax Increase	3.67	4.12	4.45	5.13	3.66

[a] 1994 millage rate, real and personal property, projected forward from 1988 at 6.1 percent annually. Increase continues through 2023.

[b] $460,000,000 less 30 percent for exempt pollution control facilities. Assumes property enters tax rolls January 1, 1994.

[c] Straightline over 30 years. Assumes land portion does not depreciate, real property value in improvements depreciates over 30 years until 30 percent of original value level is reached.

[d] Existing Units 4 and 5 tax assessment (1988). Personal property depreciated at 3.8 percent annually and real property fully depreciated.

Note: All estimated property taxes based on tax ratios from Broward County.

Sources: FPL Property Tax Department, 1989.
Broward County Tax Assessors Office, 1989.

Assuming about 30 percent of the cost of the repowering project was related to pollution control facilities which are exempt from ad valorem taxes, the project cost basis was reduced to $267.4 million and $54.6 million, respectively. Real and personal property is assessed at different ratios of taxable value to gross dollar cost. For real property, 85 percent of the combined cost of the project's land and building is reflected in its taxable value of $46.4 million ($20.25 million for land and $26.15 million for improvements). For personal property, the taxable value was assumed to be 53.2 percent of the cost or $142.3 million. As a result of these assumptions and calculations, the repowering project's taxable basis was estimated to be $188.7 million on January 1, 1994, when the project would be included on the Broward County tax rolls.

Projections for ad valorem taxes for the existing fossil-fuel-fired steam Units 4 and 5 were based upon their 1989 tax assessment of $14.5 million for real property and $48.1 million for personal property. The real property was assumed to be fully depreciated, while the personal property was assumed to have a straight line depreciation of 3.8 percent annually.

The assumptions and adjustments discussed above were used in Table 7.1-5 to estimate the difference in tax revenues between the existing fossil steam units and the repowered units. Changes in investment costs, assessment ratios, and millage rates would affect these estimates. The table shows estimated taxable values and taxes at several points in time to illustrate the effects of the existing and repowered units' depreciation on tax revenues. Assessment ratios are held constant and the millage rate is increased 6.1 percent annually, the historical rate of millage increase in Broward County. The repowered units are assumed to enter the tax rolls on January 1, 1994, being exempt from property taxes until the first calendar year after their commissioning, i.e., 1993.

Property tax revenues on the repowered units would have the greatest net increase over the existing units during the third decade of their operation, with property tax revenues increasing from an estimated $3.67 to

$5.13 million during the first 25 years of operation. Once the repowered units' real property improvements reach the 30 percent remaining taxable value plateau, only the remaining personal property value declines; therefore, the revenue increase would decline to $3.67 million over existing conditions in 2023. On the basis of the above referenced assumptions, total real and personal property tax revenues that would accrue to the tax jurisdictions from the repowered units would aggregate to approximately $113 million, or an average $3.8 million per year over 30 years. This property tax estimate is the differential between the baseline conditions in which the existing fossil steam units were assumed to continue to generate tax revenues at the current rate and the operation of the repowered units.

The Broward County School District's share of the increased tax revenues is estimated at 40 percent of the total revenue, or $45 million. The balance of $68 million would go to the county, the City of Hollywood, and the South Florida Water Management District.

7.1.2.5 Other Taxes

The principal other tax that the Lauderdale Repowering Project will generate is a gross receipts tax paid to the State. This tax is presently a 1.5 percent levy on the gross revenues from sales of FPL-generated power to its customers. Estimates of this tax's yield are uncertain due to the preliminary nature of generating cost estimates and the possibility that the tax rate might change. FPL charged $0.0456 per kilowatt-hour (kWh) in 1989 for power sold to its customers which, when adjusted by 5 percent annually, suggests a 1994 cost per kWh of $0.0582. The repowered units are planned to operate at an 80.2 percent average capacity factor, which translates into a gross output per year for both units of 5,085 million kWh. At the current $0.0456 per kWh, the two repowered units would produce electricity worth approximately $232 million annually, if 1989 prices remained stable. Were the rates to increase 5 percent annually through 1994 to $0.0582 kWh, the two repowered units would produce $296 million in 1994. The gross receipts tax, at 1.5 percent, would yield between

$3.48 (at current electric rates), and $4.44 million (with escalated rates); or approximately $4.0 million annually.

Costs of power generation are projected to escalate at a 5 percent average annual rate. Assuming the rates charged for power rise at the same rate over the 30 years, the total gross revenues from the repowered units would be $17.7 billion. The 1.5 percent gross receipts tax would yield $265.76 million. The state also charges a 6 percent sales tax on sales of electric power to commercial customers, which FPL collects as part of its billing to retail customers. This retail sales tax would yield an additional $510 million to the state over the 30-year operation of the repowered units (assuming half the power is sold to commercial customers). In addition, residential consumers are usually taxed by their local communities, each of which has a different rate and formula for calculating the tax.

Indirectly, the state will derive tax revenues from the Lauderdale Repowering Project. The multiplier effect on local incomes of purchases made by project personnel during construction and operation will also have a retail trade component, which will generate sales and gasoline taxes on local spending. The amounts of these taxes arising indirectly cannot be estimated with precision. If 50 percent of local consumption expenditures made in Broward County are for taxable goods and services, then in the peak construction year of 1992 about $20.3 million in taxable sales (Table 7.1-4, Column 5, multiplied by 0.5) would yield $1.2 million based upon the 6 percent state sales tax. On the same basis, the annual employee expenditures from the repowered units' operations would yield sales tax revenues of about $147,000 in 1993.

The state gasoline tax of 9.75 cents per gallon would also produce additional tax revenues as a result of the additional traffic generated by the construction and operations workforces. After estimating the gasoline consumption of the commuting workers, it is estimated that state gasoline revenues would be about $17,250 during the construction period and would be insignificant for the few new operations employees.

7.2 SOCIOECONOMIC COSTS (IMPACTS)

The focus of this socioeconomic analysis is on a primary impact area which encompasses a 5-mile radius of the Lauderdale Plant site. While there may also be impacts to the remainder of Broward, as well as Palm Beach, Dade, and Monroe Counties (referred to as the secondary impact area), these impacts are not expected to be significant. Further discussions of potential impacts will refer to the primary impact area in Broward County, unless stated otherwise.

Broward County's history of rapid population growth is reflected in the increasing populations of most municipalities within the 5-mile primary impact area. As shown in Table 2.2-3, with the exception of Fort Lauderdale and Hollywood, municipal population increases ranged from 11.1 percent up to 90.0 percent during the period 1980 through 1988. Table 2.2-4 shows the baseline growth in resident population within the 5-mile primary impact area from 1980 to 2010. From a total population of 322,290 residents (including portions of census tracts immediately outside the primary impact areas' boundary) in 1980, the primary impact area's population is expected to increase 32 percent to 425,302 people by 2010. Neither the construction-phase labor nor the operation-phase labor requirements are expected to materially affect the primary impact area population. The population increase from the few construction workers or permanent plant employees and their families in-migrating to Broward County is insignificant with respect to the population in-migration that is expected to continue throughout the next 20 years.

Broward County has adopted, and the Department of Community Affairs has approved, a comprehensive plan that addresses Florida's growth management requirements (Broward County, 1989). Where there are requirements applicable to the Lauderdale Repowering Project, these requirements are addressed in this section. Impacts to transportation facilities are addressed in Section 5.9.1.

7.2.1 Temporary External Costs (Impacts)

7.2.1.1 Construction-Phase Labor Requirements

With considerable population growth within Broward County and adjacent areas, the construction workforce and their dependents are expected to be drawn from Broward County and, to a lesser extent, from the adjacent counties including Palm Beach and Dade. The construction labor force, even during its peak employment in 1992, is anticipated to consist predominantly of resident commuters from the primary and secondary impact areas surrounding the site. Construction workforce relocations, if any do occur, will likely be a component of the general in-migration of prospective residents. The impact of any relocations associated with the construction labor force on the primary impact area's population (approximately 346,444) will be insignificant.

As presented in Table 7.1-2, the average annual workforce at the plant site is shown for the construction period. Building to a peak in 1992, the project's construction labor requirements total 822 construction jobs (with the peak estimated at 504 workers). Assuming that the peak construction year annual average number of workers is routinely employed on the project and 5 percent of the workforce relocated from outside of Broward, Dade, and Palm Beach counties, an average of 17 workers would relocate to the region during construction. If the construction workers bring their families, the increase in the number of new residents would be approximately 40 people based upon Broward County's 2.34 persons per household ratio (1987). Since an average of nearly 3,320 new residents are projected to settle within Broward County each year, the 40 persons potentially attributed to the repowering project workforce represent 1.2 percent of new residents, if all the construction workers chose to reside within Broward County. This increase is a conservative estimate since some construction workers will either be not married or will not relocate their families, and some construction workers will reside outside Broward County.

7.2.1.2 Temporary Service Impacts

HOUSING

Relocation of construction-phase personnel to Broward County will increase the demand for housing, both direct and induced. As depicted in Section 7.2.1.1, during 1992, the peak construction year, approximately 40 people are projected to relocate to Broward County. Assuming the current (1987) average size of 2.34 persons per household would occur in 1992, approximately 17 dwelling units will be required in Broward County due to the Lauderdale Repowering Project.

There were approximately 575,498 standard dwelling units in Broward County in 1987 (see Section 2.2.7.1). During the eighteen-year period 1970-1988, a total of 368,464 housing units of all types were built in the county. Assuming the pace of housing construction continues to increase at an annual rate of 3.1 percent, as in the baseline case, about 50,000 dwelling units will be built from 1988 to 1991, the first year of construction. As a result, the Lauderdale Repowering Project will not cause any significant pressure on availability of housing in Broward County. No significant impact on real estate values is anticipated due to the minimal housing demand associated with the project, nor are the real estate values of properties surrounding the project site expected to be adversely affected. The repowered project is wholly contained within the existing Lauderdale Plant site, and the presence of this plant has already been accommodated in the local real estate market.

EDUCATION

Approximately 17 new households are estimated to in-migrate to Broward County during 1992, the peak year of construction impact, as a result of the proposed project. Based on the ratio of students per household in Broward County (0.32 in 1988), approximately 5 additional students can be expected to enroll in the entire Broward County School District during 1992.

Based upon a fall 1988 Broward County student enrollment of 166,680, including 142,202 public school pupils and 24,478 private school students, the cost/facilities impact of 5 new students will not significantly affect the existing school system.

MEDICAL FACILITIES

A total of seven major medical facilities were identified within 5 miles of the Lauderdale Plant site (see Section 2.2.7.2). The closest full- service hospital to the site is Hollywood Memorial Hospital which includes 737 beds and a 24-hour emergency room. According to the Florida Statistical Abstract (1988), there were eight hospitals in Broward County with 4,799 employees. Among general hospitals, there were six in the county representing a ratio of 296 general hospital beds per 100,000 residents. While this level of service is below the state average of 447 beds per 100,000 people, the beds in the county's two special service hospitals were omitted from these tabulations which suggests that 296 beds/100,000 persons probably understates the county's level of hospital service. The relatively modest in-migration associated with the peak employment year in 1992 would not have any adverse impact on the quality or quantity of medical services offered in Broward County or in the vicinity of the site.

FIREFIGHTING FACILITIES

The construction of the Lauderdale Repowering Project will have no major adverse impact on the demand for firefighting services in Broward County since this project is replacing existing power facilities already served by the existing fire departments. Another mitigating factor is the fire protection equipment associated with the plant's existing and repowered facilities, as well as the presence of plant personnel trained in fire response procedures.

POLICE PROTECTION

Constructing the Lauderdale Repowering Project will primarily involve the use of existing plant facilities which are already served by the existing law enforcement resources in Broward County. The site is surrounded by canals along the southern, western, and northern boundaries. Security fences encompass all equipment and parking areas with remote television camera surveillance and controlled access at the entrances. The construction parking and laydown areas outside of FPL-owned property will be secured with a fence or patrolled by private security. No significant impact to the current level of police protection is anticipated.

RECREATION

While there is an abundance of recreational opportunities in Broward County due to its close proximity to the Everglades and the Atlantic Ocean, no parks were identified within one mile of the Lauderdale Plant (see Section 2.2.1). Five regional and eight neighborhood parks maintained by the county are identified within a 5-mile radius of the plant site. A new regional park is planned to open during 1989 (Brian Piccolo) and two others are expanding to meet the demands of a growing population. Population impacts created by constructing the repowered project are minimal because the proposed facilities are located on an existing developed site. Effects associated with construction-generated noise and fugitive dusts will not impact recreation facilities due to the distance from the site (i.e., greater than 1 mile). In addition, the construction area will not be visible from any recreational facility. As a result, no major adverse impact on the supply or utilization of recreational opportunities is expected to occur.

NATURAL GAS

The demand for natural gas in Broward County as a result of constructing the project is expected to increase only as a function of the increase in construction workers. This increase in demand will not significantly affect the existing natural gas supply/demand relationship in terms of availability or cost.

WATER SUPPLY

Potable water is provided to the Lauderdale Plant site by Broward County Environmental Services (Utility District 3A). No capacity limitations are noted nor would the water requirements for constructing the repowered units adversely impact the existing water service to the plant.

SEWAGE TREATMENT

The Lauderdale Plant currently handles its own sanitary wastes through its on-site septic systems. During construction, the existing system and portable chemical toilets will be used. As a result, the repowering project is not expected to have any impact on sewer collection, treatment, or disposal systems in Broward County. Impacts resulting from relocating workers would be negligible due to the small number of workers potentially relocating to the county.

SOLID WASTE DISPOSAL

The Lauderdale Plant's solid waste is collected by a private collection service and disposed of at any one of three landfills including the Miami, West Broward, and Pompano landfills. Any hazardous waste generated by the plant is collected, manifested, and transported to an approved disposal facility. During construction, solid waste not salvageable will be disposed of using current practices. The volume of such waste is not expected to affect significantly the capacity of the current and future facilities (i.e., South Broward County Resource Recovery Project). The increase in generation of solid waste by potentially relocating construction workers will be negligible with respect to the ability to collect, transport, and dispose of such wastes in Broward County.

ECONOMY AND TAXES

The project-induced increases in demand for various public services during the construction phase precede the placement on the tax rolls of the assessed value of the repowered units. As a result, an increase in public services could be generated by the project during its construction phase without a concomitant increase in project-generated taxes. Since the project's workforce is predominantly locally based and its construction schedule is about 2 years, the magnitude of this negative impact is not significant relative to the Broward County economy.

7.2.2 Long-Term External Costs (Impacts)

7.2.2.1 Operation Phase Labor Requirements and Impacts

The Lauderdale Repowering Project is expected to start up during October and November 1992. Commercial operation of both of the repowered units is targeted for late in the fourth quarter of 1992 or the first quarter of 1993. Since these units are replacing two existing steam-generating units, 157 of the estimated 185 total workforce necessary for the repowered facility are already employed at the Lauderdale plant. Therefore, the incremental increase in permanent employment is estimated to be 28 new employees.

The existing steam generating units operates a maintenance shift, from 11:30 p.m. to 7:30 a.m., and two production shifts, from 7:30 a.m. to 4:00 p.m. and 3:00 p.m. to 11:30 p.m. The facility is down during the night. The existing shift personnel are distributed approximately as follows: 10 employees in the maintenance shift, 70 employees in the day shift, and 20 employees in the evening shift. The remainder of the existing personnel assigned to Units 4 and 5 at the Lauderdale Plant are supervisory and are employed during the day shift.

The repowered Units 4 and 5 are expected to operate with three production shifts per day with routine maintenance occurring while the units are on-line. Each shift will be equally manned and will have round-the-clock maintenance. The additional personnel augmenting the existing complement are predominantly associated with the creation of the third operating shift.

A majority of the Lauderdale Plant's future total employment currently is employed at the site; i.e., 157 out of 185, or about 85 percent. Of the additional employees, only a few would likely relocate into the primary impact area since the size of the urban area offers a wide selection of residences. Assuming that 80 percent of the new permanent employees would relocate into Broward County (25 percent of the total to relocate to the primary impact area), six households containing approximately 14 people are projected for the primary impact area. For the remainder of Broward County, about 16 households with 37 people are projected. These projections represent an insignificant impact on the baseline trends in population growth and in-migration.

7.2.2.2 Long-Term Public Service Impacts

HOUSING

As operational personnel relocate to Broward County, the demand for housing, both direct and induced, will increase. The repowering project will add about 28 people to the existing plant's personnel complement. Assuming 80 percent of the new workers will relocate to Broward County, approximately 22 dwelling units will be required in Broward County due to the Lauderdale Repowering Project.

As previously described in Section 7.2.1.2, the large number of existing and projected housing units in the county are sufficient to assimilate the additional operational staff. No impact on real estate values is anticipated due to the minimal housing demand associated with the repowered units' operation. The market values of properties surrounding the existing Lauderdale Plant are not likely to be affected by the repowering project because the Lauderdale Plant has operated at this site since the mid-1920s.

EDUCATION

Approximately 22 new households are projected to in-migrate to Broward County as a result of expanding the plant's operating workforce. Assuming 0.32 school-age individuals for each household, approximately 7 additional students can be expected to enroll in the entire Broward County School District as a result of the repowered plant operations. This number of students is negligible compared to the current Broward County student enrollment of 166,680, and will not significantly impact the existing school system.

Broward County has enacted a school impact fee but it is applicable only to residential development.

MEDICAL FACILITIES COSTS

The relatively modest (i.e., about 50 people) in-migration resulting from operations does not appear to have any adverse impact on the quality or quantity of medical services offered in Broward County or in the vicinity of the project site.

FIREFIGHTING FACILITIES

The operation of the Lauderdale Repowering Project will have no major adverse impact on the demand for firefighting services in Broward County, since the site is currently served by fire departments and fire protection equipment and trained plant personnel will be available.

POLICE PROTECTION

Due to the presence of existing and proposed security facilities at the site, an increase in the demand for police services is not expected to result from operation of the repowered facility.

RECREATION

Since population impacts created by the repowering project are minimal, no major adverse impact on the supply or utilization of recreational opportunities is expected to occur as a result of operating the repowered units.

Broward County has enacted a park impact fee but it is assessed only to residential developments.

ELECTRICITY

Broward County is within the service territory of FPL and includes over 600,000 of FPL's customers. The Lauderdale Repowering Project will add needed generating capacity to the FPL system by 1993 as a whole, and to Broward County specifically. Locating this generation in the area of high electric demand will enhance FPL's ability to serve its customers. This goal is consistent with the Broward County Comprehensive Plan (1989), Policy 08.01.19 which recognized the need for future electrical energy for Broward County residents.

NATURAL GAS

The Lauderdale Repowering Project will receive natural gas from the pipelines currently serving the site. The amount of gas will be contracted for with an interstate supplier and supplied to the site via the Florida Gas Transmission pipeline. The natural gas used at the site will not affect the demand for natural gas used for residential and commercial purposes in Broward County. Any growth associated with new operational employees will not significantly affect natural gas usage in the county.

WATER SUPPLY

Potable water will be provided to the Lauderdale Plant site by the City of Hollywood. No capacity limitations are noted nor would the potable water requirements for the repowered units adversely impact the existing water service to the plant. The Lauderdale Repowering Project will not cause a significant increase in the plant demand or the household demand for potable water in Broward County.

SEWAGE TREATMENT

The majority of the sanitary wastes from the repowered facility will be routed to the City of Hollywood regional sewage system. The amount of sewage, about 65,000 gallons per day, is small compared to the facilities' capacity to treat wastewater. Impacts resulting from operational employees relocating to Broward is expected to be negligible due to the small number of workers relocating.

SOLID WASTE DISPOSAL

During operation of the Lauderdale Repowering Project, solid waste will be collected and disposed of at an approved disposal facility. Any hazardous waste generated by the plant will be collected, manifested, and transported to an approved hazardous waste disposal facility. Present wastestreams generated at the Lauderdale Plant will not be altered significantly by the repowering project. The increase in generation of solid waste by any relocating workers will be negligible with respect to the county's ability to handle solid wastes.

REFERENCES

Broward County. 1989. Comprehensive Plan 1989: Volume 1, 1989 Broward County Land Use Plan; Volume 2, Elements; Volume 3; Support Documents; Volume 4, Appendices.

Broward County Tax Assessor's Office. 1989. Broward County Tax Roll.

Florida Power & Light Company Property Tax Department. 1989. Personal Communication to Dan Richardson of Hunter Services from Jim Pence Regarding Assessed Values and Property Taxes, FPL Lauderdale Plant.

U.S. Department of Commerce. 1986. Regional Multipliers: A User Handbook for the Regional Input-Output Modeling System (RIMSII). Bureau of Economic Analysis.

University of Florida. 1988. Florida Statistical Abstract. Bureau of Economic and Business Research. The University Presses of Florida. Gainesville, Florida.

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Lauderdale Repowering Project

Site Certification Application

Chapter 8

Site And Design Alternatives

8.0 SITE AND DESIGN ALTERNATIVES

This optional chapter of the SCA is not being submitted as part of the application because it is not anticipated that an EIS under the National Environmental Policy Act (NEPA) would be required for the project.

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Lauderdale Repowering Project

Site Certification Application

Chapter 9

Coordination

9.0 COORDINATION

State, regional, and local agencies were contacted to inform these agencies about the Lauderdale Repowering Project and solicit their comments. The focus of these meetings and contacts was on the Environmental Licensing Plan of Study (POS). This POS outlined the engineering information, the environmental baseline studies, and the impact analyses that would be used to support this SCA. The specific objective of the POS was to achieve agreement with FDER and other affected agencies as to scope, quantity, and specificity of information that would be provided in the SCA, as well as the methods to be used in providing such information and the nature of the supporting documents to be included in the application [pursuant to 403.5063 F.S. and Chapter 17-17.041(5), F.A.C.] The POS was submitted to FDER on August 25, 1988. Public notices of Intent to File an Application for Power Plant Site Certification and of Proposed Binding Written Agreement were published on September 9 and 24, 1988. After meeting with some of the affected agencies and responding to comments received on the POS, the FDER formally agreed on May 25, 1989, as to the scope, quantity, and specificity of information to be provided in the application for certification. During the development of the POS and the final agreement as to its contents, the following agencies were contacted.

Florida Department of Environmental Regulation

May 23, 1988--Meeting with H.S. Oven, Jr.: initial briefing on Lauderdale Repowering Project.

July 8, 1988--Meeting with district staff including L. Devillon, P. Phillips, S. Brooks, L. O'Donnell, V. Kamath, and H.S. Oven, Jr., from Tallahassee: briefing on Lauderdale Repowering Project.

August 25, 1988--Meeting with H.S. Oven, Jr.: T. Rogers, B. Andrews, T. Collins, and S. H. Chu: submission of Plan of Study and review of Air Monitoring Plan.

November 30, 1988--Meeting with H.S. Oven, Jr.: discussion of agency comments to Plan of Study.

South Florida Water Management District

August 9, 1988--Briefing of staff on project.

December 12, 1988--Meeting with S. Coughanour and S. Lamb: discussion of comments on Plan of Study.

June 28, 1989--Meeting with S. Lamb: submission of permit applications for on-site auxiliary cooling water wells.

Florida Department of Natural Resources

November 22, 1988--Telephone conversation with G. Henderson of Division of Recreation and parks: Plan of Study and Impacts to Manatee.

December 23, 1988--Telephone conversation with G. Henderson: draft response to Plan of Study.

January 25, 1989--Telephone conversation with L. Dye: response to Plan of Study.

Broward County Environmental Quality Control Board

July 7, 1988--Meeting with V. Howard, J. Andrews, G. Carlson, D. Banu, and G. Malmstrom: brief staff on Lauderdale Repowering Project.

October 6, 1988--Telephone conversation with D. Banu: discuss question on air emissions.

Broward County Resource Recovery Office

August 30, 1988--Meeting with T. Henderson: brief him on the project.

November 11, 1988--Meeting with T. Henderson: discuss project.

Broward County Office of Planning

October 19, 1988--Meeting with D. Kowell, Director, Office on Planning: discuss project.

November 10 and 16, 1988--Discussions and meetings with D. Kowell and A. Shamoun: discuss zoning and compatibility with Comprehensive Plan.

January 10, 1989--Telephone conversation with Marty Burger on impact fees.

Broward County Parks and Recreation Department

April 10, 1989--Telephone discussion with Larry Lietzke on urban wilderness areas.

August 7, 1989--Telephone discussion with G. Maurer on demolition requirements.

September 8 and October 5, 1989--Telephone conservation with C. Tornese concerning building permits.

Broward County Attorney's Office

November 1989 through August 1989--Conversations and meetings with B. Hall concerning compatibility with land use plan.

Broward County Planning Council

February 2, 1989--Telephone conversation with P. Ross on land use plan.

Broward County Aviation Department

April 27, 1989--Discussion with Grace Galiano concerning airport zoning.

City of Hollywood

October 5 and 24, 1989--Telephone conversation with I. Rosenbaum concerning annexation and availability of services.

In addition to the above-listed state, regional, and local agencies, meetings and discussions were held with EPA. The purpose of these contacts was to inform EPA about the project and to obtain a decision regarding the applicability of the repowering project to be a new source under Section 306 of the Federal Water Pollution Control Act. The project was discussed initially with EPA on June 13, 1988 (Charles Kaplan, Yvonne Martin, Robert B. Howard, and David R. Hopkins), and subsequent discussions were held from August 1988 through August 1989. EPA determined that the Lauderdale Repowering Project would not be a new source and that only a modification to the existing NPDES permit would be required for the project. The application to modify the NPDES permit is contained in Appendix 10.1.2.

U.S. Fish and Wildlife Service (Joseph D. Carrol and David L. Ferrell) in Vero Beach was briefed on November 7, 1989, concerning the aspects related to the dredge-and-fill permit and manatee no-entry zone.

The Lauderdale Plant site location is about 2 miles west of the Fort Lauderdale-Hollywood International Airport. As such, the facility is within the landing zone of the airport. The proposed location and height of the new stacks associated with the project requires notification of the Federal Aviation Administration. This notification is presented in Appendix 10.1.7.