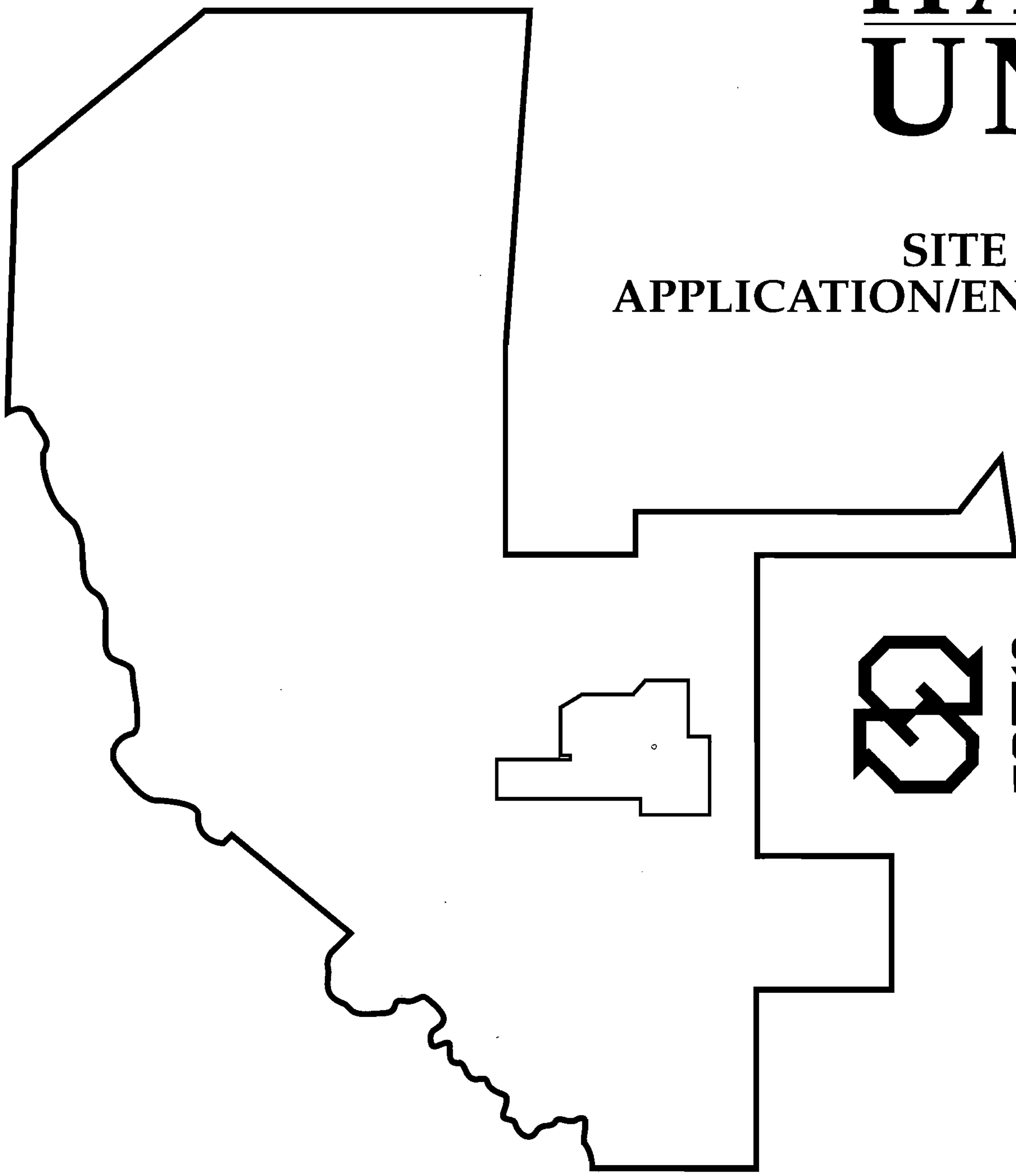
HARDEE UNIT 3

SITE CERTIFICATION APPLICATION/ENVIRONMENTAL ANALYSIS

Volume I
Chapters 1–9

Submitted by

SEMINOLE ELECTRIC COOPERATIVE INCORPORATED



APPLICANT INFORMATION

Please supply the following information:

Applicant's Official Name *Seminole Electric Cooperative Incorporated*

Address *P.O. Box 272000 Tampa, FL 33688-2000*

Address of Official Headquarters *P.O. Box 272000 Tampa FL 33688-2000*

Business Entity (corporation, partnership, co-operative) *Co-operative*

Names, owners, etc. *Seminole Electric Cooperative Incorporated*

Name and Title of Chief Executive Officer *William C. Walbridge*
Executive Vice President

Name, Address, and Phone Number of Official Representative responsible for obtaining certification: *Michael Opalinski, P.O. Box 272000*
Tampa, FL 33688-2000 (813) 963-0994

Site Location (county) *Hardee, Polk*

Nearest Incorporated City *Bowling Green*

Latitude and Longitude *27° 38' 30" N 81° 57' 45" W*

UTM's Northerly *3057.7 km*

Easterly *405.0 km*

Section, Township, Range *Section 1, Township 33S, Range 22E*

Location of any directly associated transmission facilities (counties) *None*

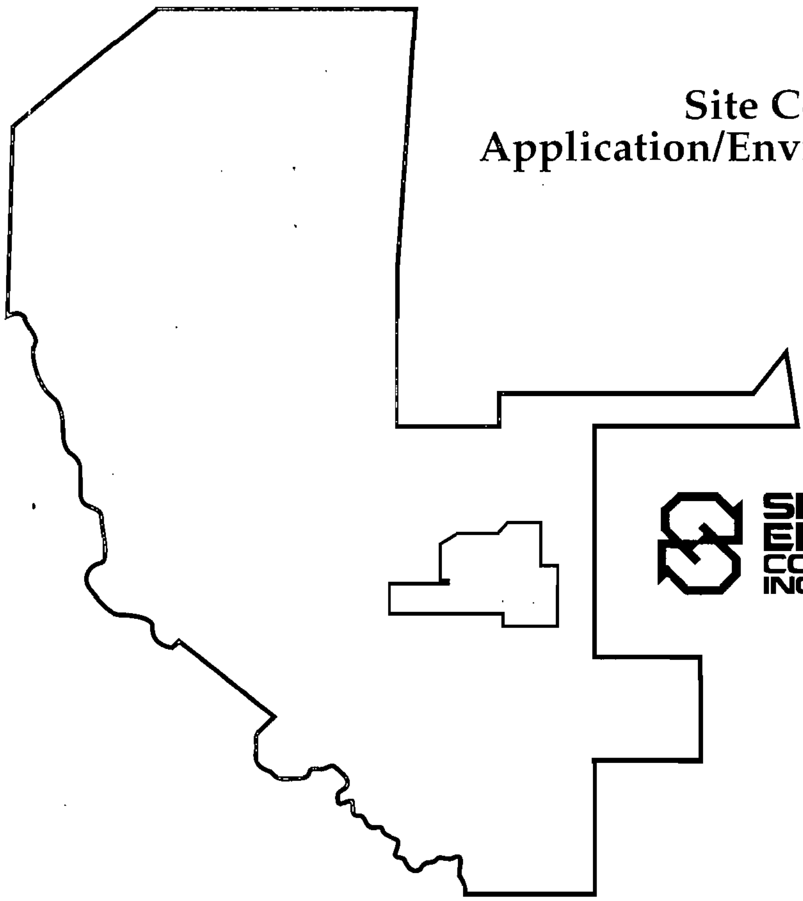
Name Plate Generating Capacity *440 Megawatts*

Capacity of Proposed Additions and Ultimate Site Capacity (where applicable) *440 Megawatts, 880 Megawatts*

Remarks (additional information that will help identify the applicant): ____________________

HARDEE UNIT 3

Site Certification Application/Environmental Analysis



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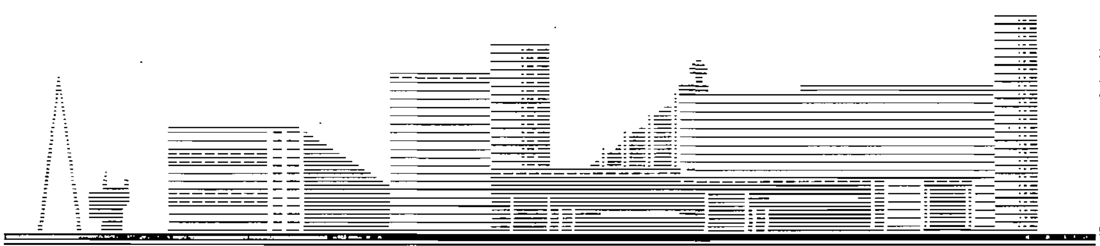


Table of Contents

TABLE OF CONTENTS
(Page 1 of 15)

TABLE OF CONTENTS
(Page 2 of 15)

CHAPTER 2.0
SITE AND VICINITY CHARACTERISTICS

TABLE OF CONTENTS
(Page 3 of 15)

TABLE OF CONTENTS
(Page 4 of 15)

TABLE OF CONTENTS
(Page 5 of 15)

CHAPTER 3.0
THE PLANT AND DIRECTLY ASSOCIATED FACILITIES

TABLE OF CONTENTS
(Page 6 of 15)

TABLE OF CONTENTS
(Page 7 of 15)

TABLE OF CONTENTS
(Page 8 of 15)

CHAPTER 4.0
EFFECTS OF SITE PREPARATION AND PLANT AND ASSOCIATED FACILTIIES CONSTRUCTION

TABLE OF CONTENTS
(Page 9 of 15)

CHAPTER 5.0
EFFECTS OF PLANT OPERATION

TABLE OF CONTENTS
(Page 10 of 15)

TABLE OF CONTENTS
(Page 11 of 15)

TABLE OF CONTENTS
(Page 12 of 15)

CHAPTER 6.0
TRANSMISSION LINES AND OTHER LINEAR FACILITIES

CHAPTER 7.0
ECONOMIC AND SOCIAL EFFECTS OF PLANT CONSTRUCTION AND OPERATION

TABLE OF CONTENTS
(Page 13 of 15)

CHAPTER 8.0
SITE AND DESIGN ALTERNATIVES

TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF TABLES
(Page 1 of 7)

LIST OF TABLES
(Page 2 of 7)

LIST OF TABLES
(Page 3 of 7)

LIST OF TABLES
(Page 4 of 7)

LIST OF TABLES
(Page 5 of 7)

LIST OF TABLES
(Page 6 of 7)

LIST OF TABLES
(Page 7 of 7)

LIST OF FIGURES
(Page 1 of 4)

LIST OF FIGURES
(Page 2 of 4)

LIST OF FIGURES
(Page 3 of 4)

LIST OF FIGURES
(Page 4 of 4)

LIST OF ABBREVIATIONS AND ACRONYMS
(Page 1 of 4)

AAQS	ambient air quality standards
ADA/DRI	Application for Development Approval/Development of Regional Impacts
ADT	average daily traffic
ANSI	American National Standards Institute
B&K	Bruel & Kjaer
BACT	best available control technology
BMP	best management practices
Btu	British thermal unit
Btu/kW	British thermal unit per kilowatt
$CaCO_3$	calcium carbonate
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CFRPC	Central Florida Regional Planning Council
cfs	cubic feet per second
CH_4	methane
cm	centimeter
cm/yr	centimeters per year
CO	carbon monoxide
CO_2	carbon dioxide
COS	carbonyl sulfide
CR	County Road
CT	combustion turbine
CWCGP	Cool Water Coal Gasification Program
dB	decibels
dBA	A-weighted decibels
DHR	Division of Historical Resources
EA	environmental assessment
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
EPRI	Electric Power Research Institute
ESE	Environmental Science and Engineering, Inc.
F.A.C.	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FDLES	Florida Department of Labor and Employment Statistics
FDOT	Florida Department of Transportation
FEPPSA	Florida Electrical Power Plant Siting Act
FGFWFC	Florida Game and Fresh Water Fish Commission
FIPR	Florida Institute of Phosphate Research

LIST OF ABBREVIATIONS AND ACRONYMS
(Page 2 of 4)

FLUFCCS	Florida Land Use, Forms and Cover Classification System
FNAI	Florida Natural Areas Inventory
FPC	Florida Power Corporation
FPL	Florida Power & Light Company
FS	Florida Statutes
ft/sec	feet per second
ft	foot
ft-msl	feet above mean sea level
ft^2/sec	square feet per second
ft^3	cubic feet
GEP	good engineering practices
gpd	gallons per day
gpd/ft	gallons per day per foot
gpm	gallons per minute
H_2	hydrogen
H_2SO_4	sulfuric acid
ha	hectare
HCN	hydrocyanic acid
HPP	Hardee Power Partners, Limited
HPS	Hardee Power Station
HRSG	heat recovery steam generators
Hz	Hertz
IPP	independent power producers
ISCST2	Industrial Source Complex Short-Term
KBN	KBN Engineering and Applied Sciences, Inc.
kg/cm^2	kilograms per square centimeter
km	kilometers
kV	kilovolt
kW	kilowatt
lb/day	pounds per day
LOS	level of service
Lpm/30 m	liters per minute per 30 linear meters
m	meters
m-msl	meters above mean sea level
m^3	cubic meters
mgd	million gallons per day
mg/L	milligrams per liter

LIST OF ABBREVIATIONS AND ACRONYMS
(Page 3 of 4)

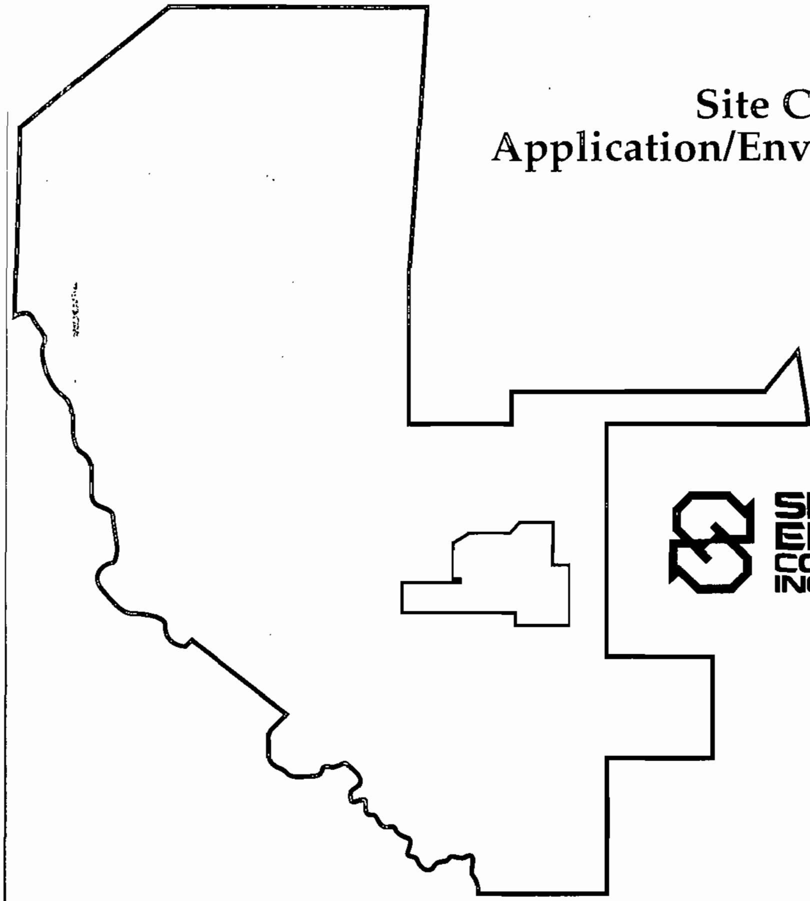
MIA	Most Impacted Areas
MMBtu	million British thermal units
MSSW	Management and Storage of Surface Waters
MW	megawatt
NEPA	National Environmental Policy Act
NO_2	nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NO_x	nitrogen oxide
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NTU	Nephelometric turbidity unit
NWS	National Weather Service
NYSDPS	New York State Department of Public Service
O_3	ozone
Pb	lead
pC/L	picocuries per liter
PM	particulate matter
PM10	particulate matter with an aerodynamic diameter less than or equal to 10 micrometers
POS	Plan of Study
PR	partial requirements
PSC	Public Service Commission
PSD	prevention of significant deterioration
PWRR	present worth revenue requirements
QA	quality assurance
QA/QC	quality assurance/quality control
QF	qualifying facility
RCRA	Resource Conservation and Recovery Act
REA	Rural Electrification Administration
RIMS II	Regional Input-Output Modeling System
SCA/EA	Site Certification Application/Environmental Analysis
SCA	Site Certification Application
SCOT	Shell-Claus Offgas Treatment
SCS	U.S. Soil Conservation Service
SECI	Seminole Electric Cooperative Incorporated
SEL	sound exposure level

LIST OF ABBREVIATIONS AND ACRONYMS
(Page 4 of 4)

SO_2	sulfur dioxide
SO_4	sulfate
SPCC	Spill Prevention Control and Countermeasure
SPL	sound pressure level
SPPP	Stormwater Pollution Prevention Plan
SR	State Road
ST	steam turbine
SWFWMD	Southwest Florida Water Management District
SWUCA	Southern Water Use Conservation Area
Syngas	synthetic gas
TBEL	technology-based effluent limitation
TPD	tons per day
TPS	TECO Power Service
TPY	tons per year
USACE	U.S. Army Corps of Engineers
USC	United States Code
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VOC	volatile organic compound
WQBEL	water-quality-based effluent limitation
$\mu g/m^3$	micrograms per cubic meter
$\mu g/L$	micrograms per liter
$\mu mho/cm$	micromhos per centimeter

HARDEE UNIT 3

Site Certification Application/Environmental Analysis



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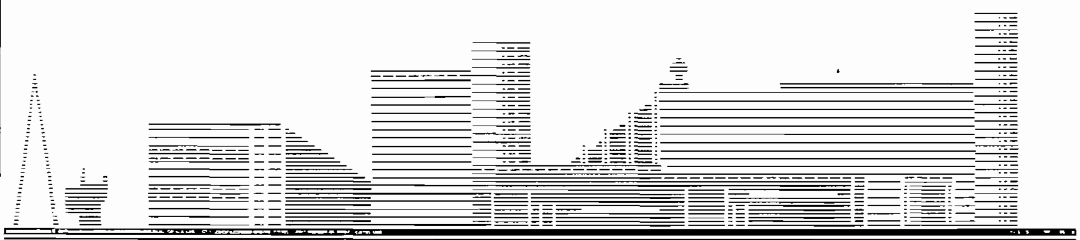

Chapter 1.0

1.0 NEED FOR POWER AND THE PROPOSED FACILITIES

TABLE OF CONTENTS

CHAPTER 1
NEED FOR POWER AND THE PROPOSED FACILITIES

LIST OF TABLES

LIST OF FIGURES

1.1 INTRODUCTION

1.1.1 THE APPLICANT

Seminole Electric Cooperative Incorporated (SECI) is a generation and transmission cooperative which generates and transmits bulk supplies of electricity to 11 member distribution cooperatives throughout Florida (Figure 1.1.1-1). More than 1 million Floridians in 45 counties rely on SECI for their electricity. SECI's existing generating capabilities consist of two 600-megawatt (MW) coal-fired units near Palatka, Florida, and a 14.4-MW share of Florida Power Corporation's (FPC's) Crystal River Unit 3 nuclear power plant. In addition, SECI owns 70 miles of 230-kilovolt (kV) double-circuit transmission line, 140 miles of 230-kV single-circuit transmission line, and 157 miles of 69-kV transmission line connecting with its existing power plant, substations, and other distribution systems. SECI also purchases backup power from Hardee Power Partners, Limited (HPP), an affiliate of TECO Power Services (TPS). This backup power is obtained from the Hardee Power Station (HPS) existing combined cycle units.

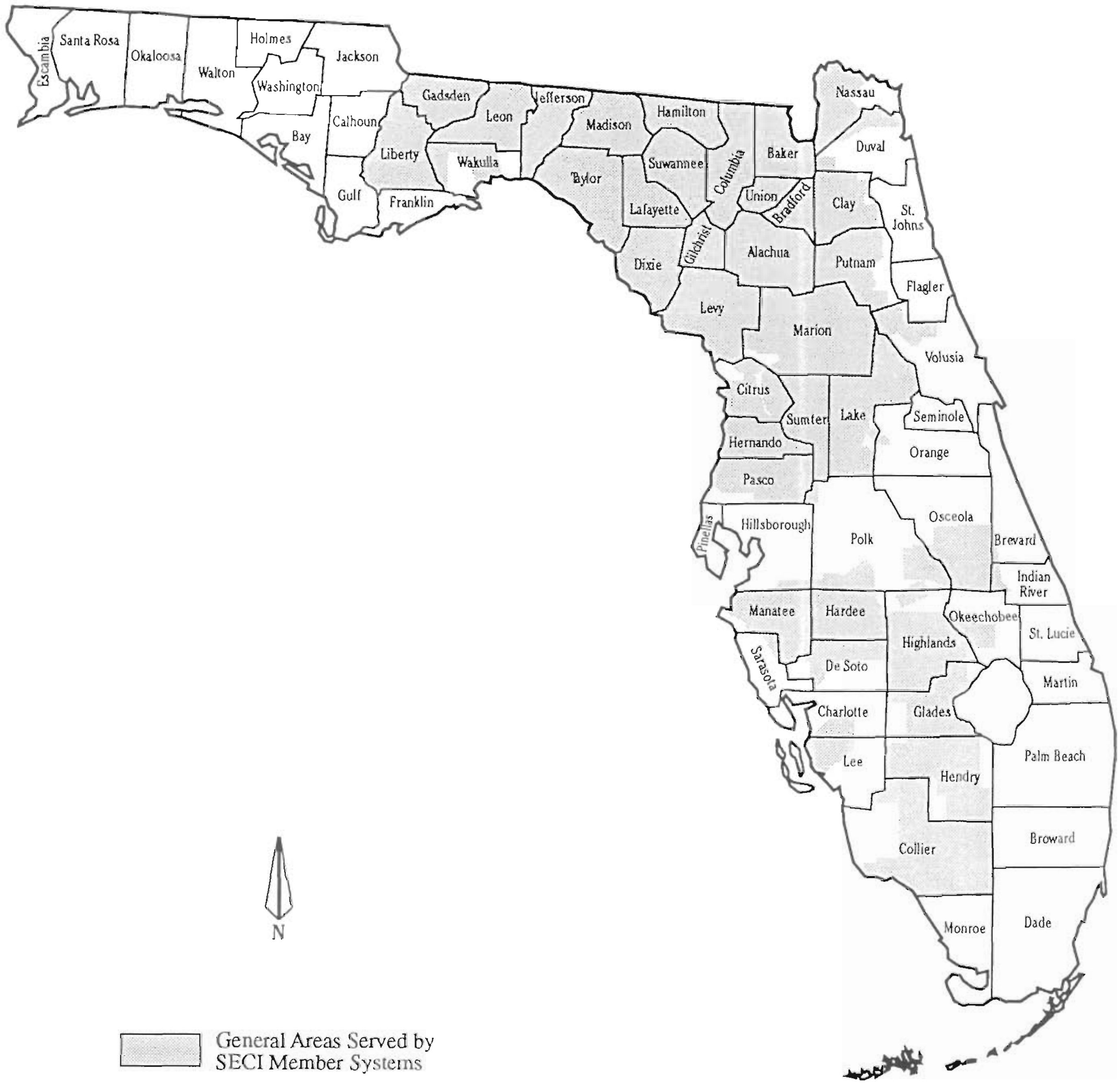

Figure 1.1.1-1
General Areas Served by SECI Member Systems

Sources: SECI, 1994; KBN, 1994.

SEMINOLE ELECTRIC COOPERATIVE INCORPORATED

1.1.2 PURPOSE OF SITE CERTIFICATION APPLICATION/ENVIRONMENTAL ANALYSIS

SECI is proposing to own and operate a new 440-MW combined cycle power plant [the Hardee Power Station Unit 3 (Hardee Unit 3) Project]. This facility will be constructed under a turnkey construction contract with Westinghouse Electric Corporation and Black & Veatch Construction, Inc. The Hardee Unit 3 Project will be located on the existing HPS site and will represent an incremental increase in the ultimate power-generating capacity of the HPS site from 660 MW to 880 MW. The HPS site was selected as the preferred location for the Hardee Unit 3 Project because this site has been previously certified for 660 MW of combined cycle power generation (Certification Number PA89-25) (TPS/SECI, 1989). Furthermore, the HPS site has adequate area to accommodate the proposed expansion from 660 MW to 880 MW. Locating the Hardee Unit 3 Project at the HPS site takes advantage of the existing infrastructure and onsite facilities, and minimizes potential environmental impacts that might otherwise be associated with the construction of a combined cycle power plant at a previously undeveloped site.

The licensing of power plants in Florida requires compliance with federal, state, regional, and local laws, regulations, and ordinances. The two primary laws governing the licensing of this project are the Florida Electrical Power Plant Siting Act [FEPPSA, 403.501-403.517-518, Florida Statutes (FS)] and the National Environmental Policy Act (NEPA).

FEPPSA establishes the state's policy toward balancing the needs for increased electrical power generation with the effects on human health, the environment and ecology of the lands and waters within the state. In the site certification process, the Florida Public Service Commission (PSC) is the exclusive forum for the determination of need, and the Florida Department of Environmental Protection (FDEP) acts as the central coordinator of the certification process. Certification begins with the submittal of a Site Certification Application (SCA) to FDEP by the applicant and culminates with approval by the Governor and Cabinet. Implementation procedures are set forth in FEPPSA and Chapter 17-17, Florida Administrative Code (F.A.C.), Electrical Power Plant Siting.

NEPA is the national charter for protection of the environment. It establishes policy, sets goals, and provides means for carrying out the policy. The Council on Environmental Quality (CEQ) promulgates regulations [40 Code of Federal Regulations (CFR) 1500] to guide federal agencies in complying with the procedures and achieving the goals of NEPA. In meeting its responsibilities under NEPA and CEQ regulations, the U.S. Department of Agriculture's Rural Electrification Administration (REA) has determined that its loan guarantee commitments to SECI for bulk power generation such as Hardee Unit 3 are major federal actions significantly affecting the quality of the human environment. Therefore, these commitments are subject to NEPA and CEQ regulations. REA typically requires a borrower to prepare an environmental analysis (EA) document prior to REA preparing its own environmental impact statement (EIS). REA's environmental policies and procedures are presented in 7 CFR 1794. In the case of the Hardee Unit 3 Project, since an EA and EIS have been previously prepared for the HPS and since the Hardee Unit 3 Project represents an incremental increase to the overall generating capacity of the HPS site, it has been determined by REA that requirements under NEPA will be satisfied through the preparation of a supplemental EA and EIS for the proposed project.

This single environmental application, an SCA/EA, is being submitted to FDEP and REA describing the Hardee Unit 3 Project and the environmental conditions and impacts associated with the project. This SCA/EA has been prepared to meet the requirements of the two primary laws, i.e., FEPPSA and NEPA, which govern this project. This SCA/EA follows the scope, quantity, and specificity of information described in the SECI Hardee Unit 3 Environmental Licensing Plan of Study (KBN, 1993). Approvals and binding agreements were requested for this Plan of Study pursuant to Section 403.5063, FS, and Chapter 17-17.041(6), F.A.C. SECI has responded to agency comments on matters to be addressed in this SCA.

Agency and public comments regarding the project have been obtained through meetings, discussions, and presentations. State and federal interagency meetings and public scoping meetings regarding the Hardee Unit 3 Project were held in December 1993. Public informational meetings were held in March 1994.

1.2 NEED FOR THE PROJECT

SECI has determined that in order to continue to provide the most reliable, cost-effective service to its customers, it must replace 440 MW of power currently purchased on a partial requirements (PR) basis from Florida Power & Light Company (FPL) with power from another source beginning in 1999. Through a competitive bidding and negotiation process, SECI has determined that the best alternative for displacing that 440 MW of PR purchases is construction and operation of the proposed 440-MW Hardee Unit 3 combined cycle generating facility.

The Hardee Unit 3 Project will save SECI's members $20 million during the project's first year of operation, and approximately $299 million in present worth revenue requirements (PWRR) over a 30-year period, compared to continuing to purchase the replaced capacity and energy from FPL. The Hardee Unit 3 Project also enhances the reliability of SECI's system, defers the need for SECI to add combustion turbine capacity to meet its reliability criterion, and reduces the risk to SECI in the event that FPL seeks to significantly modify the current PR arrangement.

1.2.1 POWER SUPPLY PLANNING PROCESS

SECI uses its on-going power supply planning process to evaluate the adequacy of SECI's resources to meet its members' capacity and energy needs as well as the cost-effectiveness of displacing PR purchases by building or purchasing additional capacity.

SECI's 1989 Power Supply Study showed for the first time that there would be a substantial economic benefit to SECI to build or purchase combined cycle capacity to replace between 440 MW and 660 MW of PR purchases between 1998 and 2000.

Based on this study, SECI issued a Request for Proposals (RFP) in July 1990, soliciting both turnkey and purchased power proposals for capacity in the 1998 to 2000 timeframe. Turnkey bids were solicited for combined cycle capacity. Purchased power bids with no limitation on the type of capacity were solicited from qualifying facilities (QFs), independent power producers (IPPs), and other utilities. SECI received responses to the RFP from both turnkey bidders and purchased power bidders.

In 1991, SECI updated its power supply analysis based on then-current planning assumptions. The updated analysis (known as the Late 90s Power Supply Study) showed that the addition of 440 MW of combined cycle capacity in 1999 to replace PR purchases from FPL was the best alternative for SECI. Based on this updated analysis, SECI in December 1991 gave the required 7 years' notice to FPL that it intended to increase its capacity commitment in FPL's control area by 440 MW effective January 1, 1999. This notice relieved FPL of the obligation to plan to serve this portion of SECI's needs and placed this obligation on SECI.

In January 1992, SECI solicited updated responses to the RFP based on the revised timing of the unit additions that resulted from the Late 90s Power Supply Study. Responses to the revised solicitation were received in February 1992 from all of the original turnkey and purchased power bidders. Following a period of evaluation and negotiation with both turnkey and purchased power bidders, SECI selected a turnkey proposal by Black & Veatch/Westinghouse for a 440-MW combined cycle unit as the best project for meeting SECI's 1999 capacity need. A contract with Black & Veatch/Westinghouse for the construction of Hardee Unit 3 was executed in June 1993.

1.2.2 NEED FOR POWER STUDY

In preparing the application for a need determination, SECI reexamined the economics of displacing PR purchases with the 440-MW plant to be built by Black & Veatch/Westinghouse using SECI's most recent generation planning assumption. The analysis, which is detailed in the need for power document filed with the PSC on December 17, 1993, shows that using Hardee Unit 3 to replace 440 MW of PR purchases from FPL beginning in 1999 provides 30-year savings of $299 million PWRR compared to a "no replacement" scenario under SECI's current base case planning assumptions.

SECI also performed numerous sensitivity analyses to determine if the construction of Hardee Unit 3 would provide benefits in the event of significant changes in planning assumptions. Those analyses show that the plan is robust in that it provides savings to SECI under a wide range of assumptions. For example, the plan provides savings even if:

- Projected increases in FPL's PR capacity charges to SECI do not materialize,
- Load growth is substantially lower than expected, or
- Fuel prices are either higher or lower than projected.

The Need Determination Study confirmed that SECI's decision in late 1991 to give 7 years' notice to FPL based on then-existing conditions remains sound under a wide range of planning assumptions, including those currently projected.

1.2.3 LOAD FORECAST AND RELIABILITY

The need for an additional 440 MW of capacity on SECI's system is not driven by projected load growth. Even after the addition of Hardee Unit 3, the growth in SECI's peak load (except in its direct serve area) will be met by FPL and FPC under the existing PR contracts. By serving an additional 440-MW increment of load with its own resources, rather than by continuing to purchase this capacity and energy from FPL, SECI expects to save $299 million (PWRR) over a 30-year period while at the same time increasing reliability. Thus, while load forecasts are an important part of any utility planning process, load growth in this case is not the driving factor in the need for Hardee Unit 3.

1.2.4 CONSERVATION AND LOAD MANAGEMENT

Conservation and load management programs that provide significant demand and energy reductions are reflected in SECI's load and energy forecasts. These programs serve primarily to reduce the amount of SECI's load during peak hours. Even after the addition of Hardee Unit 3, SECI's loads during peak periods within the FPL and FPC control areas will continue to be met by PR purchases from those companies. Thus while additional conservation would further reduce the cost of SECI's operations by reducing its PR purchases from FPL and/or FPC, it would not affect either the amount or timing of SECI's need for capacity to cost-effectively replace PR purchases.

1.2.5 RELIABILITY AND STRATEGIC CONSIDERATIONS

The addition of Hardee Unit 3 enhances the reliability of the SECI system from both technical and strategic perspectives. First, the addition of Hardee Unit 3 increases the predicted reliability of the SECI system and defers for 5 years (from 1999 to 2004) the need to add combustion turbine capacity for reliability purposes. Second, under the current PR contract with FPL, FPL has the right, on 7 years' notice, to seek to terminate the contract effective on or after May 2004. By replacing a portion of the PR purchases from FPL with its own resources in 1999, SECI reduces the risk that it might have to replace significant amounts of capacity in 2004 in the event that FPL seeks to terminate the current PR contract.

1.2.6 CONSEQUENCES OF DELAY

Upon giving notice to FPL in December 1991, SECI assumed an obligation to provide an additional 440 MW of capacity to serve load in FPL's control area beginning January 1, 1999. SECI may no longer rely on FPL to meet this portion of its members' needs, and FPL has stopped planning to meet this need. SECI must therefore have 440 MW of additional capacity resources in place by January 1, 1999 to maintain reliable service to its members. Any delay in licensing the proposed plant would result in SECI being forced to seek power purchases from other sources, if available, or to add shorter lead time combustion turbine units in order to maintain acceptable system reliability. Either of these alternatives would be only a temporary solution and would result in increased costs to SECI's members.

1.2.7 IMPACT ON STATEWIDE NEED

The construction of Hardee Unit 3 will not result in excess generating capacity on a statewide basis. This lack of excess capacity is evidenced by the fact that no Florida utility responded to SECI's RFP with an offer to provide this capacity from existing resources.

Further, the load that Hardee Unit 3 will serve must be met either by SECI or by FPL. When SECI notified FPL that it would assume the obligation to meet this load, FPL took its reduced responsibility into account in its own generation planning process. FPL has reported that SECI's replacement of these PR purchases, along with other factors, has deferred FPL's need for additional generating capacity from 1998 and 1999 to the year 2000.

The addition of Hardee Unit 3 also defers SECI's need for 75 MW of backup capacity from 1999 to 2004. The need for this capacity exists because SECI has been unable to obtain long-term contractual commitments from other Florida utilities for additional purchased power in this timeframe. This inability to locate long-term purchases is further evidence that other Florida utilities do not expect to have excess capacity available in the late 1990s timeframe.

1.2.8 NEED PETITION FILING

On December 17, 1993, SECI filed a petition to determine need for a 440-MW combined cycle unit, having an in-service date of January 1, 1999, with the PSC, pursuant to Section 403.519, FS, Docket No. 931212-EC. SECI also submitted a comprehensive Need Determination Study and Need Determination Study Appendices to the PSC in support of that petition. Those documents contain the information required by the PSC's rule (Chapter 25-22.081, F.A.C.) in order for the PSC to make a determination of need for the facilities pursuant to FEPPSA. Copies of those documents are available for inspection at the PSC, Division of Records and Reporting, 101 East Gaines Street, Tallahassee, Florida, and at the SECI Corporate Offices, 16313 North Dale Mabry Highway, Tampa, Florida.

The PSC held public hearings on SECI's petition on March 30, 1994.

The PSC Order on Need Determination, which is expected to be issued by June 1994, will be furnished when available (see Appendix 10.8).

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1.3 OVERVIEW OF HARDEE UNIT 3 PROJECT

1.3.1 INTRODUCTION

The Hardee Unit 3 Project will consist of a 440-MW (net capacity) combined cycle unit to be constructed at the previously certified HPS site, adjacent to the HPS existing units. The proposed project will utilize dry low nitrogen oxide (NO_x) combustors and will burn natural gas as the primary fuel with low sulfur fuel oil as backup fuel. Hardee Unit 3 will share a number of the existing onsite facilities, such as the cooling reservoir and existing transmission lines, with the HPS existing units. SECI is currently finalizing plans with TECO Power Services to share additional existing onsite facilities.

This document addresses the environmental aspects of the Hardee Unit 3 Project: Hardee Unit 3 facilities are described in Chapter 3.0. Terminology used through this SCA/EA document is presented in Table 1.3.1-1.

Table 1.3.1-1. Hardee Unit 3 Project Terminology

Terminology	Definition
Hardee Power Station Unit 3 (Hardee Unit 3)	Proposed power plant project consisting of a 440-MW combined cycle unit to be constructed on the Hardee Power Station site
Hardee Power Station (HPS)	Previously certified 660-MW combined cycle power plant located on the Hardee Power Station site
HPS Site	The 526-ha (1,300-acre) site located in Hardee and Polk counties
HPS Existing Units	Existing 295-MW power plant located at the HPS site
HPP	Hardee Power Partners, a subsidiary of TECO Power Services, formed to operate the TPS generation facility at HPS
Existing Cooling Reservoir	Existing 230-ha (570-acre) cooling reservoir originally certified and constructed as part of the HPS
Hardee Unit 3 Site	The 20-ha (50-acre) area and all facilities to be constructed for the Hardee Unit 3 project
Access Road	The access road between Fort Green Road and the Hardee Unit 3 site

Source: KBN, 1994.

1.3.2 GENERAL SITE LOCATION AND DESCRIPTION

The Hardee Unit 3 Project will be located on the 526-hectare (ha) (1,300-acre) HPS site in Hardee and Polk counties approximately 14 kilometers (km) (9 miles) northwest of Wauchula, 26 km (16 miles) south-southwest of Bartow, and 64 km (40 miles) east of Tampa Bay (Figures 1.3.2-1 and 1.3.2-2). The entire HPS site is owned by the Acuera Corporation, Inc., a subsidiary of SECI. The HPS site is bordered on the east by County Road (CR) 663, a CSX right-of-way, and CF Industries' Hardee Complex. IMC-Agrico properties surround the remaining portions of the site. Payne Creek flows along the southern and western boundary of the HPS site. The Hardee Unit 3 facility will occupy approximately 20 ha (50 acres) of the HPS site as depicted in Figure 1.3.2-3. An aerial photograph of the proposed site location with a simulation of the proposed facility is presented in Figure 1.3.2-4.

In 1990, a final certification order issued pursuant to the FEPPSA was obtained from the Governor and Cabinet (Certification Number PA89-25). The certification authorized construction and operation of 295 MW of combined cycle facilities for TPS and established a 660-MW ultimate site capacity for the HPS site. In 1991, REA issued a final EIS for the project which allowed for the construction and operation of up to 660 MW of combined cycle power generating capacity at the HPS site.

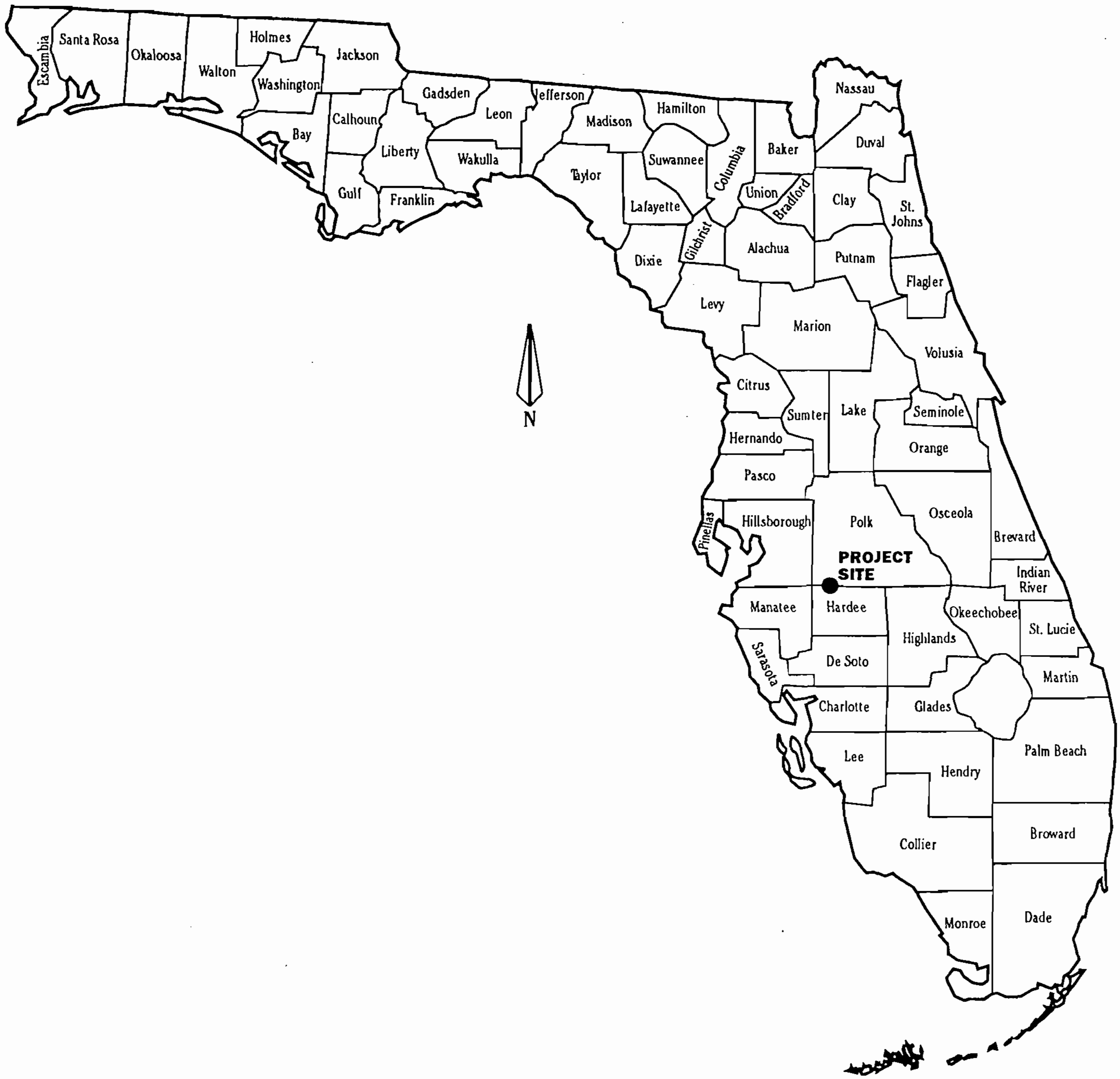

Figure 1.3.2-1
SECI Hardee Unit 3 Project Site Area

Sources: SECI, 1994; KBN, 1994.

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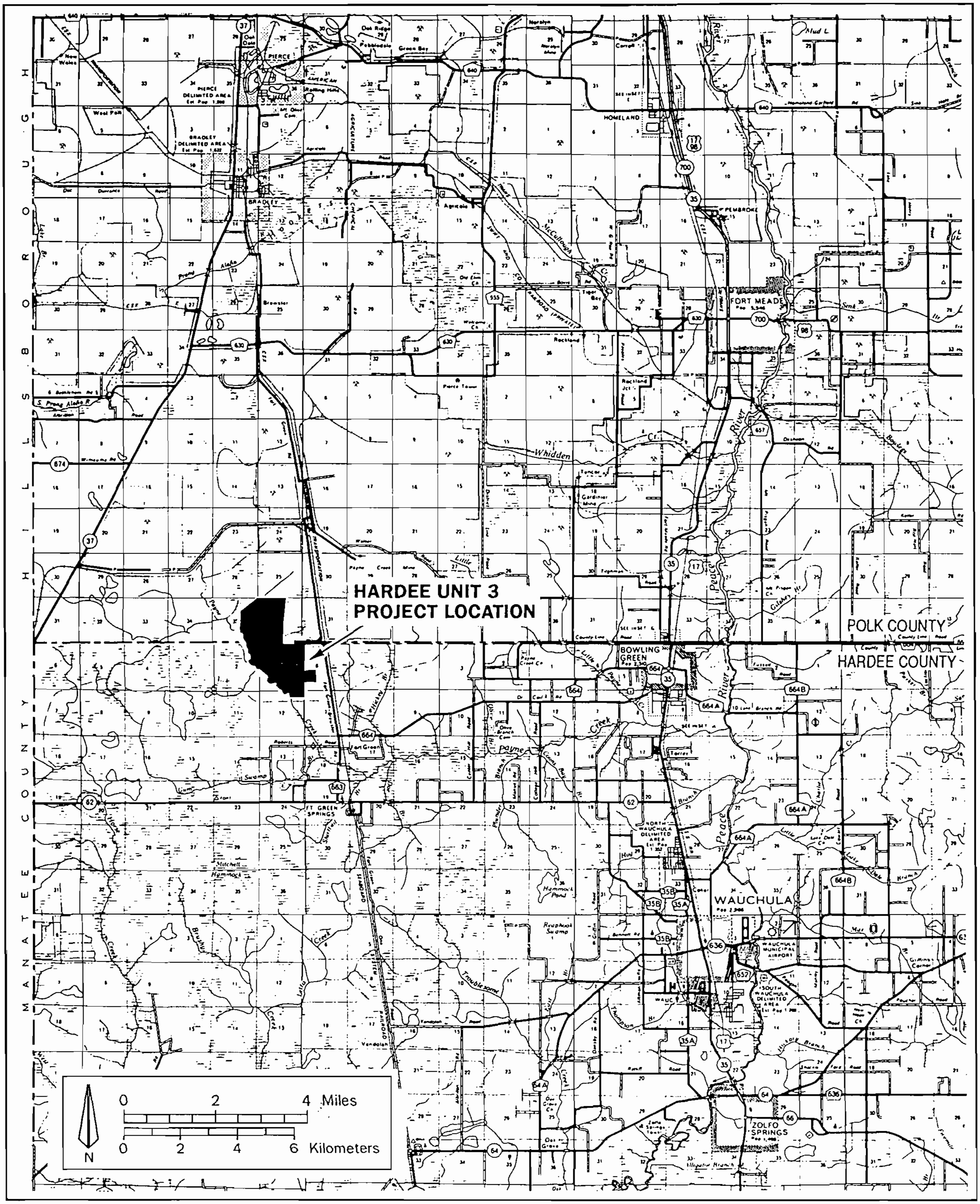

Figure 1.3.2-2
Location of Hardee Unit 3 Project

Sources: FDOT, 1990 and 1992; KBN, 1994.

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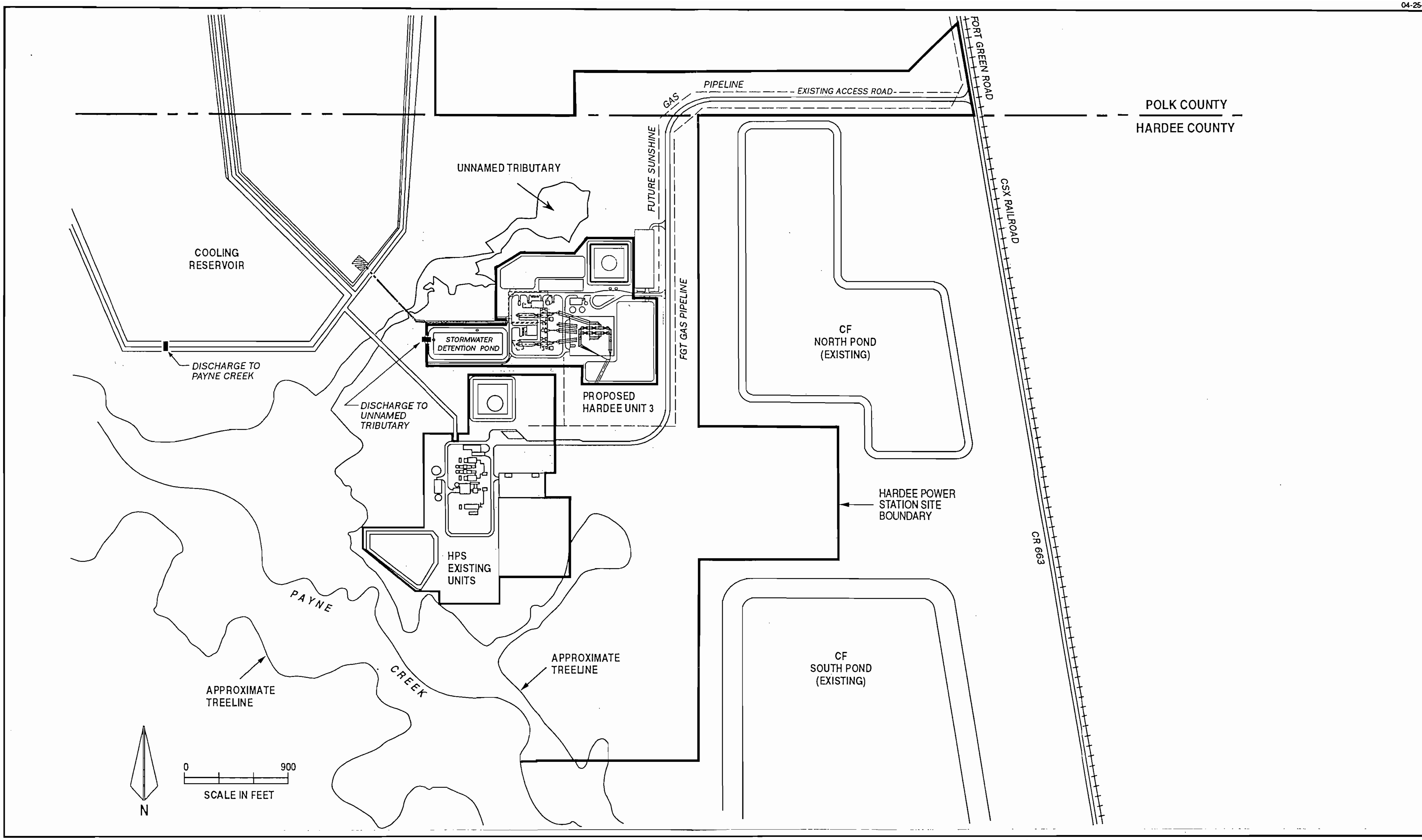

Figure 1.3.2-3
Hardee Unit 3 Proposed Site Layout

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NOTE: HPS EXISTING UNITS ON LEFT; PHOTOSIMULATION OF HARDEE UNIT 3 IN CENTER

Figure 1.3.2-4
Photosimulation of Hardee Unit 3 Project

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1.3.3 PROJECT DESCRIPTION

The Hardee Unit 3 Project involves an incremental increase to the previously certified HPS ultimate capacity of 660 MW to 880 MW. The project will consist of one highly efficient 440-MW combined cycle unit that will employ the latest pollution abatement technology and will provide optimum efficiency with regard to electric power generation. The site layout for the Hardee Unit 3 Project showing its relation to the HPS existing units is provided in Figure 1.3.2-3.

HPP entered into a contract with SECI and Tampa Electric Company for the operation of the HPS existing units. TPS, SECI, and Tampa Electric Company submitted the original site certification application with a plan for construction of the HPS to be completed in three phases (Phases 1A, 1B, and 2), resulting in the construction of 660 MW of generating capacity. Phase 1A of HPS (existing units) consists of a 295-MW generating facility with a 220-MW combined cycle unit and a 75-MW stand-alone combustion turbine (CT). Phase 1A was placed in commercial operation on January 1, 1993. Phase 1B consists of adding a 75-MW CT to the Phase 1A stand-alone CT, two heat recovery steam generators (HRSGs), and a 70-MW steam turbine to complete a second 220-MW combined cycle unit. Phase 1B will increase the total generating output of HPS to 440 MW with an in-service date no later than January 2003. Phase 2 was planned to consist of a third 220-MW combined cycle unit to be constructed by SECI and had no projected in-service date. The Hardee Unit 3 Project will be an expansion of Phase 2 from 220 MW to 440 MW, thus giving the site an ultimate generating capacity of 880 MW. When Hardee Unit 3 is placed in service in 1999, the station will have a total generating capacity of 735 MW. The ultimate HPS generating capacity of 880 MW will be achieved with the completion of Phase 1B.

The Hardee Unit 3 facility will be constructed through a turnkey contract arrangement with Westinghouse Electric Corporation and Black & Veatch Construction, Inc. This project will consist of two 150-MW Westinghouse Model 501F CTs with dry low NO_x burners totaling 300 MW (net). Each CT will be connected to a HRSG producing steam for a single 140-MW (net) steam turbine. The overall generating capacity of Hardee Unit 3 Project will be 440 MW.

Fuels to be used include natural gas as the primary fuel and fuel oil with a 0.05 percent sulfur content as backup. Fuel oil will be delivered to the site via truck and stored in a new single 16.7-million-liter (4.4-million-gallon) aboveground storage tank.

Hardee Unit 3 will connect to the Florida electric transmission grid within the existing HPS site; no new offsite transmission lines will be constructed. The Hardee Unit 3 facility will connect onsite with either an existing 46-centimeter (cm) (18-inch) natural gas lateral from the existing Florida Gas Transmission Company system already constructed to the HPS site or the proposed SunShine Pipeline Company's natural gas pipeline. Permitting for the natural gas lateral to the HPS site, if developed, will be conducted under a separate permitting process by the SunShine Pipeline Company. No new offsite associated linear facilities are required for the Hardee Unit 3 Project.

As part of the environmental licensing process, a Water Alternatives Study was conducted to:

1. Evaluate the adequacy of the existing cooling reservoir,
2. Evaluate the adequacy of the existing groundwater allocation for the HPS site, and
3. Evaluate potential alternative water sources for the proposed project.

Potential water use options evaluated include the reuse of treated effluent from communities within a 16-km (10-mile) radius of the HPS site, cooling towers, utilization of aquifer source recovery, and other surface water and groundwater sources. The results of the Water Alternatives Study showed that all water use requirements for the Hardee Unit 3 Project could be supplied by the currently existing water allocation established in the original certification for HPS. Therefore, the currently existing groundwater allocation established in the original certification (TPS/SECI, 1989) is adequate to supply the ultimate generating capacity of 880 MW for HPS, including the 440-MW Hardee Unit 3 Project. The Water Alternatives Study also showed that the existing onsite cooling reservoir is capable of accommodating the condenser cooling requirements of the total 880-MW HPS (440-MW Phase 1A and 1B, and 440-MW Hardee Unit 3). The results of the Water Alternatives Study were used in the design of the Hardee Unit 3 Project; results of the study are included in Appendix 10.10.

The Hardee Unit 3 Project will result in an incremental increase in the overall infrastructure and generating capacity of the previously certified HPS with only minimal incremental environmental impacts. Through this incremental expansion of the HPS, SECI will be able to effectively respond to the growing need for electric power to cost effectively serve its cooperative members. By locating the Hardee Unit 3 Project at the HPS site, SECI will take advantage of existing structures, such as the cooling reservoir and transmission lines, thus minimizing potential impacts associated with construction and operation of a new combined cycle facility.

1.4 BENEFITS OF THE PROJECT

1.4.1 EXTERNAL BENEFITS

The primary benefit of this project to Hardee and Polk counties, the region, and the state of Florida is the provision of a new, clean, and reliable energy source. In addition to providing energy, the Hardee Unit 3 Project will provide employment and tax revenues as well as increased statewide electrical system reliability and increased diversity of fuels usage. The Hardee Unit 3 Project makes beneficial use of mined lands in Hardee and Polk counties and minimizes potential environmental impacts through the use of existing facilities (i.e., cooling reservoir and transmission lines) at the HPS site.

Because of the previously altered environment in the project area and the relatively clean nature of the project, no significant adverse environmental or social impacts will result from the construction or operation of the Hardee Unit 3 Project.

1.4.2 INTERNAL BENEFITS

This project is beneficial to SECI due to its ability to provide economic savings and rate stability for SECI's members as well as satisfying the need to meet projected growth in electric power demand. This new generation source will provide increased SECI system reliability. Also, with its use of natural gas and fuel oil, this project will provide SECI with a diversity of power supply sources and fuel mix.

1.5 REFERENCES

The following references are cited in Chapter 1.0.

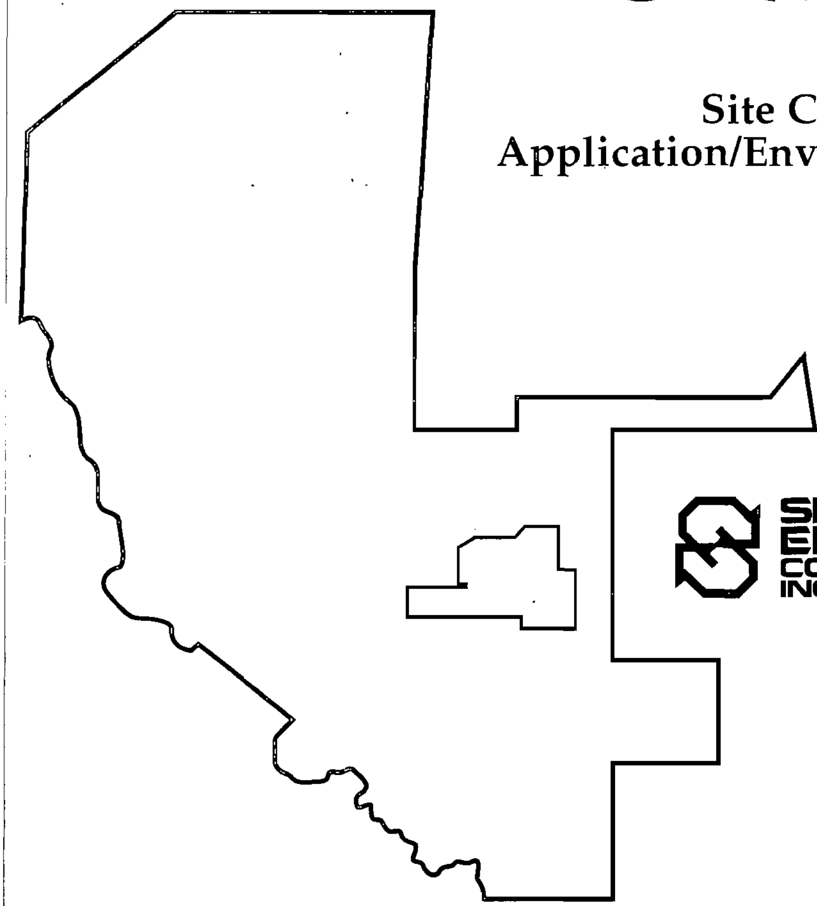
KBN Engineering and Applied Sciences, Inc. (KBN). 1993. Hardee Unit 3 Environmental Licensing Plan of Study. Prepared for Seminole Electric Cooperative Incorporated, Tampa, FL.

KBN Engineering and Applied Sciences, Inc. (KBN). 1994. Data collected and analyzed for the Seminole Electric Cooperative Incorporated Hardee Unit 3 Site Certification Application/ Environmental Assessment. Gainesville, FL.

TECO Power Services/Tampa Electric Company/Seminole Electric Cooperative Incorporated (TPS/SECI). 1989. Hardee Power Station Site Certification Application/Environmental Assessment.

HARDEE UNIT 3

Site Certification Application/Environmental Analysis



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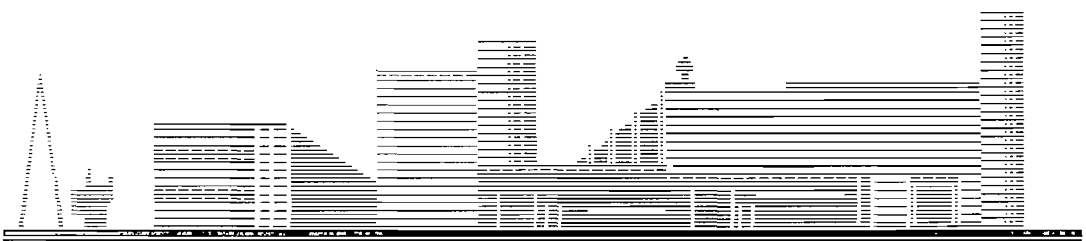

Chapter 2.0

2.0 SITE AND VICINITY CHARACTERISTICS

TABLE OF CONTENTS
(Page 1 of 4)

TABLE OF CONTENTS
(Page 2 of 4)

TABLE OF CONTENTS
(Page 3 of 4)

TABLE OF CONTENTS
(Page 4 of 4)

LIST OF TABLES
(Page 1 of 4)

LIST OF TABLES
(Page 2 of 4)

LIST OF TABLES
(Page 3 of 4)

LIST OF TABLES
(Page 4 of 4)

LIST OF FIGURES
(Page 1 of 2)

LIST OF FIGURES
(Page 2 of 2)

2.1 SITE AND ASSOCIATED FACILITIES DELINEATION

This section provides information concerning the location of the proposed project site and facilities. This section also provides maps showing the area, communities in the vicinity, adjacent properties, and existing and proposed uses of the site.

The Hardee Unit 3 Project will be located on the 526-hectare (ha) (1,300-acre) Hardee Power Station (HPS) site in Hardee and Polk counties, approximately 14 km (9 miles) northwest of Wauchula, 26 km (16 miles) south-southwest of Bartow, and 64 km (40 miles) east of Tampa Bay (see Figure 2.1.0-1). The HPS site is bordered on the east by Hardee County Road (CR) 663, a CSX Railroad right-of-way, and CF Industries' Hardee Complex. IMC-Agrico properties surround the remaining portions of the site. Payne Creek flows along the southern and western boundary of the HPS site.

The HPS site is located in Section 6 of Township 33S, Range 24E, Section 31 of Township 32S, Range 24E, Sections 1, 2, and 12 of Township 33S, Range 23E, and Sections 35 and 36 of Township 32S, Range 23E. The Hardee Unit 3 facility will occupy approximately 20 ha (50 acres) of the HPS site. The HPS site is currently used for the production of electric power by the 295-MW HPS existing units. With the exception of the HPS existing units and supporting facilities, which include a 230-ha (570-acre) cooling reservoir, the remainder of the HPS site is undeveloped. Portions of the HPS site have been mined for phosphate and reclaimed.

The existing facilities associated with the HPS site, the location of the Hardee Unit 3 facilities, and surrounding properties are shown in Figure 2.1.0-2. The 20-ha (50-acre) area identified for the construction of the Hardee Unit 3 facility currently consists of unmined and reclaimed land. Areas of the HPS site immediately adjacent to Payne Creek are in the 100-year floodplain. However, none of the proposed plant structures associated with the Hardee Unit 3 Project will be located in the 100-year floodplain of Payne Creek.

The Hardee Unit 3 Project will require no associated facilities extending beyond the current HPS site boundaries.

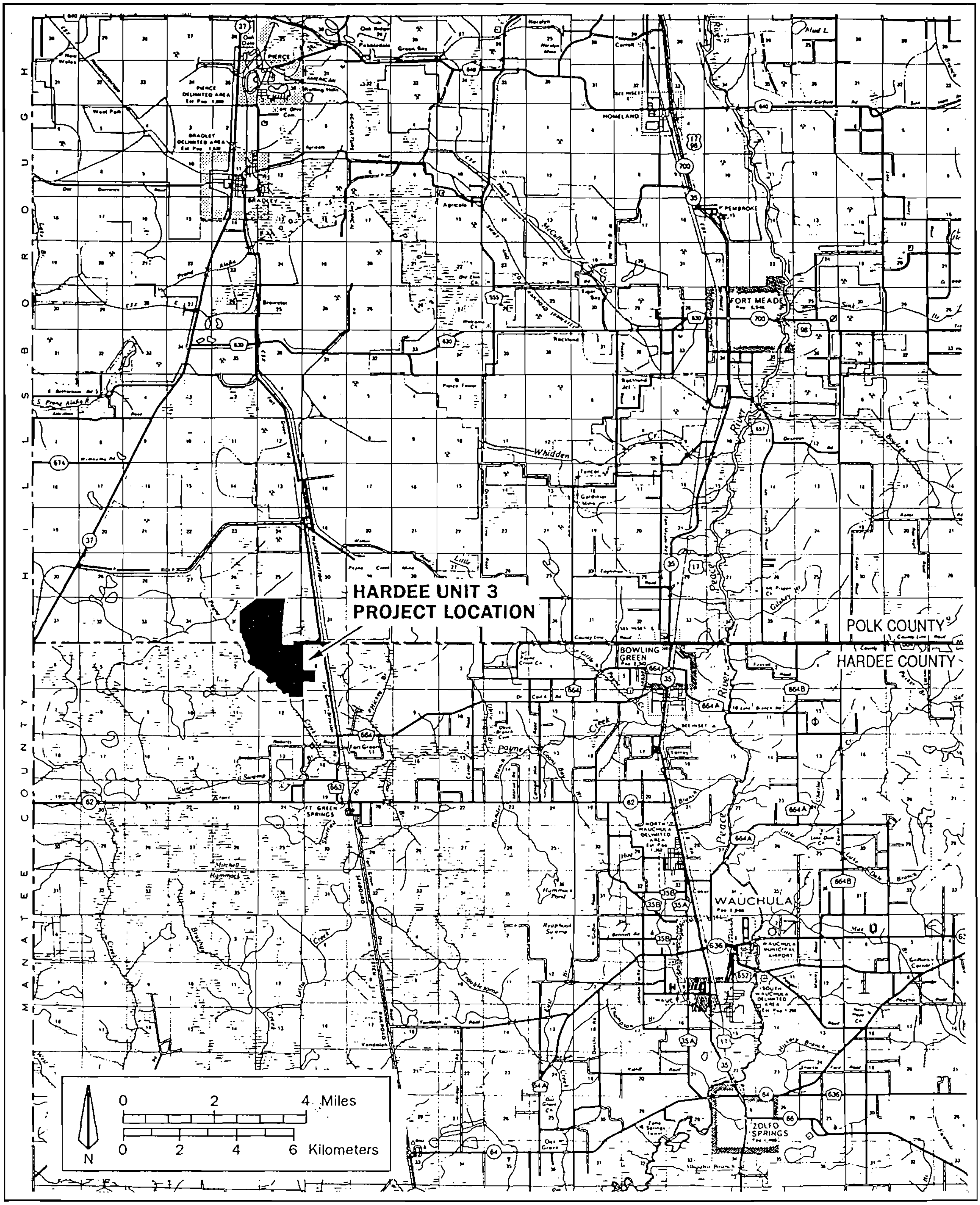

Figure 2.1.0-1
Location of Hardee Unit 3 Project

Sources: FDOT, 1990; 1992; KBN, 1994.

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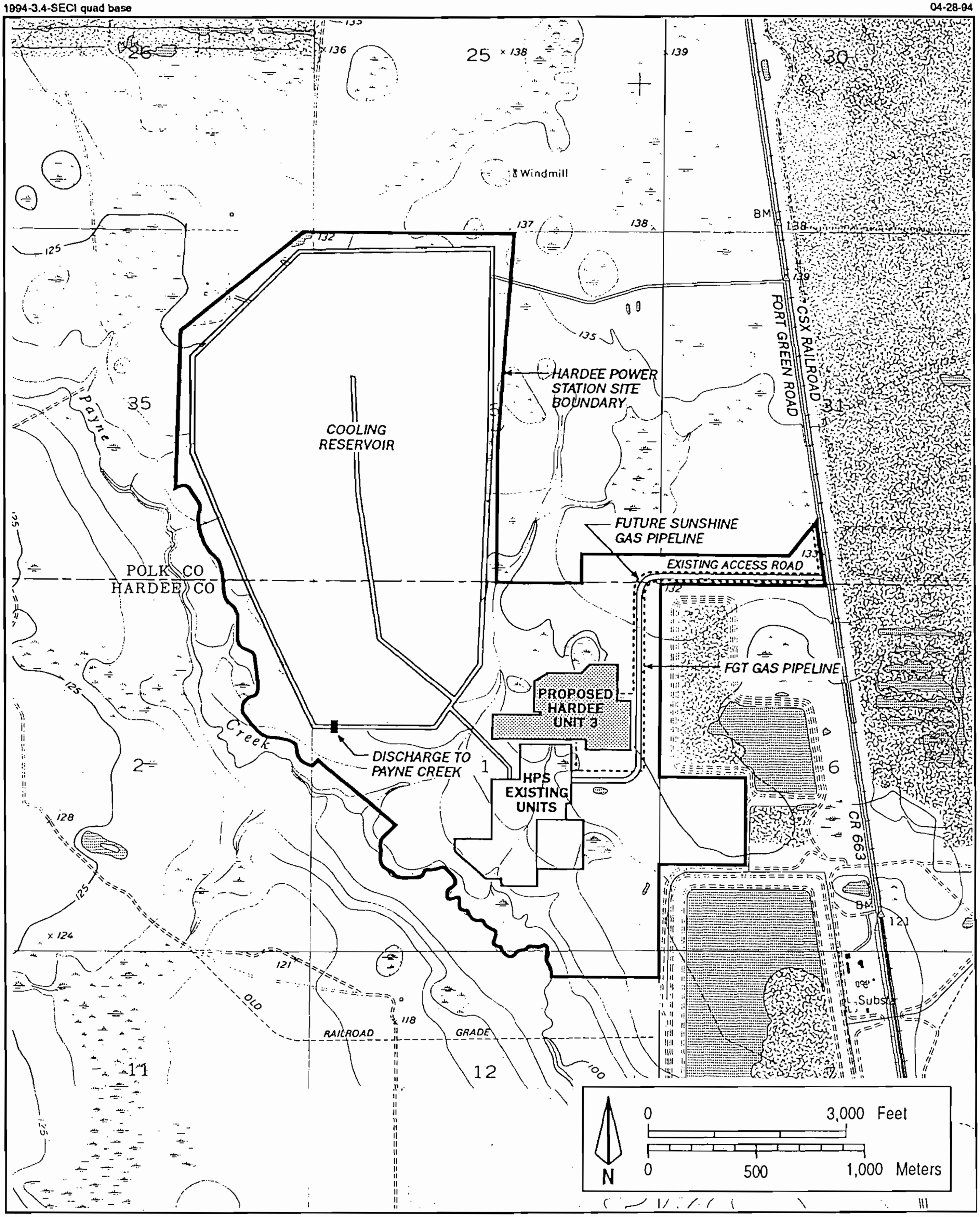

Figure 2.1.0-2
Hardee Unit 3 Site Boundary and Adjacent Properties

Sources: USGS, 1987; KBN, 1994.

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2.2 SOCIOPOLITICAL ENVIRONMENT

2.2.1 GOVERNMENT JURISDICTIONS

The proposed Hardee Unit 3 Project facilities will occupy a portion of the existing HPS site in Section 1, Township 33S, Range 22E. The Hardee Unit 3 site is located in unincorporated Hardee County, approximately 12 kilometers (km) (7.5 miles) west of Bowling Green. The existing cooling reservoir to be used by the Hardee Unit 3 facility is located in Sections 1 and 2 of Township 33S, Range 23E in Hardee County and Sections 35 and 36 of Township 32S, Range 23E in Polk County. There are no municipalities or incorporated areas within an 8-km (5-mile) radius of the proposed site. The unincorporated communities of Fort Green and Fort Green Springs are located 4 km (2.5 miles) southeast and 4.8 km (3.0 miles) south of the site, respectively. Figure 2.2.1-1 depicts the HPS site in relation to these communities. Figure 2.2.1-2 is an aerial photograph of the site and vicinity.

None of the following local, regional, or federal areas is located within an 8-km (5-mile) radius of the Hardee Unit 3 Project 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, conservation and recreation lands, save our rivers lands, archaeological landmarks or landmark zones, aquatic preserves, outstanding florida waters and wild and scenic rivers;
3. County parks or special management areas established by law; and
4. Indian reservations and military lands.

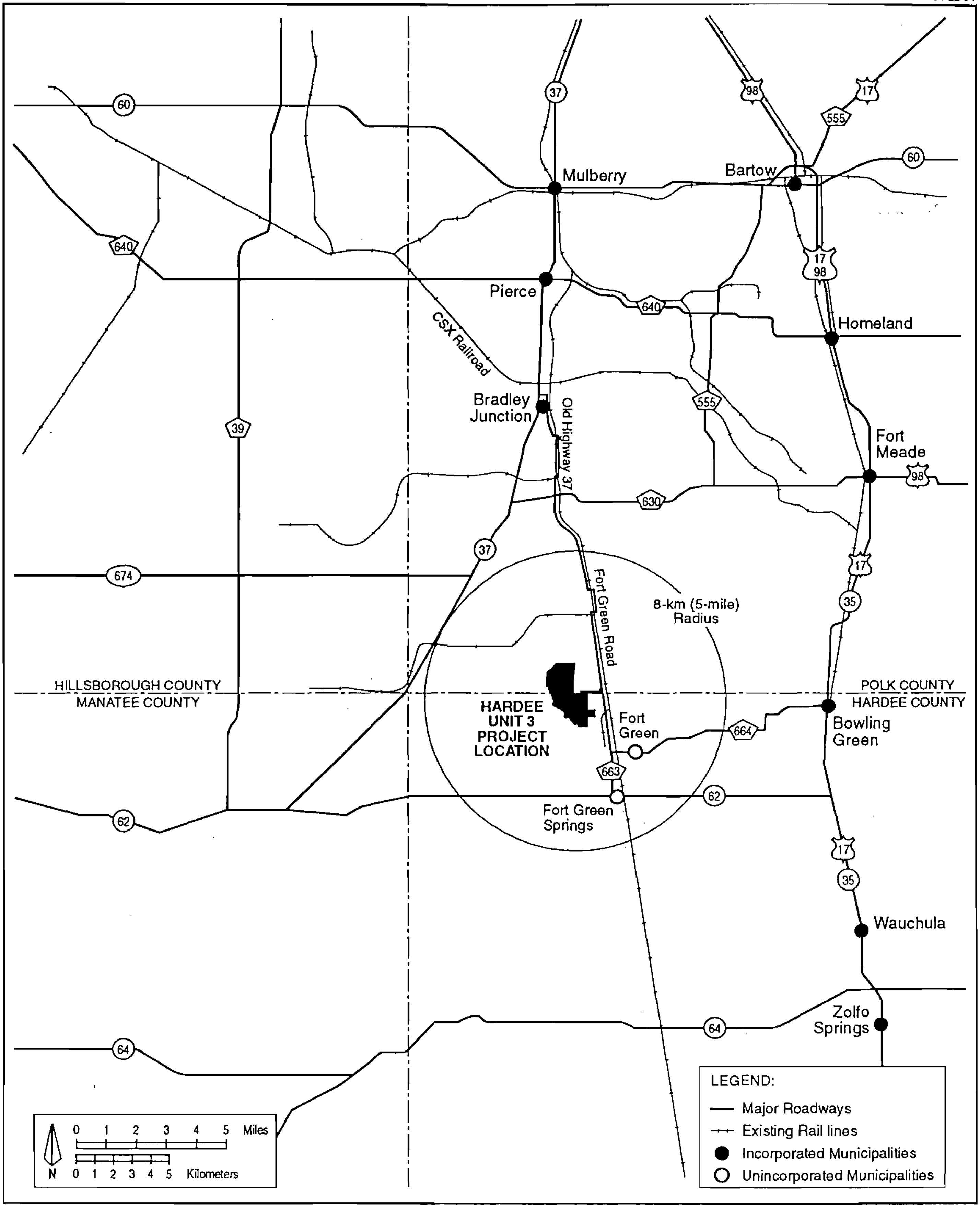

Figure 2.2.1-1
Site Location and Boundaries of Cities and Towns
Within an 8-km (5-mile) Radius

Source: KBN, 1994.

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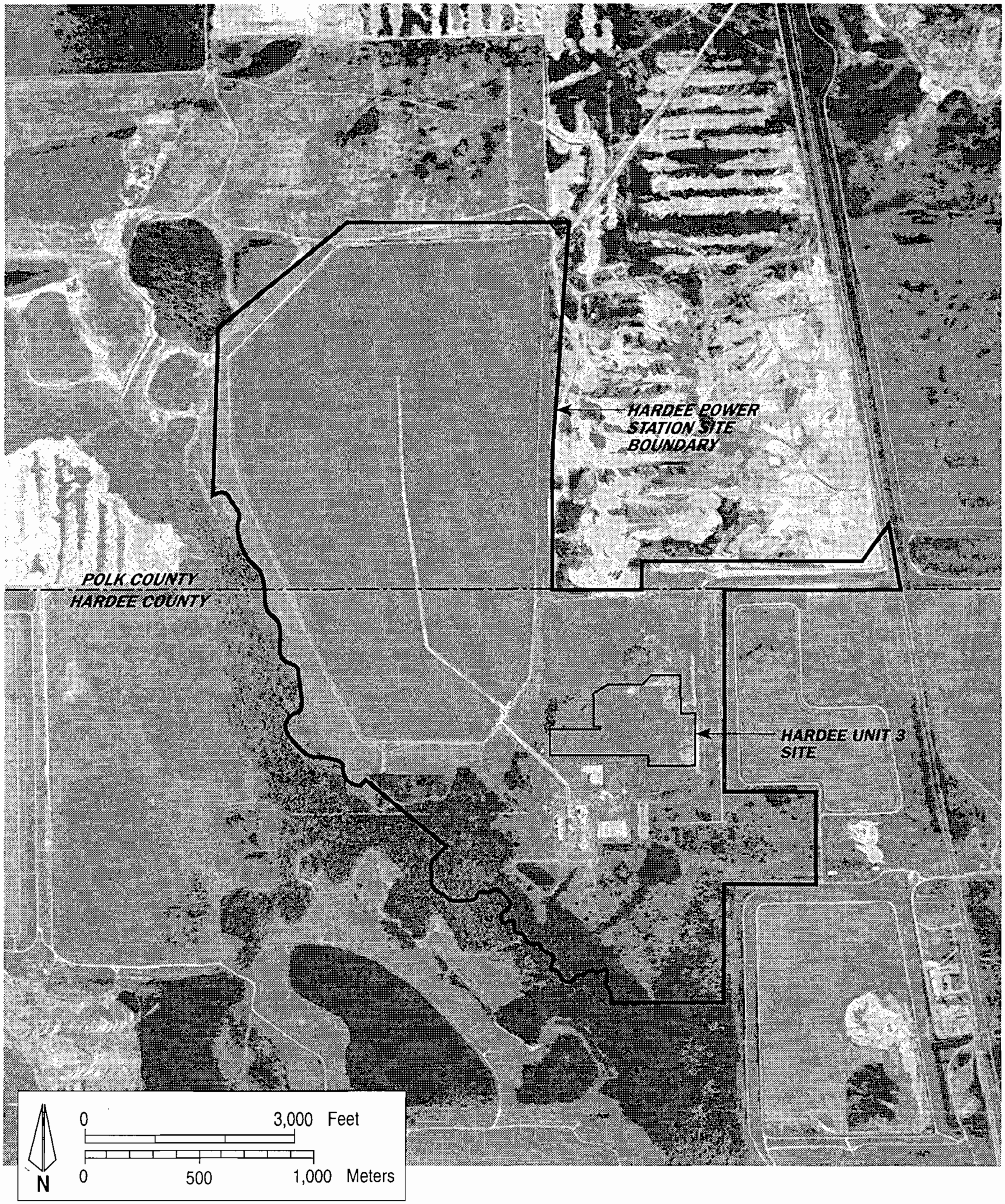

Figure 2.2.1-2
Aerial Photograph of Hardee Unit 3 Site and Surrounding Vicinity — July, 1993

Source: KBN, 1994.

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2.2.2 ZONING AND LAND USE PLANS

The Hardee Unit 3 Project will be constructed entirely within the boundaries identified for the HPS site in the original 1990 certification. All project facilities will be constructed in the portion of the site that is in Hardee County. The existing cooling reservoir (located within the HPS site), which will also be used but unaltered, lies in both Hardee and Polk counties. Local government comprehensive plans applicable to the HPS site include the Hardee County Comprehensive Plan and the Polk County Comprehensive Plan.

Both counties have comprehensive land development regulations that are applicable to the HPS site. On August 14, 1990, the entire HPS site, including the proposed location for Hardee Unit 3, was found by the Siting Board to be consistent and in compliance with the Hardee County and Polk County Land Use Plan and Zoning Regulations (see Appendix 10.4).

In addition to the local comprehensive plans, the Hardee Unit 3 Project will be consistent with the applicable goals and policies of both the State Comprehensive Plan (Ch. 187, FS) and the Central Florida Comprehensive Regional Policy Plan. The Hardee Unit 3 Project will be consistent with the goals and policies within the Natural Systems and Recreational Lands, Air Quality, Land Use, Public Facilities, and Cultural and Historical Resources Elements of the State Comprehensive Plan. The goals and policies within the Central Florida Regional Planning Council's Policy Plan that are relevant to the Hardee Unit 3 Project include: Energy Element, Regional Goal (b), Policy (4) p. II-183; Mining Element, Regional Goal (a), Policy (1) p. II-200; Land Use Element, Regional Goal (a), Policies (1) and (2), pp. II-222 and II-223.

The Hardee Unit 3 Project will be located on the existing HPS site and will represent an incremental increase in the ultimate power-generating capacity of the HPS site from 660 MW to 880 MW. The HPS site was selected as the preferred location for the Hardee Unit 3 Project because this site has been previously reviewed by Hardee and Polk counties and certified for a 660-MW of combined cycle power generation (Certification Number PA89-25) (TPS/SECI, 1989). Furthermore, the HPS site has adequate area to accommodate the proposed expansion from 660 MW to 880 MW. Locating the Hardee Unit 3 Project at the HPS site takes advantage of the existing infrastructure and onsite facilities, and minimizes potential environmental impacts that might otherwise be associated with the construction of a combined cycle power plant at a previously undeveloped site.

HARDEE COUNTY

Zoning--The proposed Hardee Unit 3 project site is located in unincorporated Hardee County. The applicable zoning ordinance is the Hardee County Land Development Code, adopted March 11, 1982, as amended. The applicable local government comprehensive plan is the Hardee County Comprehensive Plan, adopted by the Hardee County Board of County Commissioners on April 11, 1991, and amended August 26, 1992.

The Hardee Unit 3 Project site has been zoned Light Industrial (I-1) by the Hardee County Board of County Commission on May 11, 1989, to allow development of the site for a power plant (see Figure 2.2.2-1). The I-1 zoning district exists for the entire HPS site within Hardee County (a portion of the existing cooling reservoir is located in Polk County). Public and semi-public utility plants and equipment are Principal Uses and Structures within the I-1 zoning district (see Appendix 10.2 for zoning description).

Land Use--According to the Future Land Use Element in the Hardee County Comprehensive Plan (see Appendix 10.3), which was adopted subsequent to the original certification, the proposed project site is located in the Agriculture future land use designation (see Figure 2.2.2-2). All lands adjacent to the Hardee Unit 3 site are also designated Agriculture in Hardee County.

The Comprehensive Plan's Future Land Use Element specifically addresses power plants within the agricultural future land use classification. Policy L.1.6.c states:

> ...power plants or manufacturing or processing facilities may be permitted, and shall have access to a collector or arterial roadway, shall meet all local regulations, and shall be appropriately buffered from surrounding land uses, including agricultural uses.

Policy L.1.6.e addresses planning controls which will guide development within the Agricultural future land use designation. The policy states:

> New development shall: provide buffering to prevent conflicts between agricultural and non-agricultural activities; protect natural resources; allow no ancillary uses detrimental to agriculture; require that post-development conditions for stormwater run-off equal pre-development conditions; and shall require the appropriate contribution from the developer to pay for off-site as well as on-site costs associated with the impacts of the development.

The proposed Hardee Unit 3 Project will be located, constructed, and operated in a manner consistent with the Hardee County Comprehensive Plan Land Use Policies and Land Development Code regulations applicable to the site. The site is consistent with Policy L.1.6.c by being located off of CR 663 (a county-maintained collector roadway) and is surrounded by previously mined lands. The site is located on an existing power plant site and utilizes, to the extent possible, existing infrastructure to limit the impacts to natural resources in the area. No agricultural activities will be displaced as a result of the construction and operation of Hardee Unit 3. In addition, the site will comply with all stormwater regulatory requirements to be consistent with Policy L.1.6.e. A meeting with Hardee County land use and zoning officials confirmed that no additional land use or zoning approvals would be required to construct or operate the Hardee Unit 3 Project (see Appendix 10.3.1).

POLK COUNTY

Zoning--The portions of the HPS site located in Polk County, including a portion of the existing cooling reservoir and the northern section of the existing access road, which may be utilized in the operation of the proposed Hardee Unit 3, are in the Rural Conservation (RC) zoning district (see Figure 2.2.2-1). All property adjacent to the site in Polk County is also zoned RC. According to Polk County Zoning Ordinance Number 83-2, adopted March 1, 1983, power plants are considered a Class III Essential Use. Within the RC zoning district, Class III Essential Uses are allowable as a Conditional Use - Non-Agricultural. Section 5.2.C.5 addresses density and lot size requirements. The section states:

a. Gross density shall not exceed one (1) dwelling unit per acre.
b. Minimum lot area shall be forty thousand (40,000) square feet for each dwelling unit exclusive of road right-of-way.

Land Use--According to the Polk County Comprehensive Plan's Future Land Use Element, the portion of the HPS site within Polk County is located in the Phosphate Mining (PM) future land use designation (see Figure 2.2.2-2). All land adjacent to the proposed site in Polk County is designated PM. The Comprehensive Plan Future Land Use Element specifically addresses power plant development in unincorporated Polk County.

Policy 2.114-A3 indicates that "Construction, operation and maintenance of Electric-Power Generation Facilities and ancillary uses and facilities that are required to be certified pursuant to

Sections 403.501 - 403.518, FS (1990)" is a permitted use within the PM future land use designation.

Policy 2.114-C1 indicates that Certified Electric-Power Generating facilities are permitted within the PM future land use designation upon obtaining a conditional-use permit from Polk County

Policy 2.114-C2 of the Future Land Use Element addresses environmental criteria pertaining to the development of Certified Electric-Power Generating facilities in the PM designation. The criteria are:

- Environmentally sensitive areas shall be specifically detailed on the "Conceptual Electric-Power Generating Facility Site Plan" submitted as part of the conditional-use permit process.
- Certified Electric-Power Generating Facilities shall protect environmentally sensitive areas through buffering and/or other mitigating techniques imposed pursuant to Section 403.501 - 403.518, FS.
- The location of all Certified Electric-Power Generating Facilities shall comply with all applicable environmental, federal, state, and local laws, rules, and regulations pertaining to the site, certification, permitting, and operation and maintenance requirements.

The Future Land Use Element also address the development approval criteria for the development of Certified Electric-Power Generating facilities. Policy 2.114-C3(a) states:

> ...Polk County shall require proposed Certified Electric-Power Generating Facilities to obtain approval as a Conditional Use Permit, or its functional equivalent, prior to the commencement of construction of the facility which approval shall demonstrate compliance with all applicable County ordinances and these policies. Additional review criteria shall include, but not be limited to, the following:
>
> 1. that the delivery, and storage of the fuel source will not threaten the safety or health of residents;
>
> 2. that height, bulk, and noise factors associated with the facility are compatible with other land uses in the area.

Policy 2.114-C4 addresses set backs to adjacent development. The policy states:

> Certified Electric-Power Generating Facilities shall be set back and/or buffered from existing adjacent residential areas.

The existing cooling reservoir is located within a Floodplain-Protection and Wetland-Protection Areas. Policy 2.123-B2.b addresses development within the Floodplain-Protection Area as follows:

> Development or redevelopment shall meet the requirements of the Polk County "Flood Protection and Surface Water Management Code" (Ordinance 88-04), as amended, and shall not:
>
> 1. enlarge the off-site floodplain;
> 2. alter the natural function of the floodplain; nor
> 3. result in post development run-off areas for storm frequencies at least as stringent as those rates established by the applicable water management district pursuant to Section 40C, F.A.C.

Policy 2.123-C2 (b) and (c) address development criteria within wetlands as follows:

> (b) Wetland impacts shall first be avoided. Secondly, where they cannot be avoided, impacts shall be minimized and shall be mitigated by wetland compensation or wetland enhancement.
>
> (c) Commercial and industrial development shall locate on the non-wetland portion of a development site.

The HPS site was found to be consistent and in compliance with the Polk County Comprehensive Plan and Zoning Regulations in effect prior to construction of the existing facilities. No new construction activities associated with the Hardee Unit 3 Project are scheduled to take place in Polk County except for the potential for on onsite gas lateral to connect to the proposed SunShine natural gas pipeline.

Polk County planning staff and the Board of County Commissioners have determined that a Conditional Use Permit as identified in the comprehensive plan would not be required for the Hardee Unit 3 Project (see Appendix 10.3.2).

The proposed Hardee Unit 3 facilities will be located, constructed, and operated in a manner consistent with the aforementioned Comprehensive Plan Land Use Policies and zoning regulations.

CONCURRENCY MANAGEMENT

At the present time, Hardee County has not adopted a formal concurrency review policy for impacts on public services by new projects located within the county. Discussions with county officials indicated that the information on traffic impacts supplied in the SCA/EA would be sufficient to address the concurrency requirements.

Polk County's Concurrency Management Ordinance 92-10 as amended identifies several public facilities and services that will be available concurrent with the impacts associated with a proposed development activity. These facilities and services include Transportation, Potable Water and Sanitary Sewer, Parks/Open Space, Stormwater Management, Solid Waste, and Mass Transit. Since no new development activities are taking place in Polk County, only impacts associated with operation traffic on Fort Green Road in Polk County (existing plant drive entrance to be utilized by the Hardee Unit 3 Project) will be subject to a concurrency determination. Since the proposed project will generate more than 50 and less than 750 average daily trips during operation (see Section 5.9), a Minor Traffic Review will be required for the concurrency determination. The minor traffic review is included in Appendix 10.14, and a supplement study is presented in Section 5.9.

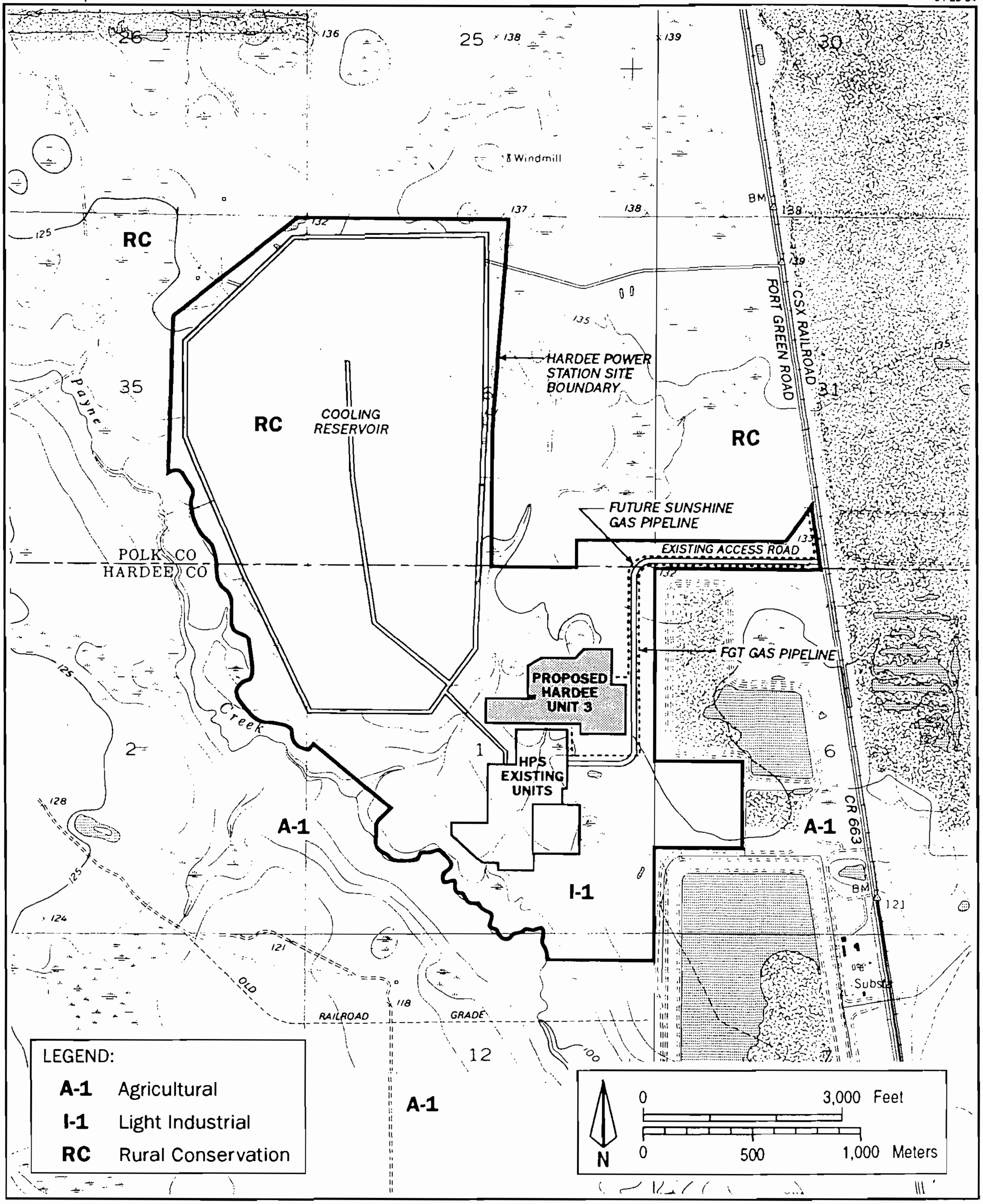

Figure 2.2.2-1
Zoning Map of the Hardee Unit 3 Site and Adjacent Properties

Sources: USGS, 1987; KBN, 1994.

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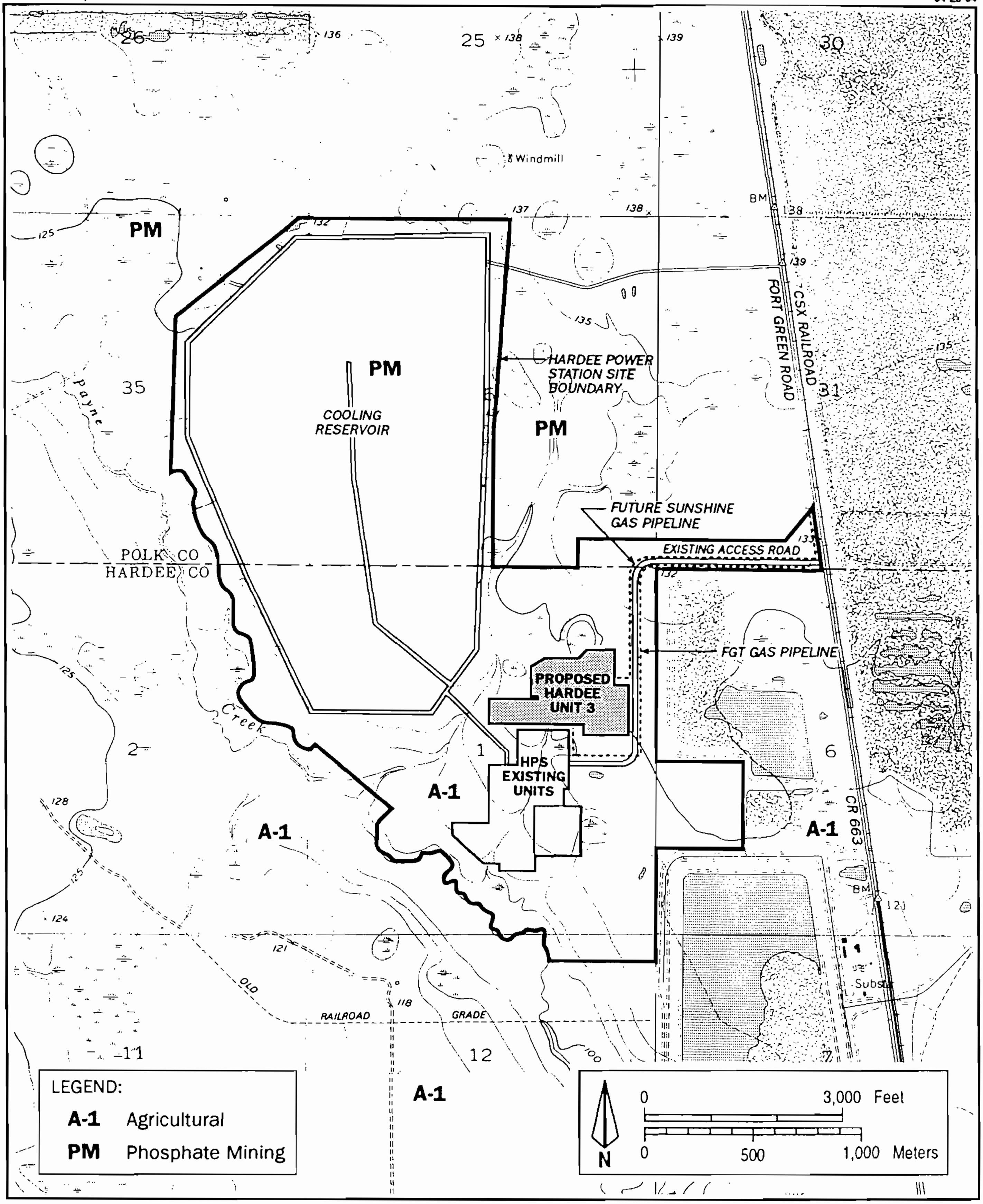

Figure 2.2.2-2
Future Land Use Designations of the Hardee Unit 3 Site and Adjacent Properties

Sources: USGS, 1987; KBN, 1994.

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2.2.3 DEMOGRAPHY AND EXISTING LAND USE

2.2.3.1 DEMOGRAPHY

There are no incorporated municipalities within 8 km (5 miles) of the Hardee Unit 3 site. Table 2.2.3-1 lists the nearest communities and their total residential populations for 1980 and 1990. The majority of recent resident population growth has occurred southeast of the site in Wauchula, with a population increase of approximately 8.9 percent in the last decade, whereas Bowling Green and Zolfo Springs experienced decreases in population. Hardee County's unincorporated area population has decreased by 2.8 percent from 13,566 residents in 1980 to 13,191 residents in 1990. Table 2.2.3-2 lists the projected populations for Hardee and Polk counties for the years 1995 and 2000.

The Hardee Unit 3 Project is located in an unincorporated area of Hardee County immediately south of the Hardee/Polk County line, 12 km (7.5 miles) west of Bowling Green. There is no residential population within 1.6 km (1 mile) of the site due to the mining operations and industrial facilities in the area. A low-density residential population exists approximately 4 km (2.5 miles) to the southeast of the site in the unincorporated community of Fort Green Springs.

The cities of Winter Haven and Lakeland are located approximately 40 km (25 miles) north of the site in Polk County. In 1980, the populations for these two cities were 21,119 people and 47,406 people, respectively, or about 21 percent of Polk County's total population. Winter Haven experienced an increase of 17.1 percent, and Lakeland experienced an increase of 48.9 percent between 1980 and 1990 (BEBR, 1991). The cities of Winter Haven and Lakeland are highly urbanized and represent a considerable portion of the population growth in Polk County.

Polk County contained a population of 321,652 people in 1980 and has grown to 405,382 people between 1980 and 1990, an increase of 26 percent (U.S. Bureau of the Census, 1990). In 1980, more than 40 percent of Polk County's population resided in incorporated communities with a majority of that population located in the north-central portion of the county near the cities of Winter Haven and Lakeland.

2.2.3.2 ONGOING LAND USE

Most of the land within an 8-km (5-mile) radius of the site is being actively mined for phosphate or has been reclaimed to pasture or wetlands. Citrus groves are the predominant agricultural activity in the area and occupy several small pockets of land south and southeast of the site.

The only residential community within 8 km (5 miles) is Fort Green Springs which contains about 60 houses (permanent dwellings and mobile homes) and is located about 4 km (2.5 miles) south of the plant site. With the exception of the expansion of the phosphate mining activities to the west and south into Hardee County, no significant changes in land use have occurred in the past 30 years or are likely to occur in the near future based on information obtained by the counties and regional planning councils. Figure 2.2.3-1 shows the existing land use within an approximate 8-km (5-mile) radius of the proposed plant. Data presented in the map are based on U.S. Geological Survey (USGS) 7.5-minute quadrangle maps of the site area, aerial photographs dated 1988 and 1992, local comprehensive plans, and field reconnaissance during November 1993.

Table 2.2.3-1. Historic Populations for Selected Communities and Unincorporated Areas in Hardee and Polk Counties

Community	Population		Percent Change (1980-1990)
	1980	1990	
Unincorporated Hardee County	13,566	13,191	-2.8
Bowling Green	2,310	1,836	-20.5
Wauchula	2,986	3,253	8.9
Zolfo Springs	1,495	1,219	-18.5
Unincorporated Polk County	190,071	242,195	27.4
Bartow	14,780	14,716	-0.4
Fort Meade	5,546	4,976	-11.5
Frostproof	2,995	2,808	-6.7
Lakeland	47,406	70,576	49.9
Winter Haven	21,119	24,725	17.1

Note: The 1990 population counts are subject to adjustment for undercount or overcount by the U.S. Bureau of the Census.

Source: U.S. Bureau of the Census, 1990.

Table 2.2.3-2. Projected Population for Hardee and Polk Counties

Area	Projected Population 1995	2000
Hardee County		
Unincorporated Population	16,144	16,883
Total Population	24,496	25,723
Polk County		
Unincorporated Population	275,814	487,200
Total Population	443,747	477,857

Sources: Polk County Planning Department, 1994.
Hardee County Comprehensive Plan, 1992.

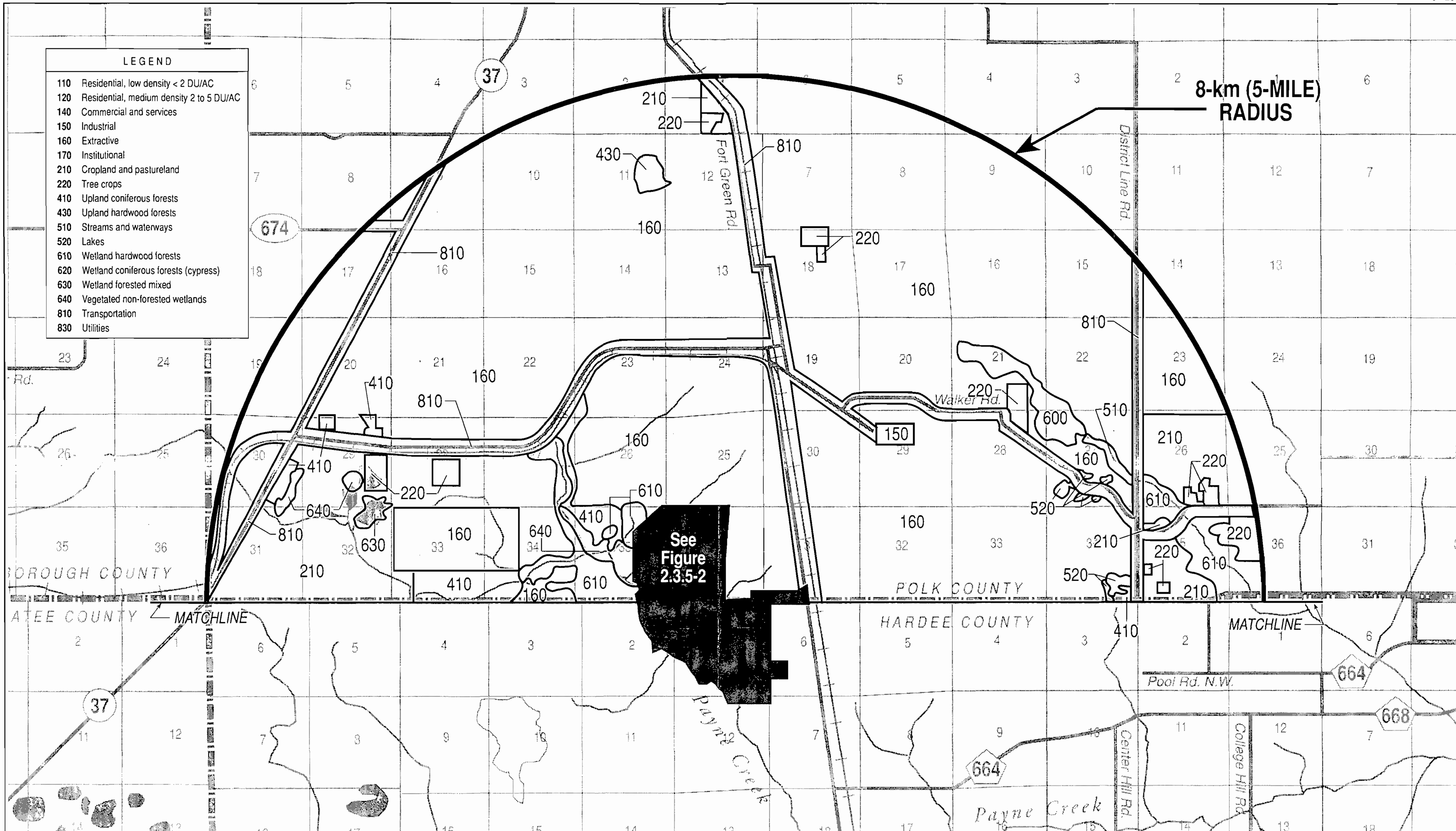

Figure 2.2.3-1 (Page 1 of 2)
Existing Land Use Within 8 km (5 miles) of the Hardee Unit 3 Site

Sources: FLUCFCS, 1985; KBN, 1994.

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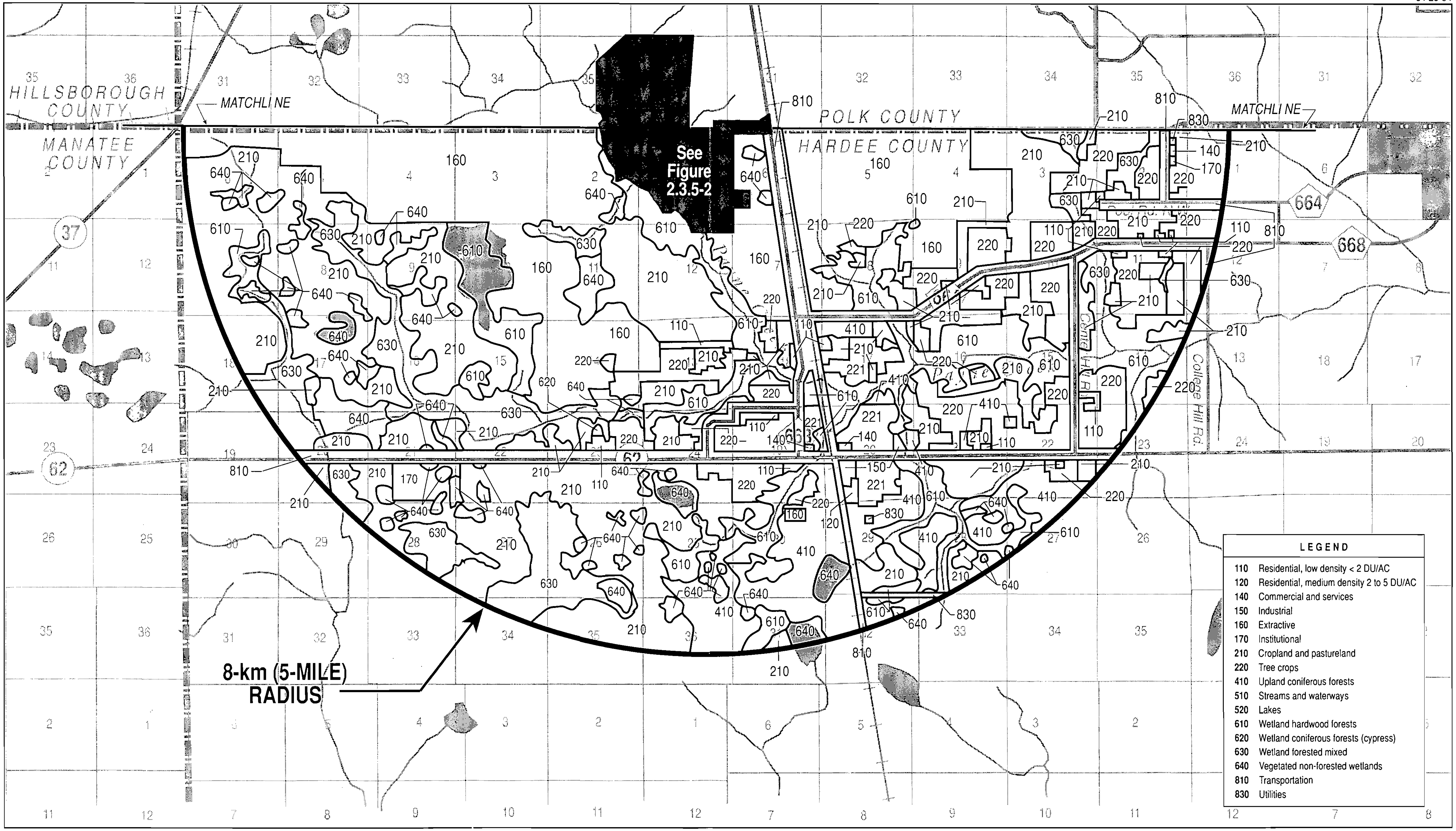

Figure 2.2.3-1 (Page 2 of 2)
Existing Land Use Within 8 km (5 miles) of the Hardee Unit 3 Site

Sources: FLUCFCS, 1985; KBN, 1994.

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2.2.4 EASEMENTS, TITLE, AGENCY WORKS

The property on which the Hardee Unit 3 Project is to be constructed is owned by SECI through a subsidiary (Acuera, Inc.). Therefore, no easements, titles, or approvals to use agency works will be required for this project.

2.2.5 REGIONAL SCENIC, CULTURAL AND NATURAL LANDMARKS

There are no federal, state, regional, or local scenic, cultural, or natural landmarks within an 8-km (5-mile) radius of the proposed project.

2.2.6 ARCHAEOLOGICAL AND HISTORIC SITES

There are no known significant archaeological or historical resources on the HPS site. The general area surrounding the HPS site appears to be one with infrequent sites, containing a sparse amount of cultural materials. None of these sites has been considered significant in terms of National Register of Historic Places criteria.

One insignificant prehistoric archaeological site is recorded in the SW1/4 of the NE1/4 of the SW1/4 of Section 1, Township 33 South, Range 23 East. This site is known as 8-Hr-35 in the Florida Master Site File and is located in the Hardee County portion of the HPS site. The prehistoric site was found by Jerald Milanich and Raymond Willis who concluded that the site was not significant in terms of National Register of Historic Places criteria under 36 CFR 63. This recommendation was made to the Florida Division of Historical Resources (DHR) which concurred with the recommendation in 1990.

DHR was contacted prior to submittal of the SCA/EA for the Hardee Unit 3 Project and concluded "that no significant archaeological and historical sites are recorded for or considered likely to be present within the project area...Therefore, it is the opinion of this office that the proposed project will have no effect on any sites listed, or eligible for listing, in the National Register of Historic Places, or otherwise of national, state, or local significance" (see Appendix 10.6).

2.2.7 SOCIOECONOMICS AND PUBLIC SERVICES

2.2.7.1 SOCIAL AND ECONOMIC CHARACTERISTICS

Hardee County's labor force totaled 9,368 in 1991, an increase of 9.7 percent from a 1989 labor force of 8,536. This percentage increase is higher than the statewide labor force increase of 3.8 percent. The 1991 count represents 3.9 percent of the Central Florida Region's total labor force (see Table 2.2.7-1). The Central Florida Region consists of DeSoto, Hardee, Highlands, Polk, and Okeechobee counties. DeSoto County had the lowest annualized unemployment rate in the region (7.8 percent), whereas Hardee County had the highest in the region (10.5 percent) and the sixth highest unemployment rate of the 67 counties in Florida.

The labor force in Polk County experienced an increase of 5.3 percent between 1989 and 1991. This increase also represents a larger percentage increase than the statewide labor force increase of 3.8 percent for the same time period. Three out of every four jobs in the Central Florida Region are located within Polk County.

Average monthly employment statistics for Hardee and Polk counties and the Central Florida Region by major industry group are presented in Table 2.2.7-2. Between 1990 and 1991, employment in Hardee County increased in each employment group with the exception of the manufacturing, wholesale trade, and services industries which experienced decreases. Most employment in Hardee County occurs in the agriculture industry. However, most employment in the Central Florida Region occurs in the services and retail trade industries. The services category employs proportionately fewer people in Hardee County than the region and the state. The transportation, communication, and public utilities industry and the construction industry are also a small component of the county economy compared to regional and state percentages. The agriculture category plays a relatively large role in the Hardee County economy.

Employment in Polk County is focused in the retail trade and service industries (Table 2.2.7-2). In 1991, more than 50 percent of the county labor force was engaged in one of these two industries. Approximately 13 percent of the labor force was employed by the manufacturing industry. While a significant portion of land in Polk County is dedicated to the mining industry, less than 3 percent of the county's workforce is employed in mining.

Personal income data for 1989 and 1990 are presented in Table 2.2.7-3 and Table 2.2.7-4, respectively. Additional income characteristics for Polk and Hardee counties are presented in Table 2.2.7-5. The majority of employment groups in private, nonfarm industries in Hardee and Polk counties experienced an increase in personal income between 1989 and 1990. The largest increase came from the manufacturing industry in Hardee County and the transportation, communication, and public utilities industry in Polk County. With the exception of the construction industry, all major employment groups experienced increases in personal incomes within the Central Florida Region and the state. Finance, insurance, and real estate showed the slowest personal income growth from 1989 to 1990, posting only a 1.4 percent increase in Hardee County. The slowest growth in Polk County came from the wholesale trade industry, posting only 0.9 percent increase. This pattern is also consistent with regional and state trends that depict slow manufacturing income growth for the same period. The largest industry in Hardee and Polk counties is the service sector, which generated 35.9 and 31.7 percent, respectively, of the total personal income in 1990. The service sector is also the largest industry in the Central Florida Region and the state.

In addition to the private, nonfarm industries depicted in Tables 2.2.7-3 and 2.2.7-4, farm and government industries contribute to personal income. In the farm industry, Hardee County posted a 19.5 percent decrease in total personal income from 1989 to 1990. This decrease which occurred in the farm industry was a significant portion of the 24.5 percent total decrease in personal income experienced in the Central Florida Region.

The government industry produced personal income increases in Hardee County, the Central Florida Region, and the state between 1989 and 1990. The large personal income increases came from the Central Florida Region, primarily due to Polk County government industries, which generated 72.5 percent of the region's personal income in the government sector.

Hardee County contained 5,213 households in 1990 at an average size of 2.87 people per household. This represents a 4.5 percent increase in the number of households from those counted in the 1980 federal census, but a 4.1 percent decrease in household size during the same time period. The average household size is somewhat above the average for the state of 2.45 people per household in 1991 and 2.45 in 1980. The number of households is anticipated to continue to increase and was estimated at approximately 5,750 and 6,180 households in 1995 and

2000, respectively, with an average size of 2.78 and 2.70 people in 1995 and 2000, respectively. Polk County was estimated to contain approximately 160,535 households in 1991 at an average household size of 2.52 people (University of Florida, 1992).

Housing in Hardee County is primarily owner-occupied and single-family structures, a majority of which have been constructed since 1960. In 1989, 46 building permits were issued for new single-family homes, one of which was to be located in the Bowling Green area. Forty-seven new single-family structures were authorized in 1990, and no new permits were issued in Bowling Green (Hardee County Building and Zoning Department, 1991).

Polk County experienced a much higher demand for new housing and authorized 1,828 single-family homes and 50 multi-family structures in 1992 and 2,116 single-family and 23 multi-family structures in 1993. A majority of the new units authorized in Polk County are located in the Lakeland/Winter Haven areas (Polk County Building Department, 1994).

In 1990, the median value of an owner-occupied home was $40,300 in Hardee County and $61,000 in Polk County. Both counties fell below the median for the state of $77,100 (U.S. Bureau of the Census, 1990 Census of Population and Housing). In 1990, the median contract rent for Hardee and Polk counties was $257/month and $300/month, respectively.

2.2.7.2 TRANSPORTATION

Access in and around the area surrounding the HPS site is almost exclusively by private vehicle. There are no public transit facilities serving the local area and communities. Figure 2.2.7-1 shows the major rail and road routes to and surrounding the Hardee Unit 3 site. The following paragraphs describe the routes that the construction and operation workforces are expected to travel.

State Road (SR) 37 is the primary north-south state highway in southwest Polk County. This is a 2-lane facility south of SR 60 in Mulberry and is expected to serve as the primary access route [to its intersection with County Road (CR) 630] for construction and operation workers returning to the Lakeland area and smaller communities such as Mulberry and Bradley Junction north of the plant site. It is expected that workers from these areas would exit the site heading north on Fort Green Road. At the intersection of Fort Green Road and CR 630, construction workers would head west on CR 630, then turn north on SR 37. The 1993 p.m. peak-hour traffic count for the section of SR 37 south of SR 60 was 1,160 vehicles (total two-way), about 5 percent of this traffic being trucks [Florida Department of Transportation (FDOT, 1993)]. There are four at-grade railroad crossings on this section of roadway.

The section of SR 37 south of CR 630, down to SR 674 is also likely to be used by workers residing west of Polk County on SR 674. From CR 630, workers would travel south on SR 37 and west on CR 674. The section of SR 37 between SR 674 and CR 630 had a 1993 p.m. peak-hour traffic count of 132. Approximately 14 percent of this volume was truck traffic. There are no rail crossings on this section of the road.

Access to the site to the Polk County communities of Winter Haven and Bartow, northeast of the site, and Fort Meade to the east is provided over US 17/SR 35. This is a 4-lane divided highway from US 98 in Fort Meade to its intersection with SR 60 in Bartow. While this highway follows a somewhat northwesterly direction (away from the site) between Fort Meade and Bartow, its high-speed/high-capacity design and the absence of rail crossings would likely induce workers residing in northern communities to take Fort Green Road to CR 630, where they would head east to US 17/SR 35. The 1993 p.m. peak-hour traffic count for this portion of US 17/SR 35 was 993 north of the intersection with CR 630/US 98.

While US 17/SR 35 carries a p.m. peak hour volume of 858 south to Bowling Green in Hardee County, it is not likely that site workers would follow that route to the site (via CR 663 and SR 62 or CR 664) since it is a longer route to the site than the one through Polk County (via Fort Green Road and CR 630). The only portion of US 17/SR 35 in Hardee County that is likely to be used by workers is the portion south of the intersection with SR 62. This segment would provide access for workers residing in Wauchula and Zolfo Springs in Hardee County and in Arcadia in DeSoto County. These workers would turn east onto SR 62 from CR 663 when leaving the site. The 1993 p.m. peak-hour volume on the portion of US 17/SR 35 just south of SR 62 was 858, approximately 6 percent of this being truck traffic. There are no at-grade rail crossings along this route.

CR 555 was constructed by the state and is currently maintained by Polk County and provides access from the site to the northeast by connecting CR 630 west of Fort Meade to SR 60 in

Bartow. This road provides a direct, low-volume alternative to US 17/SR 35 for workers returning to the Winter Haven-Bartow area. The 1993 p.m. peak-hour volume for this portion of CR 555 was 552 south of SR 60. Workers living in the Winter Haven-Bartow area would exit the site on Fort Green Road heading north to CR 630. They would then head east on CR 630 to its intersection with CR 555 where they would turn north toward the Winter Haven-Bartow area. This segment has a low traffic volume and has three at-grade railroad crossings.

CR 630 provides a direct east-west connection between SR 37 and US 17/SR 35. This 2-lane Polk County highway was also originally a state highway. Workers would exit the site onto Fort Green Road using CR 630 westbound to SR 37 and eastbound to either US 17/SR 35 or CR 555 to Fort Green Road. The 1993 p.m. peak-hour volume for CR 630 east of SR 37 was 110. There is a high level of truck traffic on this road as well as four at-grade rail crossings.

Access from the site to western coastal communities and the population centers of Hillsborough County is provided over SR 674. Workers would travel west on CR 630 and then south on SR 37 to SR 674. At that point, workers would travel west on SR 674 toward the western coastal communities. The 1993 p.m. peak-hour volume for SR 674 just west of SR 37 was 57.

Fort Green Road is a 2-lane, county-maintained highway extending from Bradley Junction to south of the site entrance. Fort Green Road will provide the principal access for workers exiting the site in both north and south directions. The surface condition of the road is generally good, and the road had a p.m. peak-hour volume of 78 in 1993. The Polk County portion has some alignment changes and four rail crossings. Traveling north toward CR 630, Fort Green Road makes four 90-degree turns as it crosses first to the east and then back to the west of the CSX rail line. The CSX trains average 8 to 12 movements a day through this area, with a possibility of at least 1 or 2 trains during the morning and afternoon shift changes.

Within Hardee County, SR 62 is a 2-lane state highway that runs east-west and will provide workers with access to points west and southeast (via US 17/SR 35). Worker traffic would exit the site on CR 663 and turn either west or east on SR 62. The 1993 p.m. peak-hour volume on the section of SR 62 just west of US 17/SR 35 was 181. There is moderate truck traffic on this road. South of SR 62, CR 663 is an unpaved road and is not a viable alternative to other local roads.

CR 664 is a 2-lane county highway that proceeds southwest from Bowling Green (and its intersection with US 17/SR 35) to an intersection with CR 663 south of the site. Workers using this highway would probably exit east toward Bowling Green. Correspondence with Hardee County staff indicated that no traffic counts are available for this portion of CR 664. There is one rail crossing on CR 664 just east of CR 663.

The CSX Transportation branchline (Brewster Subdivision - Tampa Division) provides north/south rail service to the area. The railroad is located about 0.8 km (0.5 mile) east of the center of the site, extends south from Edison (between Keysville and Bradley Junction), and interchanges with the Seminole Gulf Railway, a Class III short-line, at Arcadia. Numerous spurs off of this line to the north provide private access to phosphate companies.

No public licensed airports or airfields are located within an 8-km (5-mile) radius of the proposed site.

2.2.7.3 MEDICAL FACILITIES

Hardee County contains one general hospital with 50 beds, and Polk County contains eight hospitals with a total capacity of 1,811 beds. The nearest facility to the project site is Hardee Memorial Hospital located approximately 22.5 km (14 miles) southeast of the site in Wauchula. Both counties contain nursing homes and nursing and personal care facilities.

Emergency medical services are located in both Hardee and Polk counties. Within Hardee County, one ambulance and an emergency medical team are located in Wauchula. In Polk County, within an approximate 16-km (10-mile) radius of the facility, Fort Meade and Mulberry each contain one ambulance and medical team. Bartow, located farther north, also contains two ambulances and two emergency medical teams.

2.2.7.4 FIREFIGHTING FACILITIES

Emergency fire response in the site vicinity is provided by the Hardee County Fire Department and the Polk County Fire Department. The primary responder is Station 1, which is located in Wauchula, approximately 21 km (13 miles) southeast of the site. Station 1 is equipped with a pumper, tanker, and rescue equipment and is staffed with a 20-person crew. The response time from this facility is expected to be approximately 15 to 20 minutes. Backing up Station 1, if necessary, is the Bowling Green Station, located on Highway 17 in Bowling Green.

The primary responder in Polk County is the Bradley Station. The Bradley Station is equipped with a 750-gallon-per-minute (gpm) pumper, tanker, and rescue equipment and is staffed with two people during the day and volunteers at night. The response time from the Bradley Station is approximately 10 minutes. Backup support would be provided by the Fort Meade Station or the Bowling Green Station in Hardee County. Table 2.2.7-6 lists the firefighting equipment for communities within 16 km (10 miles) of the site.

Firefighting equipment is available throughout the area. Within Hardee County, the fire departments in Bowling Green and Zolfo Springs are voluntary; the Wauchula Fire Department has a full-time force of 20 (Choate, 1994).

In Polk County, Fort Meade's force of 27 is entirely voluntary; however, the fire department in Bartow contains 14 full-time firefighters, 17 part-time firefighters, and 40 voluntary members (Monroe, 1994). Bradley Junction has 2 full-time and 10 volunteer members (Gunter, 1994).

2.2.7.5 POLICE PROTECTION

Police protection in the vicinity of the proposed project site is currently provided by the Hardee County Sheriff's Department. The proposed project site is located in the north (police service) zone. Each zone in Hardee County is patrolled by two deputies. Deputies from adjacent zones are available to provide backup if necessary. The response time is approximately 15 to 20 minutes, depending on the location and workload of the deputy on duty in the zone and the type of assistance requested.

The Hardee County Sheriff Department maintains a force of 57 officers with 32 vehicles, and 1 air patrol, and is responsible for police protection in the unincorporated portions of the county (Harris, 1994). Bowling Green, Wauchula, and Zolfo Springs have police departments which serve those communities. The police force in Bowling Green consists of four full-time employees, six part-time employees, and six vehicles (Brown, 1994). Wauchula's police department consists of 11 full-time and 6 part-time employees plus 17 vehicles (Brock, 1994). Zolfo Springs' police department consists of four employees and four vehicles (Brock, 1994). In addition to county and local police, the area is also served by the Florida Highway Patrol (FHP), with one officer stationed in Hardee County (Clerk of FHP, 1994).

As of February 4, 1994, Polk County has 360 full-time certified law enforcement employees and 3 part-time certified law enforcement employees. Within the unincorporated portion of the county are four primary patrol zones. Each patrol zone is normally staffed by one uniformed deputy sheriff per shift, 24 hours a day. The proposed project site is located in Zone 66. Zone 66 is patrolled by one deputy; however, additional deputies are available if necessary. The response time is approximately 10 to 15 minutes. In addition, Bartow, Mulberry, and Fort Meade each have police departments which service these communities (Polk County Sheriff Department, 1994).

2.2.7.6 RECREATION FACILITIES

There are no federal, state, or local recreation facilities within an 8-km (5-mile) radius of the project site. The nearest local facility is the Little Cypress Golf and Country Club, which is located about 16 km (10 miles) away, just west of Wauchula.

Two state parks, Highlands Hammock and Payne Creek, and one state recreation trail, Peace River, are located within Hardee County. Payne Creek State Park and the Peace River Recreational Trail are located about 13.7 km (8.5 miles) east of the site. Highlands Hammock State Park is located in the southeastern edge of the county, more than 32 km (20 miles) southeast of the site.

Polk County contains two state parks (Lake Kissimmee and Lake Arbuckle), one special water area, and several state-owned fish management areas. None of these facilities is located within 8 km (5 miles) of the proposed site.

2.2.7.7 ELECTRIC AND GAS

Electricity is supplied to the area by the Peace River Electric Cooperative, Florida Power & Light Company (FPL), and Tampa Electric Company (Polk County only). Hardee County contains no natural gas transmission pipelines except for the line that is currently serving the existing HPS. The Florida Gas Transmission Company distributes gas to Fort Meade in Polk County and to the HPS site by a gas lateral constructed as part of the original site certification.

2.2.7.8 WATER SUPPLY FACILITIES

Hardee County has no county-owned water facilities; all are municipal or private. The rural unincorporated areas of the county receive water from private wells. Municipal service is provided in Wauchula, Bowling Green, and Zolfo Springs.

Polk County provides water to certain communities within the county; however, Bartow, Fort Meade, and Mulberry each contain municipal treatment and distribution systems.

2.2.7.9 SEWAGE TREATMENT FACILITIES

Sewage treatment facilities in Polk and Hardee counties are located only in the more urbanized areas; the unincorporated areas use private septic systems.

Sewage treatment systems serve Wauchula, Bowling Green, and Zolfo Springs in Hardee County and Fort Meade, Bartow, Lakeland, and Winter Haven in Polk County. Table 2.2.7-7 lists current treatment volumes and capacities for each system.

2.2.7.10 SOLID WASTE DISPOSAL

One solid waste disposal area is located near Wauchula in Hardee County. The landfill has an expected capacity of 10.25 years remaining and receives an average of 21,350 tons per year (TPY) (Williamson, 1994).

Polk County contains three county landfills: North Central at Lakeland, Southeast at Lake Wales, and Northeast at Lake Hamilton. The area in Polk County surrounding the proposed site would use the North Central landfill which receives an average of about 300,000 TPY of solid waste with an anticipated design capacity of 20 years (Mahler, 1994).

Table 2.2.7-1. 1991 Labor Force, Employment, and Unemployment for Hardee County, Polk County, the Central Florida Region, and Florida

Area	Labor Force	Employment	Unemployment	Unemployment Rate (%)
Hardee County	9,368	8,381	987	10.5
Polk County	180,659	162,390	18,269	10.1
Central Florida Region	238,446	214,947	23,499	9.42
Florida	6,431,205	5,960,694	470,525	7.3

Sources: State of Florida, Department of Labor and Employment Security, unpublished data.
U.S. Department of Labor, Bureau of Labor Statistics.
University of Florida, 1992.

Table 2.2.7-2. 1991 Average Monthly Employment by Major Industry Group for Hardee County, Polk County, the Central Florida Region, and Florida

Industry	Hardee County	Polk County	Central Florida Region	Florida
Agriculture, Forestry, and Fishing	2,387	10,433	19,274	149,784
Mining	ND	3,820	3,820	8,147
Construction	181	8,019	9,931	283,999
Manufacturing	312	20,653	22,688	491,919
Transportation, Communication, and Public Utilities	169	8,152	9,615	315,448
Wholesale Trade	296	7,504	8,839	287,354
Retail Trade	1,094	33,612	42,806	1,120,022
Finance, Insurance, Real Estate	209	7,433	8,965	359,575
Services	1,603	44,588	58,791	1,904,943
Government	670	10,480	13,963	371,986
Other	ND	189	189	13,022
TOTAL	6,921	154,883	196,181	5,306,199

ND = Not disclosed.

Source: State of Florida, Department of Labor and Employment Security, Bureau of Labor Market Information, "Employment, Wages, and Contributions Report" (ES-202), unpublished data.

Table 2.2.7-3. 1989 Personal Income for the Major Private, Nonfarm Industries in Hardee County, Polk County, the Central Florida Region, and Florida

	Income ($1,000)			
Private Nonfarm Industries	Hardee County	Polk County	Central Florida Region	Florida
Manufacturing	5,483	604,975	652,734	14,974,128
Mining	ND	139,609	142,021	570,501
Contract Construction	ND	255,086	310,735	10,100,898
Wholesale Trade	6,291	222,992	249,555	9,046,497
Retail Trade	13,836	542,981	664,727	17,225,299
Finance, Insurance, and Real Estate	4,093	190,015	222,784	10,679,489
Transportation, Communication, and Public Utilities	6,684	215,262	253,584	8,917,942
Services	27,205	1,000,555	1,198,169	42,719,679
Other	11,439	78,138	117,811	1,365,900
Total	74,986	3,249,613	3,812,120	115,600,333

Note: ND = Not disclosed.

Source: U.S. Department of Commerce, Bureau of Economic Analysis, unpublished data.

Table 2.2.7-4. 1990 Personal Income for the Major, Private, Nonfarm Industries in Hardee County, Polk County, the Central Florida Region, and Florida

	Income ($1,000)			
Private, Nonfarm Industries	Hardee County	Polk County	Central Florida Region	Florida
Manufacturing	6,408	620,354	668,044	15,425,169
Mining	ND	142,663	145,113	556,068
Contract Construction	ND	246,588	301,495	9,976,541
Wholesale Trade	5,545	225,044	253,505	9,478,339
Retail Trade	14,324	561,726	688,088	18,006,791
Finance, Insurance, and Real Estate	4,151	202,703	238,627	11,250,991
Transportation, Communication, and Public Utilities	6,616	236,972	277,692	9,655,678
Services	28,151	1,075,966	1,295,691	47,264,771
Other	13,193	78,914	126,137	1,464,546
Total	78,388	3,390,930	126,137	123,078,894

Note: ND = Not disclosed.

Source: U.S. Department of Commerce, Bureau of Economic Analysis, unpublished data.

Table 2.2.7-5. 1989 Income Characteristics for Hardee and Polk Counties

Income Characteristic	Hardee County ($)	Polk County ($)
Per Capita Income (1989)	9,411	12,392
Median Income--Family	24,327	28,965
Median Income--Household	22,065	25,216

Source: U.S. Department of Commerce, Bureau of the Census, 1990 Census of Population and Housing: Summary Tape File 3.

Table 2.2.7-6. Firefighting Equipment for Communities Within Approximately 16 km (10 miles) of Hardee Unit 3

Community	Equipment	
	Pumpers	Tankers
Hardee County		
Bowling Green	2	1
Wauchula	3	1
Zolfo Springs	1	1
Polk County		
Fort Meade	3	2[a]
Bartow	3	2[b]
Bradley Junction	1	1[a]

[a] Plus one rescue vehicle.
[b] Plus one aerial truck.

Sources: M. Choate, Hardee Fire and EMS Department, 1994.
W. Gunter, Bradley and Fort Meade Fire Departments, 1994.
Monroe, Bartow Fire Department, 1994.

Table 2.2.7-7. 1989 Municipal Sewage Systems Usage and Capacity for Selected Communities in Hardee and Polk Counties

	Volume (mgd)	
Community	Current Use	Capacity
Hardee County		
Bowling Green	0.220	0.320
Wauchula	0.86	1.0
Zolfo Springs	0.125	0.2
Polk County		
Fort Meade	0.5	1.0
Bartow	2.75	2.75

Sources: D. Elbertson, Bowling Green Municipal Offices, 1994.
Polk County Water and Sewer Department, 1994.
R. McClellan, Zolfo Springs Municipal Offices, 1994.
G. Heine, Wauchula Municipal Offices, 1994.
D. Allen, Bartow Water Department, 1994.

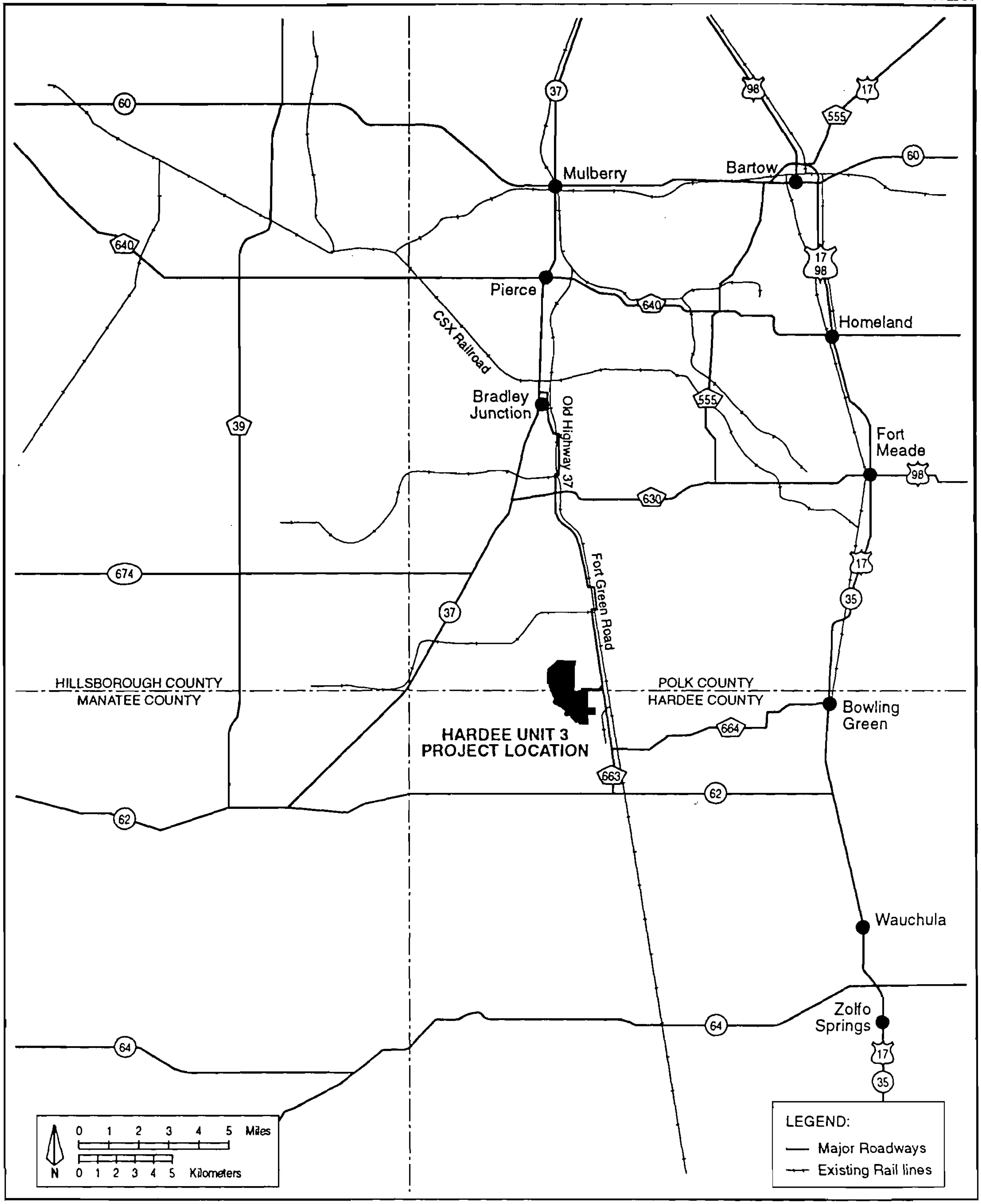

Figure 2.2.7-1
Major Transportation Routes Surrounding the
Hardee Unit 3 Project

Source: KBN, 1994.

SEMINOLE ELECTRIC COOPERATIVE INCORPORATED

2.3 BIOPHYSICAL ENVIRONMENT

2.3.1 GEOHYDROLOGY

Characterization of the geohydrology of the overall HPS site was included in the SCA/EA document prepared for the original HPS (TPS/SECI, 1989). Site-specific data were collected to describe lithology and hydrogeologic units and allow comparison with regional trends. The data collected for the HPS site are considered to be representative of the Hardee Unit 3 Project area and provide the basis for the description of the current project area in this section.

2.3.1.1 GEOLOGIC DESCRIPTION OF THE SITE-AREA

2.3.1.1.1 Regional Stratigraphy

The HPS site lies within Polk and Hardee counties and is underlain by sediments and rock primarily of Tertiary age (Stewart, 1966; Wilson, 1977). Portions of the HPS site have been mined to recover phosphate ore and reclaimed. Mining activities are restricted to the upper 9 to 12 m (30 or 40 ft) of substrate. After mining, reclamation activities result in a mixture of upper-sand layers. Unmined or deeper soils will conform to the following description.

A generalized stratigraphic section for the two-county area near the site is shown in Figure 2.3.1-1. The deepest described formation is the Cedar Keys which overlies rocks deeper than 610 m (2,000 ft). Above this formation is the Oldsmar Limestone which underlies all of the Florida peninsula. The Avon Park Limestone, which thickens to more than 305 m (1,000 ft) and is found above the Oldsmar, is the primary aquifer across Florida (refer to Section 2.3.2). Overlying the Avon Park is the Ocala Group which consists of (in ascending order) the Inglis, Williston, and Crystal River Formations. The Ocala crops out in the Green Swamp area of northern Polk County and increases in thickness from 90 to 180 m (300 to 600 ft).

The Suwannee Limestone Formation ranges in thickness from 25 to 75 m (80 to 250 ft), crops out in northeastern Hillsborough County, and pinches out in Polk County. Overlying the Suwannee are the Hawthorn Group strata. Current practice is to subdivide the lower part into the Tampa member, which consists of a lowermost "sand and clay" unit, and an upper limestone unit. The overlying Hawthorn Formations rest upon a weathered contact and are subdivided into a lower calcareous formation, an interbedded middle member, and an upper clastic member. Total thickness of the Hawthorn Group varies from very thin to as much as 90 m (300 ft) in Polk and Hardee counties.

The Tamiami Formation and the overlying Caloosahatchee Marl generally occur south of the site but are discontinuous near the site area where the Bone Valley member predominates. The Bone Valley ranges in thickness from 6 to 18 m (20 to 60 ft) and is exposed in stream cuts and on high plateaus in Polk County.

The most recent deposits are the unnamed terrace deposits which range from 0 to 21 m (0 to 70 ft) thick. These deposits are described more fully in Section 2.3.1.3.

2.3.1.1.2 Lithology

Generalized descriptions (from Wilson, 1977, except as noted) of the formations in the site area are summarized here in ascending order.

Oldsmar (Lake City) Formation--Limestones and dolomites with evaporites, soft to hard, chalky zones, occasional fine honeycomb, abundant nodules and nests of nodules of gypsum altered from anhydrite, some selenite cemented fractures (Stewart, 1966).

Avon Park Formation--Limestone, chalky, nodular, oolitic, fragmental, intergranular anhydrite and gypsum, very fossiliferous, cream, white, and buff; commonly thin dolomite in middle part, dense to finely crystalline or sucrosic, yellow to grayish brown. Lower dolomite unit massive, dense to finely crystalline or sucrosic, some coarsely crystalline, pale-yellow and brown to dark-brown and gray, mottled.

Ocala Group--Limestone, chalky, nodular, granular, fragmental, some oolitic, generally very fossiliferous, cream, white, some buff; occasional dolomite in lower part, sucrosic to dense and cherty, yellowish brown to dark-brown and gray.

Suwannee Formation--Limestone, nodular, granular, chalky, some fragmental, some oolitic, usually very fossiliferous, cream to white, occasionally some clear quartz grains.

Sand and Clay Unit of Tampa Limestone--Sand, fine-coarse grained, clean to silty, limey, grayish green; and clay, silty, sandy, marly, gray to pale green, and hard, waxy, dark green to black, marly; minor limestone.

Tampa Limestone Unit--Limestone, massive or thick-bedded, hard, dense, cherty, fossiliferous, phosphatic, white to gray and brown; minor thin bedded sand and clay. Where underlying sand and clay unit is absent, equivalent beds are limestone, predominantly sandy, fossiliferous, gray, cherty; in places marly, soft, pebbly.

Hawthorn Group--Predominantly marl, dolomite and limestone; soft, chalky, fine-grained to sandy or pebbly; abundant brown or black phosphorite grains or pebbles; minor thin-bedded sand and clay. Generally the uppermost limestone in the section, less clastic than the underlying sand and clay unit, phosphatic throughout.

Bone Valley Member--Clayey sand and sandy clay, fine-grained, calcareous to noncalcareous; abundant phosphorite nodules up to pebble size, white to gray in upper part, amber or black in lower part; includes beds of clean phosphatic sand, and sand and gravel.

Unnamed Sand Unit--Sand, clayey, very fine to medium grained, predominantly fine-grained; white to brown; trace of phosphate in lower part, minor thin beds of limestone, and bluish gray clayey sand and clay.

2.3.1.1.3 Site-Area Stratigraphy

The results of four deep borings were used to prepare the general stratigraphic description for the site. These borings are the Southwest Florida Water Management District (SWFWMD) Regional Observation Monitoring Program (ROMP) No. 40 Well near Duette, the United States Steel Agri-Chemicals (USSAC) South Rockland Well in Section 1 of Township 33 S, Range 24 E, about 3.2 km (2 miles) west of Bowling Green (Dames & Moore, 1979), and the CFI production test well and deep Floridan test well, both in Section 26 of Township 34 S, Range 23 E, about 3.2 km (2 miles) southwest of Fort Green Springs. The terrace sands range in thickness from 9 to 12 m (30 to 40 ft), and the Hawthorn lies from 9 to 113 m (30 to 370 ft) deep. The Tampa Formation lies at depths of from 67 to 146 m (220 to 480 ft); the top 18 to 29 m (60 to 95 ft) is limestone, and the bottom 9 to 14 m (30 to 45 ft) is sand and clay. The Suwannee Limestone lies at depths of 108 to 204 m (355 to 670 ft), and the Ocala Group ranges from 146 to 283 m (480 to 930 ft) deep. Two of the deep wells reached the Avon Park Limestone at depths of 223 and 482 m (730 and 1,580 ft). The deep Floridan test well reached the Oldsmar (Lake City) Formation at a total depth of 550 m (1,800 ft).

2.3.1.1.4 Site-Area Structure

The major geologic structure is the Peninsular Arch, which forms the backbone of the Florida peninsula striking S 35°E. Subparallel to this and to the north of the site is the Ocala Uplift which is a faulted elliptical area in Levy County where this structure is 370 km (230 miles) long and 113 km (70 miles) wide. The nearest structure to the site is the Kissimmee flexure, which strikes east of northeast through the central part of southern Polk County. To the south of the site is the South Florida Basin which is a gentle structure trending S 45°W. Faulting has not been identified within the immediate site vicinity to date.

2.3.1.1.5 Site-Area Physiography

The area falls into the geomorphic province known as the Polk Upland (White, 1970), occurring above the Wicomico Shoreline which is a Pleistocene terrace landform occurring at elevation +30 m (+100 ft) several miles south of the site. South of the site is the geomorphic terrain mapped as the DeSoto Plain. The Polk Upland is flat and covered with a blanket of permeable sand; seepage is rapid and little dissected by streams, resulting in a subdued topography. Only remnants of the ancient shoreline, i.e., bars, spits, and terrace scarps, mark the landform as it gently slopes toward the south.

2.3.1.2 DETAILED SITE LITHOLOGIC DESCRIPTION

The presence of pebble-sized phosphate grains in localized areas or very thin zones within the Bone Valley strata dominates the detailed site geohydrology. Parts of the site containing economic deposits of pebble-phosphate have been strip mined. Mining activity typically removed the unnamed surficial sands (overburden) and placed them in the adjacent pit bottom at a lower elevation. Mixing with clayey sand overburden is inevitable so that the entire zone, typically less than 9 m (30 ft), has been altered where mining activity was conducted. Strip mining and reclamation activities have been completed within the HPS site, resulting in land surface configurations that restore drainage basins to pre-mining conditions. Other parts of the HPS site have not been mined and remain undisturbed.

An exploratory program was conducted to characterize the hydrogeologic units occurring at the HPS site. The subsurface investigations consisted of:

1. Ten Standard Penetration Test (SPT) borings. These borings, identified as B-1 through B-10, were drilled to depths varying from 12 m (40 ft) to greater than 61 m (200 ft).
2. Six shallow aquifer observation wells completed to approximate depths of 6.1 m (20 ft). These observation wells were identified as B-1, B-2, B-3, B-10, B-11, and B-12. These borings were advanced with casing and water to approximately 9 m (30 ft). Copies of the boring logs are included in the HPS SCA/EA (TPS/SECI, 1989).
3. Three deep intermediate aquifer observation wells completed to depths greater than 61 m (200 ft). These observation wells were identified as B-3A, B-10A, and B-12A. These borings were advanced with casing and water to approximately 25 m (80 ft), and then were drilled with open hole using native fluids to boring termination. Copies of the boring logs are included in HPS SCA/EA (TPS/SECI, 1989).

Split spoon samples, Shelby tube samples, and wash samples were obtained during drilling activities conducted during the exploratory program. The laboratory testing program consisted primarily of moisture content, dry density, organic content, Atterberg limits, sieve analyses, and permeability testing, with some shear strength testing (see Section 2.3.1.4) for foundation design. A total of 86 grain-size analyses were conducted, 16 of which included a hydrometer test on the silt and clay fraction. Soil classification tests according to the Unified Method (ASTM D2487) were prepared for the samples. The group symbols ranged from SP to SM to ML for the clastic units and from CH and CL to SC for the cohesive soil units. The definitions of these symbols are provided in Figure 2.3.1-2. Results of geotechnical testing program are included in the HPS SCA/EA (TPS/SECI, 1989).

Cross sections for the HPS site have been developed with the data collected from the three deep borings (see Figure 2.3.1-3). A north-south cross section is presented in Figure 2.3.1-4, and a west-east cross section is presented in Figure 2.3.1-5.

The Upper Sand Unit is a gray, fine-grained sand that becomes browner and siltier with depth. In areas where mining has occurred, this overburden material was removed and reworked or replaced with tailing sands. The natural water content of these soils averaged 12 percent, and the fines ranged from 18 to 34 percent in eight tests. Thickness of this unit is typically 1.5 to 3 m (5 to 10 ft), except in mined areas where it can be up to 8 m (25 ft) thick.

The Upper Confining Bed underlies the Upper Sand Unit and consists of sandy clay, clayey sand, and cemented sand layers. The unit is typically a light gray to tan clayey sand underlain by light gray to light brown sandy clay which may interfinger toward the base. Water contents range from 25 to 60 percent in 37 tests on these materials. Liquid limits averaging 90 percent and plastic limits averaging 30 percent were found in 27 tests. Dry densities from tube samples were extremely variable from 18 tests yielding total porosities of 30 to 70 percent. From 30 grain size tests, the fines ranged from 18 to 62 percent. Kaolinite, palygorskite, and montmorillonite clay minerals are present according to the literature, and the presence of montmorillonite is confirmed by the very high liquid limits of 185 percent found in some samples. Cation exchange capacities are expected to be as high as 100 milliequivalents per 100 grams (meq/100 g) for the clays that are predominant near the base of the upper confining bed. Near the top of the bed, where the clays are kaolinitic, the cation exchange capacity is expected to be only 5 to 15 meq/100 g. Three laboratory permeability tests ranged from a low of 7.4×10^{-9} cm/sec to a high of 6.7×10^{-6} cm/sec. Thickness ranged from 6 to 15 m (20 to 50 ft) at the site, although silty sand and even gravelly sand seams (the phosphate deposit) may be found as inclusions within this unit. Where mining has taken place, this unit may be as thin as 3 to 5 m (10 to 15 ft). Typically a "hardpan" or "pit bottom" of limestone or calcareous cement zone is found at depths of from 8 to 16 m (25 to 50 ft). These are materials of the Bone Valley Formation.

The Intermediate Sand Unit is found directly underlying the Upper Confining Bed and consists of gray phosphatic sands and silts of the upper Hawthorn Formation. The water content ranged from 28 to 50 percent, the liquid limit was 74 percent (average), and the plastic limit was 37 percent (average) based on results of tests conducted on the clayey interbeds. This suggests that the cation exchange capacity of this layer is similar to that of the overlying clays; montmorillonite is present in the clay interbeds. Tests conducted on undisturbed tube samples gave total porosity values of 52 and 64 percent, and percent fines ranged from 15 to 45 percent. This unit contains numerous beds which are similar to the layers above, but layers of gray to black fine-grained sands with sandy silt are abundant enough to form an interconnected porous media which is 12 to

21 m (40 to 70 ft) thick on the site. Thin cemented layers and silty clay interbeds are characteristic inclusions.

The Lower Confining Bed that underlies the Intermediate Sand Unit consists of clayey sands and silts of the lower Hawthorn Formation. Tests performed on samples collected from this layer show water content ranging from 41 to 53 percent, an average liquid limit of 60 percent, plastic limit of 38 percent, and fines ranging from 35 to 60 percent. These beds include silty clay, phosphatic clayey sand, clay, sandy clays, sand and clay, and sand with brown clay near the base. Very thin carbonate beds and calcareous cemented interbeds are found throughout this unit. Based on boring data, this unit appears to be 24 to 30 m (80 to 100 ft) thick at the site.

The Carbonate Unit underlies the Lower Confining Bed and consists of dolomite and limestone of the lowermost Hawthorn and Tampa Formations. This unit occurs where the carbonate layers became relatively massive or where 50 percent of the section is dominated by carbonate beds. This can be a white limestone to a gray dolomite with occasional chert. In boring P-12A, this unit was as thin as 3.3 m (11 ft).

2.3.1.3 GEOLOGIC MAPS

Soils have been mapped in both Polk County and Hardee County by the U.S. Department of Agriculture in cooperation with the county soil conservation services (USDA, 1984; and Polk County SCS, unpublished, 1988). The site occurs predominantly within the Smyrna-Myakka-Ona general soil grouping, which consists of nearly level, poorly drained soils that are sandy throughout and that have a dark colored subsoil at a depth of less than 76 cm (30 inches). Individual soil mapping units include Smyrna sand, Myakka fine sand, Ona fine sand, Basinger fine sand, Fort Green fine sand on 2 to 5 percent slopes, Immokalee fine sand, Wabasso fine sand, Placid fine sand (depressional, in sinkholes), Samsula muck, and Bradenton-Fleda-Chobee association (frequently flooded, in wetlands). In Polk County, areas of mined land are described as:

> #11 - Arents - Water complex consists of overburden material (material removed to get to the "matrix" material or phosphate-bearing strata) piled into mounds of narrow ridges with very steep sides separated by narrow pits that may or may not contain water. The water table of this complex is variable but primarily the arents part has a water table more than 2 m (80 inches) from the surface.

This statement described the topography and soils at the mined portions of the HPS site prior to subsequent reclamation and construction. The area designated for Hardee Unit 3 includes mined soils that have been reclaimed and unmined soils.

The lowest point on the HPS site is at elevation +30 m (+100 ft) where Payne Creek flows southeastward from the extreme southern end of the site. The floodplain of Payne Creek forms the southwestern boundary of the site, and the elevations raise up somewhat steeply to elevation +35 m (+115 ft). The land slopes gently upward toward the north and northeast at a fairly uniform grade to a maximum elevation of +42 m (+137 ft) at the extreme northeastern corner of the site. Several circular depressions are shown on aerial photographs and topographic maps which predate the mining activity. These features are discussed in Section 2.3.2.2.

Polk County has been geologically mapped in detail (Campbell, 1986) whereas Hardee County has not. Significant geologic units in the site area (Brooks, 1981) include mainly the Pliocene Bone Valley (Pbv) Formation which is mapped in the site area. To the east along the Peace River, the Miocene Hawthorn (Mh2) Formation is mapped, and to the south of the site deposits are mapped as Miocene Hawthorn of the Statenville Type (Mh3).

Differentiation of the uppermost Unnamed Sand unit from the Bone Valley member is based on a noticeable change in clay content. Typically, the top of the Bone Valley is represented by a clayey sand often yellowish gray and poorly indurated. Since this clayey sand is only 1.5 m (5 ft) thick and occasionally underlain by a white to light gray fine grain sand, it cannot be relied upon as a confining bed. Presence of ditch drains (see Section 4.1.4) and deeper mine pits onsite provide an interconnection between the recent sand deposits and the sand units contained within the Bone Valley member. For these reasons, the most significant geologic horizon is the "hardpan" or "pit bottom" strata where calcareous cementation marks the first Hawthorn Group carbonate.

Figure 2.3.1-3 shows the boring location plan for the HPS site. It also includes locations of cross sections and piezometers. Figure 2.3.1-6 shows the elevation of geologic "hardpan" layer which separates the water table aquifer from the intermediate confined aquifer.

2.3.1.4 BEARING STRENGTH

A preliminary geotechnical and foundation engineering study was conducted to characterize subsurface conditions at the Hardee Unit 3 site (AT&E, 1993; see Appendix 10.7). The study included performing laboratory and field testing on collected soil samples, evaluating conditions encountered with respect to proposed construction, and preparing preliminary recommendations for foundation design. Fourteen soil borings (see Figure 2.3.1-7) were conducted in general compliance with ASTM procedures for standard field penetration tests (D-1586). The penetration resistance (N-value) recorded by driving split-spoon samplers was the measurement used to determine bearing strength of site soils.

The soils in the west-central portion of the Hardee Unit 3 site were described as typically clean to slightly silty or slightly clayey fine sand extending from ground surface to depths of 0.6 to 4 m (2 to 13 ft). The sands were generally underlain by clayey sands which graded to sandy clays and clays to boring termination depths of 9 to 27 m (30 to 90 ft) below existing ground surface. Soils in the upper 9 m (30 ft) typically had N-values ranging from 8 to 40 blows per foot. Below a depth of approximately 9 m (30 ft), the soils generally increased in relative density with N-values frequently above 30 blows per foot. The soils encountered in these standard penetration test boring locations are generally consistent with the findings of the exploratory drilling program previously conducted for the HPS site as summarized in Section 2.3.1.2. Soils encountered in the west-central portion of the Hardee Unit 3 site are comparable to the soils of the Upper Sand Unit and Upper Confining Bed, as depicted in Figures 2.3.1-4 and 2.3.1-5.

Exceptions to this trend were noted at two borings located in the eastern portion of the Hardee Unit 3 site, along the entrance road alignment. Soils encountered in this part of the site included clean and slightly clayey fine sand to 8.5 m (28 ft) underlain by sandy clay to a boring termination depth of 14 m (45 ft) at one location; at the second boring location, clean sand at the surface was underlain by 10 m (34 ft) of loose to very loose sand and soft clay, which in turn was underlain by stiff to very hard clayey sand to boring termination depth of 20 m (65 ft). These borings appeared to be located within an area that had been previously mined because the soils within the upper to 9 to 12 m (30 to 40 ft) had much looser relative densities than noted for the balance of the Hardee Unit 3 site. The N-values recorded at these two locations for soils in the upper 9 m (30 ft) were less than 10 blows per foot, with N-values for deeper soils generally greater than 10 blows per foot.

The subsurface soil conditions were concluded to be generally suitable for support of the proposed power block facilities on mat foundation systems. Major heavily loaded equipment foundations, such as stack foundations subjected to high overturning loads, will be founded on deep foundations such as auger cast pilings. It was indicated that high contact pressures might preclude the use of spread footings, while deep foundation systems were considered suitable for use if the arrangement of structures resulted in the potential for excessive differential settlement. Special pavement design was recommended for construction of the access roadway across mined areas in the eastern portion of the site.

System	Series	Group	Formation	Lithology	Hydrostratigraphic Unit
	RECENT		UNNAMED SANDS	SAND, CLAYEY, VERY FINE TO MEDIUM MOSTLY FINE GRAINED, WHITE TO BROWN, TRACE PHOSPHATE IN LOWER PART, MINOR THIN BEDS OF LIMESTONE AND BLUE GRAY CLAYEY SAND AND CLAY.	SURFICIAL AQUIFER
	PLEIST-OCENE				
TERTIARY	PLIOCENE				
	MIOCENE	HAWTHORN GROUP	BONE VALLEY	CLAYEY SAND AND SANDY CLAY, FINE-GRAINED, CALCAREOUS TO NON-CALCAREOUS, ABUNDANT PHOSPHORITE NODULES TO PEBBLE SIZE, WHITE TO GRAY IN UPPER PART, AMBER & BLACK IN LOWER PART, BEDS OF CLEAN PHOSPHATE.	INTERMEDIATE AQUIFER
			PEACE RIVER	PREDOMINANTLY A CLASTIC UNIT BROWN TO BLACK, FINE GRAINED TO SANDY OR PEBBLY, W/OCCASIONAL CARBONATE BEDS, CLAYEY, DOLOMITIC, PHOSPHATIC	
			ARCADIA	VERY CALCAREOUS OR DOLOMITIC QUARTZ SAND TO VERY SANDY CARBONATE, W/SANDY CALCAREOUS TO DOLOMITIC CLAYS, 15-20% PHOSPHATE.	
			TAMPA	DOLOMITIC LIMESTONE NEAR TOP WITH CLAYEY INTERBEDS, BECOME GREENISH SAND - CLAY AT BASE.	FLORIDAN AQUIFER
	OLIG-OCENE		SUWANNEE	LIMESTONE, NODULAR, GRANULAR, CHALKY, FOSSILS, CREAM TO WHITE IN COLOR.	
	EOCENE	OCALA	CRYSTAL RIVER WILLISTON INGLIS	LIMESTONE, CHALKY, NODULAR, GRANULAR, FRAGMENTAL, SOME OOLITIC, FOSSILIFEROUS, CREAM WHITE, SOME BUFF, W/OCC DOLOMITE IN LOWER PART, SUCROSIC TO DENSE AND CHERTY, YELLOWISH BROWN TO DARK - BROWN AND GRAY.	
			AVON PARK	LIMESTONE, CHALKY, NODULAR, FRAGMENTAL, W/ANHYDRITE AND GYPSUM, CREAM WHITE TO BUFF.	
			OLDSMAR	LIMESTONE, AS ABOVE, WITH RUBBLE ZONES.	
	PALEO-CENE		CEDAR KEYS	ANHYDRITE AND DOLOMITE BEDS WITH GYPSUM NODULES.	

Figure 2.3.1-1
Generalized Stratigraphic Column of the HPS Site Vicinity

Sources: Ad Hoc Committee on Florida, Hydrostratigraphic Unit Definition, 1986; Wilson, 1977; Stewart, 1966; KBN, 1994.

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SOIL CLASSIFICATION CHART
ASTM D 2487

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE-GRAINED SOILS more than 50% retained on no. 200 sieve	**SANDS** more than 50% of coarse fraction passes no. 4 sieve	**CLEAN SANDS**	SP	Poorly graded sands and gravelly sands, little or no fines
		SANDS WITH FINES	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS 50% or more passes no. 200 sieve	**SILTS AND CLAYS** liquid limit 50% or less		ML	Inorganic silts, very fine sands, silty or clayey fine sands
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
	SILTS AND CLAYS liquid limit greater than 50%		CH	Inorganic clays of high plasticity, fat clays

Figure 2.3.1-2
Definition of Soil Types Underlying the HPS Site

Sources: ASTM Book of Standards, Volume 4.08, 1994; KBN, 1994.

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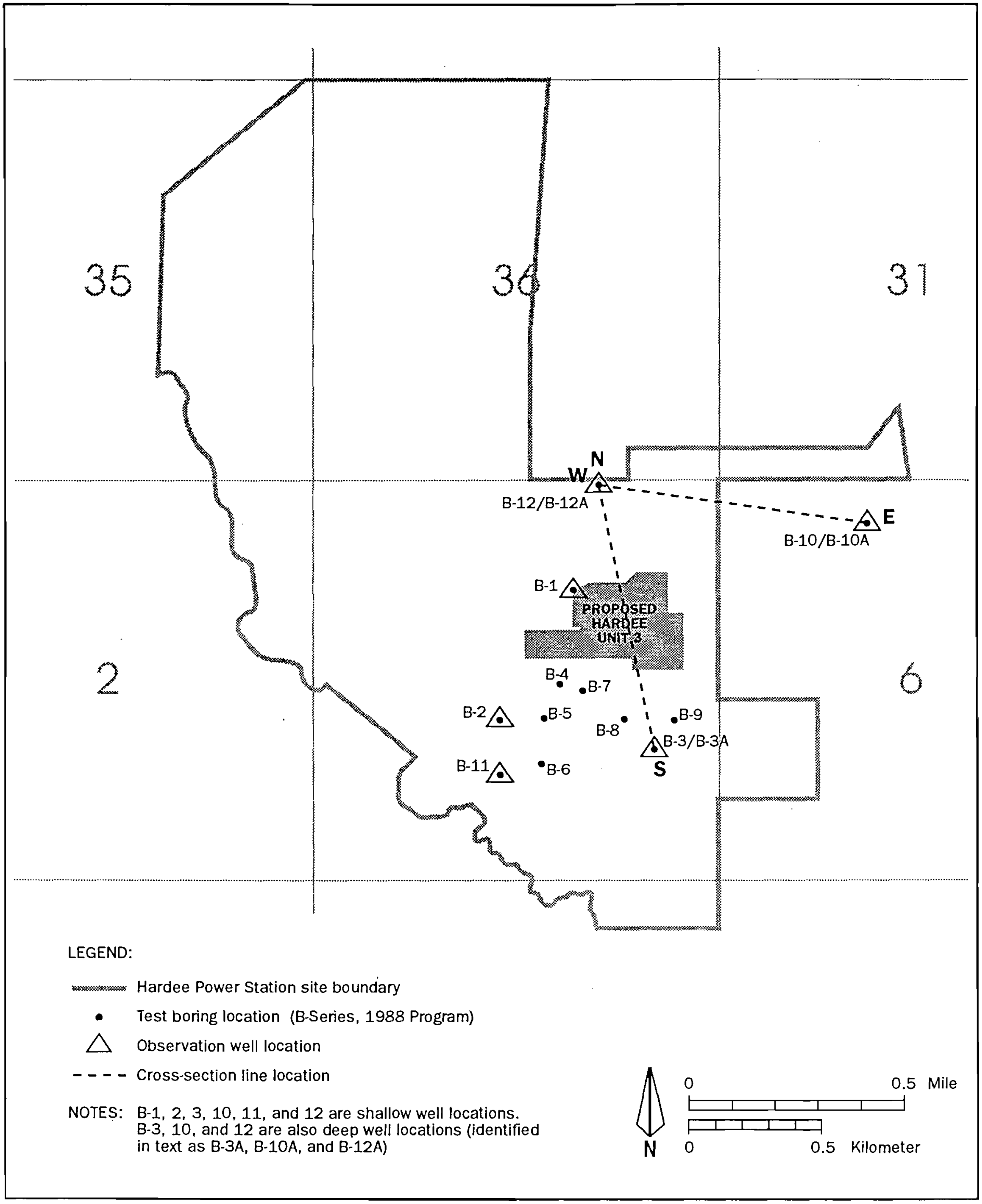
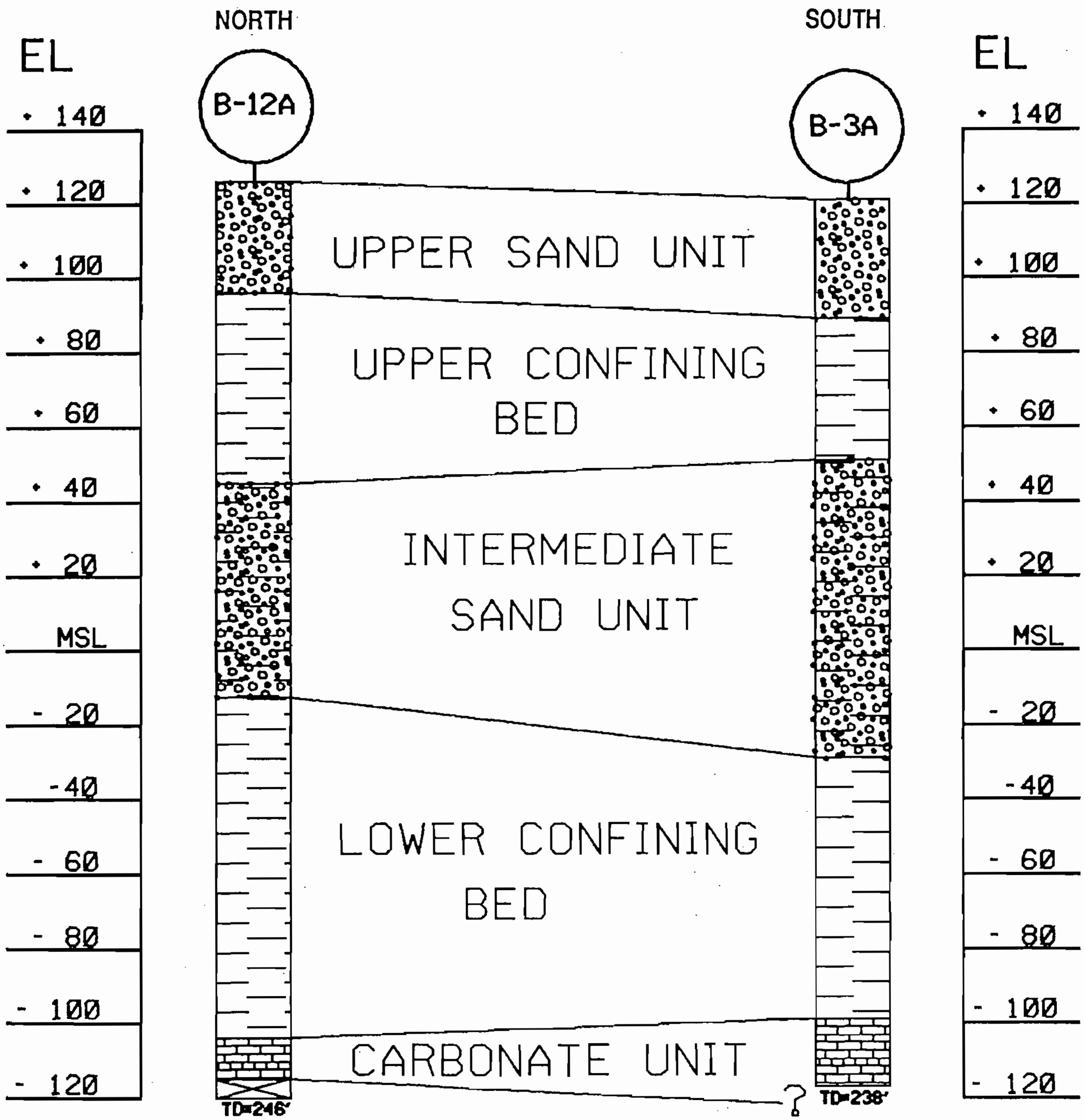


Figure 2.3.1-3
Boring Location Plan With Cross-Section Lines

Sources: TPS/SECI, 1989; KBN, 1994.

SEMINOLE ELECTRIC COOPERATIVE INCORPORATED

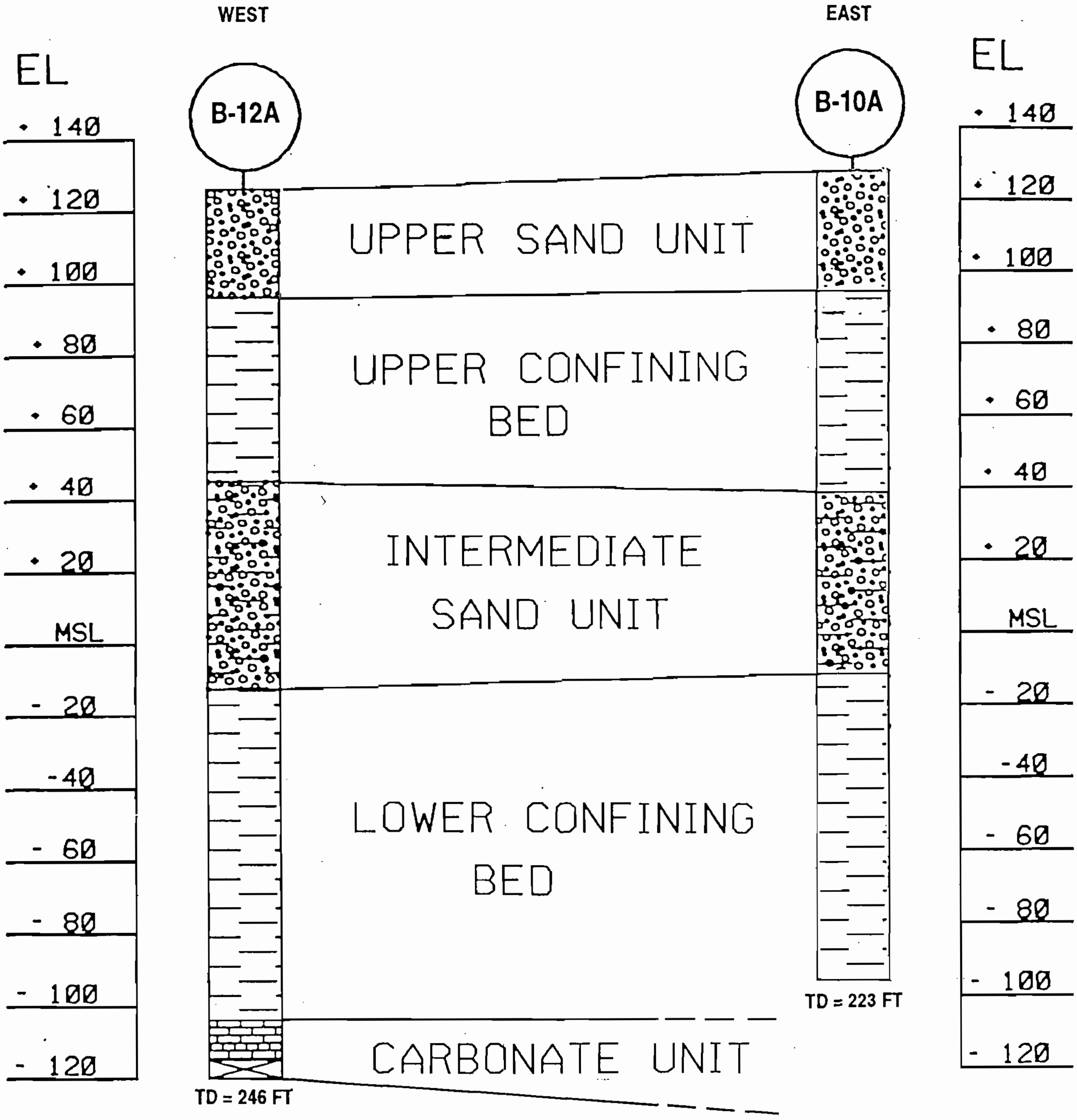


NOTE: VERTICAL EXAGGERATION = 40X

Figure 2.3.1-4
Generalized North–South Stratigraphic Cross Section of the HPS Site

Source: TPS/SECI, 1989.

SEMINOLE ELECTRIC COOPERATIVE INCORPORATED

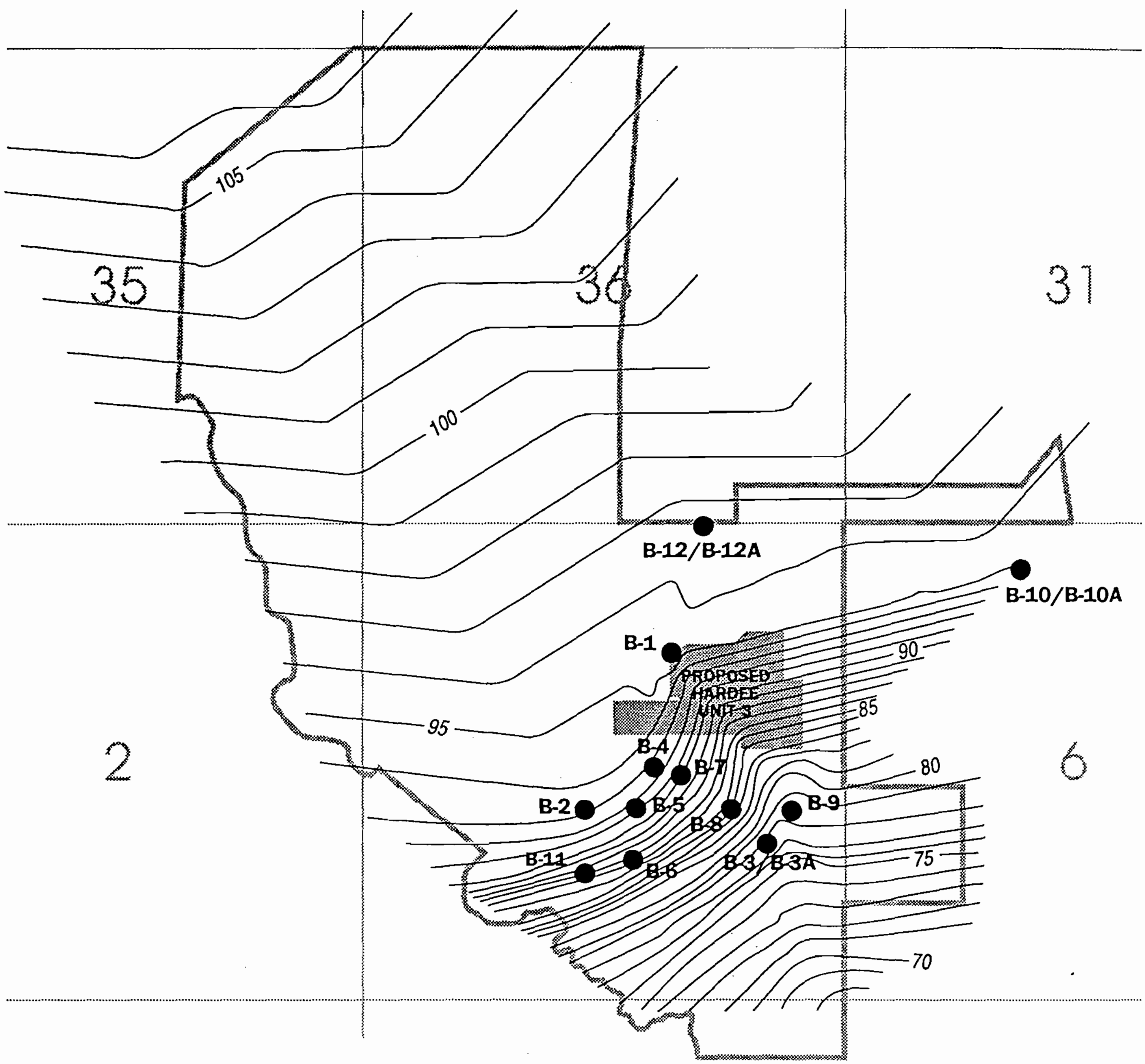


NOTE: VERTICAL EXAGGERATION = 40X

Figure 2.3.1-5
Generalized West–East Stratigraphic Cross Section of the HPS Site

Source: TPS/SECI, 1989; KBN, 1994.

SEMINOLE ELECTRIC COOPERATIVE INCORPORATED



LEGEND:

Hardee Power Station site boundary

• Test boring location (B-Series, 1988 Program)

—95— Hardpan surface (base of surficial aquifer) contour elevations in feet above MSL (Contour interval = 1 foot)

NOTE: Extrapolation from B-series test borings based on Florida Geological Survey IC-103, Wells W-15346, W-13238, W-11570, and W-13245.

N

0 0.5 Mile

0 0.5 Kilometer

Figure 2.3.1-6
Geologic Map of Hardpan (Upper Surface of Confining Layer)

Sources: TPS/SECI, 1989; KBN, 1994.

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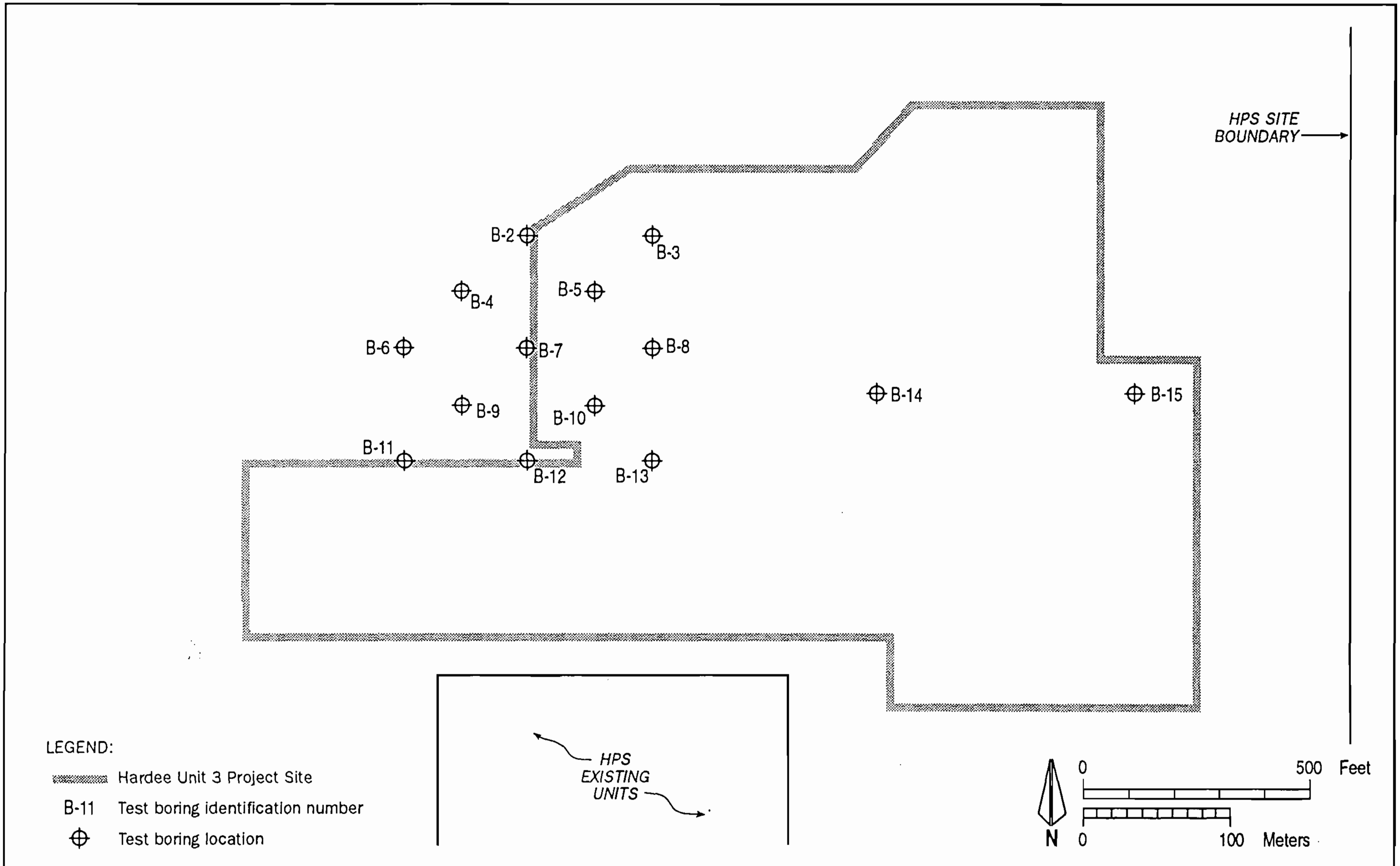

Figure 2.3.1-7
Location of Test Borings at the Hardee Unit 3 Site — April 1993

Sources: AT&E, 1993; KBN, 1994.

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2.3.2 SUBSURFACE HYDROLOGY

The SCA/EA document prepared for HPS (TPS/SECI, 1989) included a detailed characterization of subsurface hydrology for the site. The occurrence and movement of groundwater in the surficial, intermediate, and Floridan aquifers were described based upon a site-specific data collection program that is considered representative of the HPS site, including the specific area identified for Hardee Unit 3. Supplemental data collected at the HPS site are provided herein to characterize groundwater quality trends and the potential for karst activity.

2.3.2.1 SUBSURFACE HYDROLOGIC DATA FOR THE SITE

2.3.2.1.1 Shallow Aquifer

Groundwater in this aquifer is classified as G-II. The shallow aquifer at the HPS site was initially characterized at six locations (see Figure 2.3.1-3) using 5.1-cm (2-inch) diameter PVC observation wells. These wells were constructed with 1.5-m (5-ft) screens installed at depth intervals of 4.5 to 6 m (15 to 20 ft) below ground (TPS/SECI, 1989).

Falling head borehole permeability testing was conducted in these observation wells on December 11, 1988, and results are shown in Table 2.3.2-1. The objective of these tests was to estimate the permeability and hydrologic characteristics of the shallow aquifer at areas that had not been mined and areas that had been mined. These characteristics are representative of mined and reclaimed portions of the HPS site and are therefore considered applicable to the Hardee Unit 3 Project.

Water-level data were collected at the Hardee Unit 3 site during the preliminary geotechnical and foundation engineering study (AT&E, 1993; see Appendix 10.7). Groundwater levels in the shallow aquifer were measured at the completion of drilling during the period from April 13 to 29, 1993. The water table surface was encountered at land surface to a maximum depth of 0.8 m (2.7 ft). The April 1993 water levels were used to construct a water table surface contour map as presented in Figure 2.3.2-1. Groundwater flow is predominantly westward with some variation of the water table surface near the west-central portion of the Hardee Unit 3 site. The direction of groundwater flow in this portion of the site may be influenced by localized topography or the interface between native and reclaimed soils.

Saturated flows closely parallel the top of the clayey sand which is considered to be the top of the Bone Valley formation. Continuous monitoring of the shallow aquifer at SWFWMD shallow Well No. 40 near Duette, Florida, indicated water levels fluctuated approximately 3.5 m (11 ft) during a 9-year period of record from 1981 to 1990.

Data from a total of 13 pump tests within a 24-km (15-mile) radius of the site were presented by SWFWMD (SWFWMD, 1988, Table 4). The average values reported for these tests suggest that for the shallow aquifer, the coefficient of transmissivity (T) equals 1,650 square feet per day (ft^2/day) and that the specific yield (Sy) equals 0.11 or 11 percent by volume. The ratio of horizontal to vertical hydraulic conductivity is on the order of 200.

Water quality in the shallow aquifer is highly dependent on the surface activities and the chemical makeup of the rainfall. Based on the SWFWMD ambient groundwater quality monitoring program (SWFWMD, 1988, Figure 20), the following regional trends are considered as background levels: total dissolved solids (TDS) concentration is expected to be less than 250 milligrams per liter (mg/L), total hardness (TH) less than 180 mg/L, chlorides (Cl) less than 25 mg/L, and sulfates (SO_4) less than 25 mg/L.

Site-specific water quality parameters were characterized during the preconstruction period at HPS in February and March 1989, with results listed in Table 2.3.2-2. Pertinent parameters tested met primary and secondary drinking water standards.

Supplemental groundwater quality characterization of the shallow aquifer has been conducted since October 1991 at six monitor well locations at the HPS site as a condition of certification. These locations, designated Wells HPS-1 through HPS-6, are distinct from the observation wells installed prior to site certification, as described above. These wells are part of the monitoring plan implemented for the HPS existing units to characterize groundwater quality trends in the vicinity of the cooling reservoir and the detention pond, and are described as follow:

- HPS-1 Shallow well, upgradient from the cooling reservoir
- HPS-2 Shallow well, downgradient from the cooling reservoir
- HPS-3 Deep well, downgradient from the cooling reservoir
- HPS-4 Shallow well, downgradient from the cooling reservoir

- HPS-5 Shallow well, upgradient from the detention pond
- HPS-6 Shallow well, downgradient from the detention pond

Monitor well locations are presented in Figure 2.3.2-2, and analytical data are summarized in Table 2.3.2-3.

2.3.2.1.2 Intermediate Aquifer

The intermediate aquifer at the HPS site was initially characterized at three locations (B-3A, B-10A, and B-12A) using 2-inch-diameter PVC observation wells. These wells were screened between depths of 30 and 60 m (100 and 200 ft) below ground. Intermediate aquifer monitor well construction details are presented in the HPS SCA/EA (TPS/SECI, 1989).

Falling head borehole permeability testing was conducted in these observation wells on December 11, 1988, to determine the permeability and hydrologic characteristics of the intermediate aquifer. Results are shown in Table 2.3.2-4.

Water-level data recorded for the three observation wells completed in the intermediate aquifer during the preconstruction period (December 1988) at HPS indicated the water surface occurred between 3 and 8.5 m (10.2 and 28 ft) below land surface. Regional data reported by USGS (1993a) indicate the HPS site is located in the vicinity of a potentiometric surface high for the intermediate aquifer. The contours of the potentiometric surface of the intermediate aquifer reported for September 1992 are presented in Figure 2.3.2-3. The direction of groundwater flow in the intermediate aquifer is toward the south-southeast in the vicinity of the HPS site. Continuous monitoring of the intermediate aquifer at SWFWMD Hawthorn Well No. 40 near Duette, Florida, indicated water levels fluctuated approximately 4.3 m (14 ft) during a 10-year period of record from 1981 to 1990.

A total of nine pump tests within a 24-km (15-mile) radius of the site were presented by SWFWMD (SWFWMD, 1988, Table 4). The average values reported for these tests suggest that for the intermediate aquifer, T equals 1,450 ft^2/day; storativity (S) equals 0.0002; and leakance coefficient (L) equals 0.0002 cubic foot per day per square foot (ft^3/day/ft^2). The ratio of horizontal to vertical hydraulic conductivity is on the order of 2,000.

Based on the SWFWMD (1988, Figure 27) ambient groundwater quality monitoring program, the following regional trends are considered as background levels: TDS is expected to be less than 250 mg/L, TH less than 120 mg/L, Cl less than 25 mg/L, and SO_4 between 25 and 250 mg/L. Site-specific water quality results are listed in Table 2.3.2-5. The sampled parameters generally meet state drinking water quality standards.

2.3.2.1.3 Floridan Aquifer

The Floridan aquifer was not initially characterized with site-specific data collected at the HPS site, but was described on a regional basis. The contours of the regional potentiometric surface of the Floridan aquifer reported by USGS (1993b) for September 1992 are presented in Figure 2.3.2-4. Direction of groundwater flow in the Floridan aquifer is toward the southwest in the vicinity of the HPS site. Continuous monitoring of a well completed in the Avon Park Formation of the Floridan aquifer at SWFWMD ROMP No. 40 deep well near Duette, Florida, indicated water levels fluctuated approximately 15.2 m (50 ft) during a 10-year period of record from 1981 to 1990.

Data from a total of 11 pump tests within a 24-km (15-mile) radius of the site were presented by SWFWMD (SWFWMD, 1988, Table 4). The average values reported for these tests indicate that for the Floridan aquifer, T equals 250,000 ft^2/day, S equals 0.0011, and L equals 0.00021 ft^3/day/ft^2. The ratio of horizontal to vertical hydraulic conductivity is on the order of 2. Based upon the hydrologic data that characterized the Floridan aquifer in the vicinity of the HPS site, a water use authorization was issued as part of the original site certification for HPS (TPS/SECI, 1989) for groundwater withdrawals of 3.8 mgd annual average and 8.64 mgd maximum daily average.

Water quality in the Floridan aquifer is dependent on the recharge from the overlying aquifers. Based on the SWFWMD ambient groundwater quality monitoring program (SWFWMD, 1988, Figure 36), the following regional trends are considered as background levels: TDS is expected to be less than 350 mg/L, TH between 120 and 180 mg/L, Cl less than 25 mg/L, and SO_4 between 25 and 250 mg/L. Additional water quality characteristics are provided in Table 2.3.2-6, based on available data collected offsite.

Supplemental analysis of groundwater samples collected from production Well No. 1 installed at the HPS existing facilities has been conducted. Analyses of chloride, sulfate, and TDS conducted on samples collected during 1993 are summarized in Table 2.3.2-7. The sampled parameters generally meet state groundwater quality standards.

2.3.2.1.4 Characteristic Confining Units

The Upper Confining Bed as described in Section 2.3.1.2 separates the shallow aquifer above from the intermediate aquifer below. Recharge to the intermediate aquifer through the upper confining bed is classified as none to very low, perhaps ranging from 0 to 5 cm (0 to 2 inches) per year (SWFWMD, 1988).

The Lower Confining Bed as described in Section 2.3.1.2 separates the intermediate aquifer above from the Floridan aquifer below. Recharge to the Floridan aquifer through the lower confining bed is classified as very low, less than 5 cm (2 inches) per year (Stewart, 1980).

2.3.2.2 KARST HYDROGEOLOGY

The HPS site falls into the area of Central Florida Karst where cover collapse sinkholes dominate (Sinclair *et al.*, 1985). This area consists of cohesive sediments interlayered with discontinuous carbonate beds. A major tenet of karst development theory is that active solution enlargement of voids in carbonate rock occurs above the water table. When the site area was subjected to significant sea level changes during the Pleistocene epoch, karst activity was possible. Sea level stands at elevation (El) +45 m (+150 ft) (Okefenokee Shoreline), El +30 m (+100 ft) (Wicomico Shoreline), El + 9 m (+30 ft) (Pamlico Shoreline), and El +2 m (+8 ft) (Silver Bluff Shoreline) would presumably affect the deposits above those elevations. From the deep borings on the site, these elevations are represented by the calcareous layers in the Hawthorn Formation. The lower carbonate unit at El-30 m (-100 ft) is well below the water table surface and subject to a reduced threat of current karstic activity.

Apparent surface depression features identified in the vicinity of the HPS existing units were ground-truthed. Most of the surface depressions identified were shallow and located outside the main plant area, although some were within the cooling reservoir area (TPS/SECI, 1989). Initial subsurface explorations conducted at the HPS site did not reveal significant solutioning of the surfaces of the Hawthorn and surficial soils in these surface depressions.

An assessment of potential sinkhole development was conducted by Jammal & Associates, Inc. (1990), prior to construction of the HPS existing units. The site-specific assessment included review of black and white and infrared aerial photographs, review of soil boring logs conducted by others, review of published data for the site vicinity, field reconnaissance of surface depressions, and installation of two additional soil borings in areas adjacent to selected surface depressions. On the basis of qualitative and quantitative analyses, it was concluded that the potential for sinkhole development at the HPS existing units and at the HPS site overall was very low to none. It was also concluded that alternate foundation designs for plant buildings would not impact sinkhole potential during or after installation.

Topographic depressions noted in areas surrounding the HPS site typically appear to be 2 to 4 ha (5 to 10 acres) in size and are roughly circular. These depressions appear to be on an east-northeast orientation that may be associated with a fracture and related to sinkhole activity in the past.

The findings of the preliminary geotechnical and foundation engineering study conducted at the Hardee Unit 3 site (AT&E, 1993; see Appendix 10.7) were reviewed for evidence of potential karst activity. The lithologic logs prepared for the 14 soil borings did not indicate the occurrence of loss circulation zones, voids, or cavities to depths up to 27 m (90 ft) below existing ground surface. Clayey soils consistent with the upper confining bed were encountered at the 14 boring locations in areas of native and reclaimed soils.

Table 2.3.2-1. Results of Permeability Testing of Shallow Water Table Observation Wells at the HPS Site (December 1988)

Piezometer No.	Ground Surface Elevation (ft-msl)	Groundwater Elevation (ft-msl)	Permeability (cm/sec)
P-1	122.3	118.8	2.0×10^{-4}
P-2	114.2	109.4	2.0×10^{-4}
P-3	121.7	114.3	4.9×10^{-4}
P-10	127.4	123.9	1.3×10^{-4}
P-11	113.1	109.8	1.7×10^{-4}
P-12	126.3	121.7	3.2×10^{-4}

Note: cm/sec x 0.04 = inch/sec.
ft-msl x 0.3 = m-msl.

Source: TPS/SECI, 1989.

Table 2.3.2-2. Water Quality Characteristic of the Shallow Aquifer at the HPS Site (February/March 1989)

Parameters	Concentration	
	Well P3[a]	Well P12[a]
Total Alkalinity, mg/L as $CaCO_3$	6.0	12.0
Chloride, mg/L	15.5	24.2
Nitrate + Nitrite as Nitrogen, mg/L	<0.005	0.009
Ortho-Phosphorus, mg/L	0.980	1.70
Silica, Total, mg/L	16.8	21.2
Silica, Dissolved, mg/L	5.21	9.83
Total Dissolved Solids, mg/L	78.7	111
Total Suspended Solids, mg/L	93.3	694
Specific Conductance, µmho/cm	120	222
Sulfate, mg/L	4.1	3.2
Total Calcium, mg/L	10.8	26.3
Total Iron, mg/L	7.9	10.3
Total Magnesium, mg/L	3.0	6.7
Total Manganese, µg/L	14	12
Total Potassium, mg/L	0.96	1.77
Total Sodium, mg/L	7.5	16.6
Dissolved Iron, mg/L	0.67	2.37
Dissolved Manganese, µg/L	4.0	6.0

[a] These wells are 9.1 m (30 ft) below present existing grade.

Source: TPS/SECI, 1989.

Table 2.3.2-3. Results of Groundwater Monitoring Conducted at the HPS Site During 1993 (Page 1 of 6)

Parameter	Sampling Date	Units	Concentration in Monitor Well					
			HPS-1	HPS-2	HPS-3	HPS-4	HPS-5	HPS-6
Total Metals								
Aluminum	1/26/93	mg/L	<0.5	<0.5	0.95	<0.5	7.1	<0.5
	7/22/93	mg/L	<0.2	<0.2	0.9	<0.2	6.6	<0.2
	Max. Value	mg/L	120	8.8	8.6	1.1	75	77
	Min. Value	mg/L	<0.2	<0.2	0.9	<0.2	3.4	<0.2
Arsenic	1/26/93	μg/L	15	<10	<10	<10	<10	<10
	7/22/93	μg/L	15	<10	<10	<10	<10	<10
	Max. Value	μg/L	20	<10	18	<10	<10	<10
	Min. Value	μg/L	<10	<10	<10	<10	<10	<10
Beryllium	1/26/93	mg/L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
	7/22/93	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
	Max. Value	mg/L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
	Min. Value	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Cadmium	1/26/93	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	7/22/93	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
	Max. Value	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	Min. Value	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

Table 2.3.2-3. Results of Groundwater Monitoring Conducted at the HPS Site During 1993 (Page 2 of 6)

Parameter	Sampling Date	Units	Concentration in Monitor Well					
			HPS-1	HPS-2	HPS-3	HPS-4	HPS-5	HPS-6
Total Metals (continued)								
Chromium	1/26/93	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	7/22/93	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	Max. Value	mg/L	0.42	<0.05	0.007[a]	<0.05	0.23	0.20
	Min. Value	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Copper	1/26/93	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	7/22/93	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	Max. Value	mg/L	0.007[a]	<0.05	<0.05	<0.05	<0.05	<0.05
	Min. Value	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Iron	1/26/93	mg/L	48	2.9	23	21	2.2	11
	7/22/93	mg/L	41	4.7	21	25	1.9	13
	Max. Value	mg/L	48	4.7	46	25	12	41
	Min. Value	mg/L	10	1.2	21	1.3	1.9	9.3
Lead	1/26/93	µg/L	<5	<5	<5	<5	8	<5
	7/22/93	µg/L	<5	<5	<5	<5	<5	<5
	Max. Value	µg/L	36	10	<5	<5	90	51
	Min. Value	µg/L	<5	<5	<5	<5	<5	<5

Table 2.3.2-3. Results of Groundwater Monitoring Conducted at the HPS Site During 1993 (Page 3 of 6)

Parameter	Sampling Date	Units	Concentration in Monitor Well HPS-1	HPS-2	HPS-3	HPS-4	HPS-5	HPS-6
Total Metals (continued)								
Mercury	1/26/93	μg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	7/22/93	μg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Max. Value	μg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Min. Value	μg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Nickel	1/26/93	mg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	7/22/93	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Max. Value	mg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Min. Value	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Selenium	1/26/93	μg/L	<10	<10	<10	<10	<10	<10
	7/22/93	μg/L	<10	<10	<10	<10	<10	<10
	Max. Value	μg/L	<10	<10	<10	<10	<10	<10
	Min. Value	μg/L	<10	<10	<10	<10	<10	<10
Zinc	1/26/93	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
	7/22/93	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
	Max. Value	mg/L	0.06	0.06	0.15	0.07	0.07	0.066
	Min. Value	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

Table 2.3.2-3. Results of Groundwater Monitoring Conducted at the HPS Site During 1993 (Page 4 of 6)

Parameter	Sampling Date	Units	Concentration in Monitor Well					
			HPS-1	HPS-2	HPS-3	HPS-4	HPS-5	HPS-6
Radionuclides								
Gross alpha (total)	1/26/93	pCi/L	12.±2.4	2.8±1.5	3.0±1.2	2.0±1.0	32.7±4.4	3.9±1.2
	7/22/93	pCi/L	12.8±2.5	5.0±2.0	8.7±2.4	3.8±1.4	14.1±2.4	13.2±2.3
	Max. Value	pCi/L	884.±53	108.±12.4	26.2±7.6	12.6±3.1	1528.±102	424.±46
	Min. Value	pCi/L	12.±2.4	2.1±1.4	3.0±1.2	2.0±1.0	14.1±2.4	6.6±1.7
Gross alpha (dissolved)	1/26/93	pCi/L	4.0±1.4	2.1±1.3	4.1±1.7	1.9±0.9	4.5±1.4	3.7±1.2
	7/22/93	pCi/L	11.4±2.4	4.5±1.8	3.2±1.3	3.0±1.3	8.5±1.8	6.3±1.6
	Max. Value	pCi/L	15.4±3.1	4.5±1.8	5.9±2.0	4.4±1.5	81.±5.3	10.9±2.6
	Min. Value	pCi/L	3.5±1.2	1.4±0.8	3.0±1.2	1.5±1.2	4.5±1.4	6.1±1.6
Radium 226 (total)	1/26/93	pCi/L	3.6±0.3	2.0±0.3	1.1±0.2	0.3±0.1	3.2±0.3	0.4±0.2
	7/22/93	pCi/L	2.3±0.3	2.4±0.3	1.1±0.2	0.6±0.1	1.8±0.2	0.6±0.1
	Max. Value	pCi/L	125.±2.7	9.9±0.6	3.3±0.3	1.4±0.2	193.±4.7	42.1±1.9
	Min. Value	pCi/L	1.8±0.2	0.2±0.1	0.2±0.2	0.1±0.1	1.8±0.2	0.0±0.1
Radium 226 (dissolved)	1/26/93	pCi/L	2.5±0.3	1.4±0.2	0.5±0.2	0.2±0.1	1.6±0.2	0.3±0.1
	7/22/93	pCi/L	2.0±0.2	2.4±0.3	0.5±0.1	0.5±0.2	1.2±0.2	0.4±0.1
	Max. Value	pCi/L	5.3±0.5	2.4±0.3	0.7±0.2	0.5±0.2	2.4±0.4	0.6±0.1
	Min. Value	pCi/L	0.7±0.1	0.1±0.1	0.1±0.1	0.0±0.1	0.9±0.2	0.0±0.1

Table 2.3.2-3. Results of Groundwater Monitoring Conducted at the HPS Site During 1993 (Page 5 of 6)

Parameter	Sampling Date	Units	Concentration in Monitor Well					
			HPS-1	HPS-2	HPS-3	HPS-4	HPS-5	HPS-6
Chloride	1/26/93	mg/L	14	8.5	49	17	6.1	21
	7/22/93	mg/L	13	12	57	18	9	17
	Max. Value	mg/L	17	12	83	22	11	34
	Min. Value	mg/L	8.5	5.0	49	10	5.3	17
Color (apparent)	1/26/93	PCU	750	70	750	450	880	50
	7/22/93	PCU	350	65	600	300	1000	35
	Max. Value	PCU	1000	500	1500	900	4000	1000
	Min. Value	PCU	25	35	600	45	650	20
Color (true)	1/26/93	PCU	700	20	630	350	810	40
	7/22/93	PCU	300	25	500	300	800	35
	Max. Value	PCU	700	40	1300	750	3000	250
	Min. Value	PCU	40	20	500	20	600	25
Oxidation-Reduction Potential	1/26/93	Eh	29	53	130	75	230	32
	7/22/93	Eh	4.1	7.4	63.7	45.6	157.8	27.2
	Max. Value	Eh	280	240	303	260	320	290
	Min. Value	Eh	4.1	7.4	72	36.2	98	27.2

Table 2.3.2-3. Results of Groundwater Monitoring Conducted at the HPS Site During 1993 (Page 6 of 6)

Parameter	Sampling Date	Units	Concentration in Monitor Well HPS-1	HPS-2	HPS-3	HPS-4	HPS-5	HPS-6
Sulfite (field)	1/26/93	mg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	7/22/93	mg/L	<2.0	<2.0	6.0	<2.0	<2.0	<2.0
	Max. Value	mg/L	0.4	1.2	6.0	0.4	5.0	1.2
	Min. Value	mg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Sulfate	1/26/93	mg/L	<5	<5	<5	<5	7	13
	7/22/93	mg/L	<5	10	<5	<5	<5	12
	Max. Value	mg/L	2.3	10	<5	<5	21	72
	Min. Value	mg/L	<5	<5	<5	<5	<5	12
Total Dissolved Solids	1/26/93	mg/L	200	370	370	270	250	120
	7/22/93	mg/L	150	470	440	330	230	130
	Max. Value	mg/L	330	470	460	360	930	140
	Min. Value	mg/L	91	260	250	200	160	120

Note: Groundwater samples collected by Pace Incorporated personnel on the dates indicated.
Groundwater sample analysis excluding radionuclides conducted by Pace Incorporated; analysis for radionuclide parameters conducted by Thornton Laboratories, Inc.

mg/L = milligram per liter
µg/L = microgram per liter
pCi/L = picoCurie per liter
Eh = redox potential
PCU = platinum cobalt units

[a] Reporting limit indicated by Pace Incorporated for samples collected June 30, 1992, was an order of magnitude different than for other sampling events; maximum value reported for this one sampling event was at a lower concentration than the reporting limit for the other events.

Source: Hardee Power Partners, Inc., 1991 - 1993.

Table 2.3.2-4. Results of Permeability Testing of Intermediate Aquifer Observation Wells at the HPS Site (December 1988)

Piezometer No.	Ground Surface Elevation (ft-msl)	Groundwater Elevation (ft-msl)	Permeability (cm/sec)
B-3A	121.7	93.7[a]	4.4×10^{-5}
B-10A	127.4	117.2	1.7×10^{-5}
B-12A	126.3	114.8	9.3×10^{-6}

Note: cm/sec x 0.4 = inch/sec.
ft-msl x 0.3 = m-msl.

[a] Depth to water dropped to 54.7 ft-msl on 2/16/89 suggesting that this is a Floridan aquifer observation well.

Source: TPS/SECI, 1989.

Table 2.3.2-5. Water Characteristics (Inorganics) at the HPS Site for Intermediate Aquifer--Well P12A (February/March 1989) (Page 1 of 2)

Parameter	Concentration
Total Alkalinity, mg/L as $CaCO_3$	216
Chloride, mg/L	27.9
Nitrate + Nitrite as Nitrogen, mg/L	0.072
Ortho-phosphorus, mg/L	0.034
Silica, Total, mg/L	58.1
Cyanide, mg/L	<0.004
Total Dissolved Solids, mg/L	327
Total Suspended Solids, mg/L	23
Specific Conductance, μmho/cm	458
Sulfate, mg/L	21
Fluoride, mg/L	1.80
MBAS, mg/L	0.14
Ammonia Nitrogen, mg/L	0.33
TKN, mg/L	0.79
Oil and Grease, mg/L	<5
BOD, mg/L	5.4
COD, mg/L	<10
Turbidity, NTU	6.8
Aluminum, μg/L	67
Antimony, μg/L	<10
Arsenic, μg/L	2.0
Beryllium, μg/L	<2
Cadmium, μg/L	0.5
Calcium, mg/L	43.0
Chromium, μg/L	<11
Copper, μg/L	<7
Iron, μg/L	198
Lead, μg/L	<3
Magnesium, mg/L	19.8
Manganese, μg/L	<6
Mercury, μg/L	<0.2
Nickel, μg/L	<26
Potassium, mg/L	4.4
Selenium, μg/L	<2
Silver, μg/L	<0.05
Sodium, mg/L	35.6
Zinc, μg/L	18.0
Phenols, μg/L	<5
Aldrin, μg/L	<0.003
Dieldrin, μg/L	<0.0003
Chlordane, μg/L	<0.01
4,4'DDT, μg/L	<0.001
Demeton, μg/L	<0.1

Table 2.3.2-5. Water Characteristics (Inorganics) at the HPS Site for Intermediate Aquifer--Well P12A (February/March 1989) (Page 2 of 2)

Parameter	Concentration
Endosulfan, μg/L	<0.003
Endrin, μg/L	<0.004
Guthion, μg/L	<0.01
Heptachlor, μg/L	<0.001
Lindane, μg/L	<0.01
Malathion, μg/L	<0.1
Methoxychlor, μg/L	<0.03
Myrex, μg/L	<0.001
Parathion, μg/L	<0.04
2,4-D, μg/L	<10
Silvex, μg/L	<20
Toxaphene, μg/L	<0.005
PCB-1016, μg/L	<0.001
PCB-1221, μg/L	<0.001
PCB-1232, μg/L	<0.001
PCB-1242, μg/L	<0.001
PCB-1248, μg/L	<0.001
PCB-1260, μg/L	<0.001
Chlorinated Hydrocarbons	
2-Chloronapthalene, μg/L	<10
1,2-Dichlorobenzene, μg/L	<10
1,3-Dichlorobenzene, μg/L	<10
1,4-Dichlorobenzene, μg/L	<10
Hexachlorobenzene, μg/L	<10
Hexachlorobutadiene, μg/L	<10
Hexachlorocyclopentadiene, μg/L	<10
Hexachloroethane, μg/L	<10
1,2,4-Trichlorobenzene, μg/L	<10
Gross Alpha, pCi/L	2.2±2.3
Gross Beta, pCi/L	5.7±4.2
Radium 226, pCi/L	4.1±0.1
Radium 228, pCi/L	0.0±1.0
Strontium 90, pCi/L	<0.5

Source: TPS/SECI, 1989.

Table 2.3.2-6. Water Quality Characteristics for the Lower Floridan Aquifer (Page 1 of 2)

Parameter	Value
Calcium, mg/L as $CaCO_3$	113
Magnesium, mg/L as $CaCO_3$	49
Sodium, mg/L as $CaCO_3$	37
Potassium, mg/L as $CaCO_3$	8
Total Hardness, mg/L as $CaCO_3$	162
Alkalinity, mg/L as $CaCO_3$	160
Sulfate, mg/L as $CaCO_3$	26
Chloride, mg/L	21
Silica, mg/L	27
Fluoride, mg/L	2.0
Cyanide, mg/L	<0.005
MBAS, mg/L	<0.180
Oil and Grease, mg/L	<5
Turbidity, NTU	14
pH, units	7.5
Total Dissolved Solids, mg/L	342
Specific Conductivity, µmho/cm	320
Total Kjeldahl Nitrogen, mg/L	0.39
Ammonia Nitrogen, mg/L	0.20
Organic Nitrogen, mg/L	0.19
Nitrate+Nitrite-Nitrogen, mg/L	0.031
	0.421
Total Nitrogen, mg/L	
Orthophosphorus, mg/L	0.20
Total Phosphorus, mg/L	0.20
Arsenic, µg/L	<10
Barium, µg/L	75
Beryllium, µg/L	<0.1
Cadmium, µg/L	<0.7
Chromium, µg/L	13
Copper, µg/L	7

Table 2.3.2-6. Water Quality Characteristics for the Lower Floridan Aquifer (Page 2 of 2)

Parameter	Value
Calcium, mg/L as $CaCO_3$	113
Iron, µg/L	420
Lead, µg/L	1
Manganese, µg/L	28
Mercury, µg/L	<0.2
Nickel, µg/L	23
Selenium, µg/L	16
Silver, µg/L	<0.07
Strontium, µg/L	300
Zinc, µg/L	143
Alpha, Gross (pC/L)	8.4
Radium 226 (pC/L)	3.0

Sources: TPS/SECI, 1989.
KBN, 1994.

Table 2.3.2-7. Results of Groundwater Analyses Conducted at HPS Production Well No. 1

Parameter	Sampling Date	Concentration (mg/L)
Chloride	4/6/93	8.4
	7/7/93	16.2
Sulfate	4/6/93	86.7
	7/7/93	179
Total Dissolved Solids	4/6/93	281
	7/7/93	285

Note: mg/L = milligrams per liter.

Groundwater samples collected by HPS personnel on the dates indicated.
Groundwater sample analysis conducted by Tampa Electric Company, Central Testing Laboratory.

Source: Hardee Power Partners, Inc., 1993.

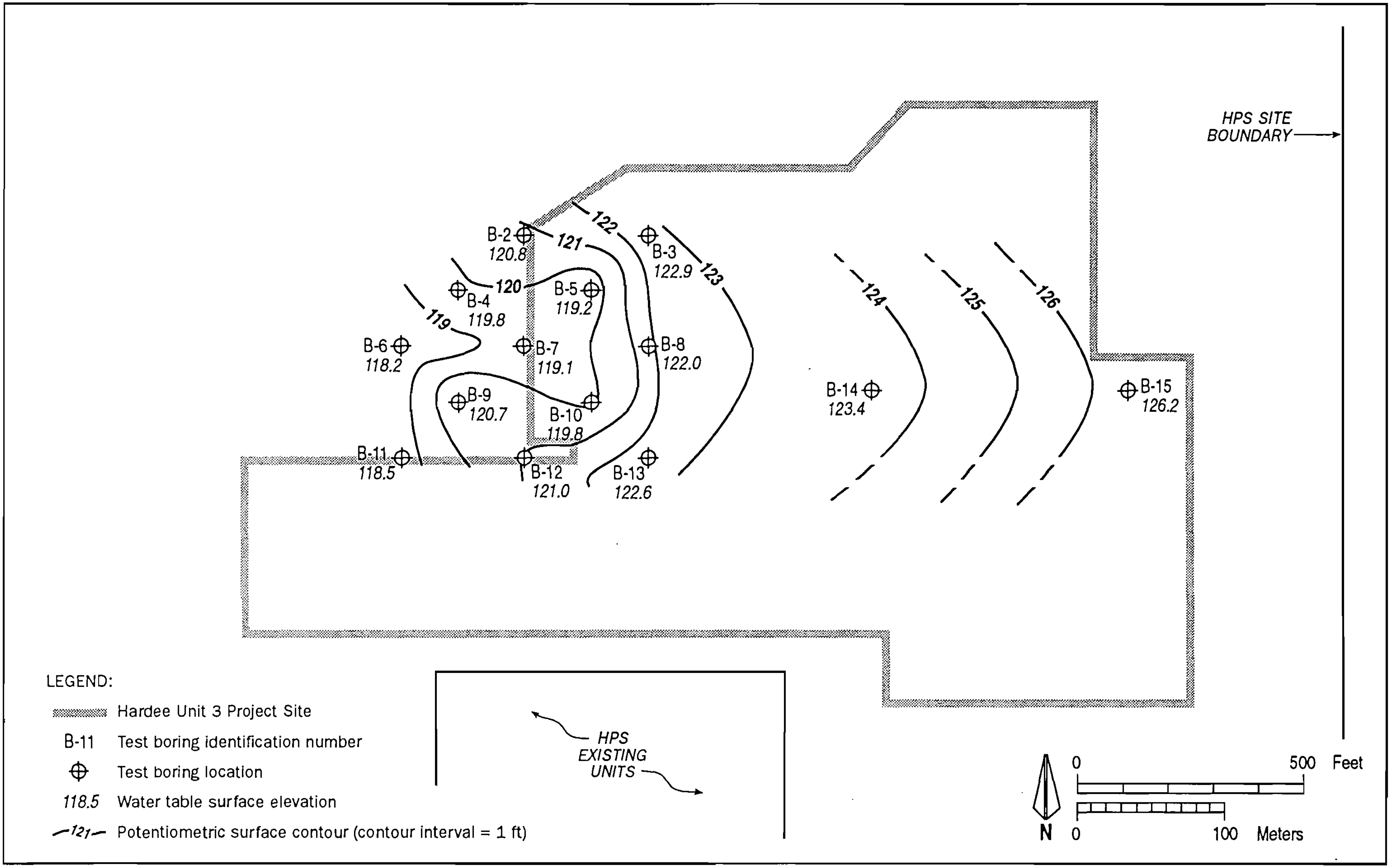

Figure 2.3.2-1
Potentiometric Surface of the Water Table Aquifer
at the Hardee Unit 3 Site — April 1993

Sources: AT&E, 1993; KBN, 1994.

SEMINOLE ELECTRIC COOPERATIVE INCORPORATED

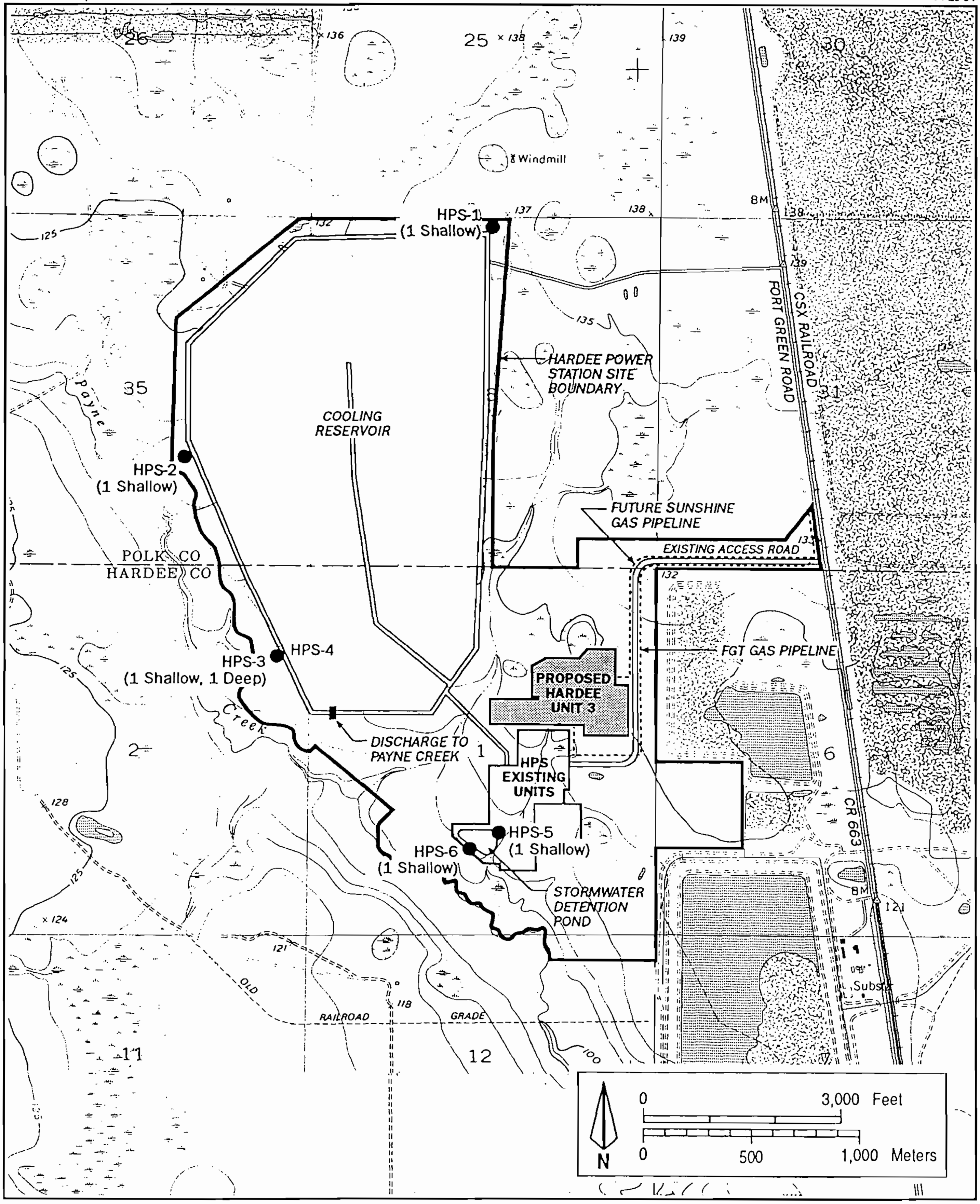

Figure 2.3.2-2
HPS Existing Groundwater Monitoring Well Locations

Sources: USGS, 1987; KBN, 1994.

SEMINOLE ELECTRIC COOPERATIVE INCORPORATED

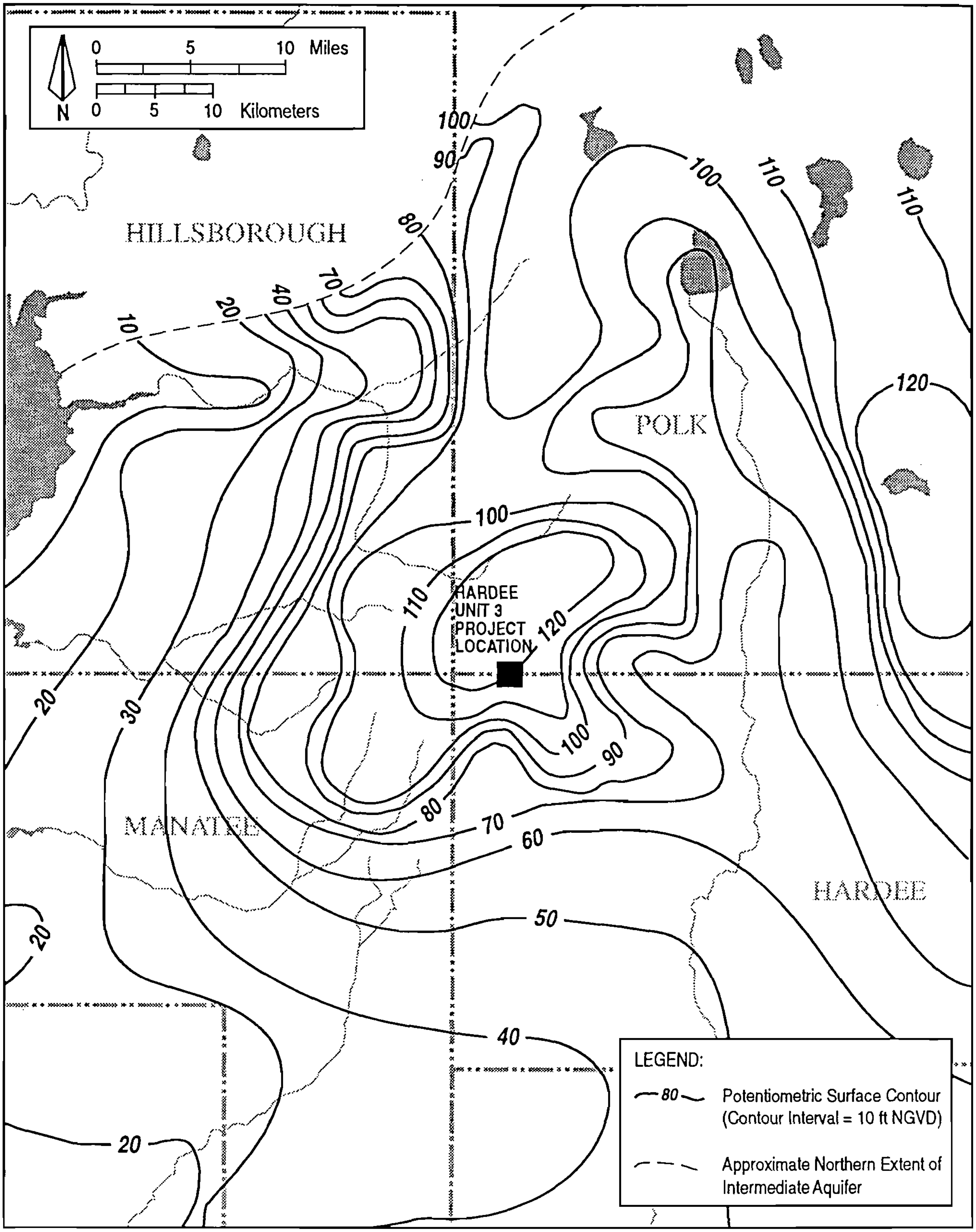

Figure 2.3.2-3
Potentiometric Surface of the Intermediate Aquifer in the Vicinity of the Hardee Unit 3 Site — September 1992

Sources: USGS, 1993a; KBN, 1994.

SEMINOLE ELECTRIC COOPERATIVE INCORPORATED

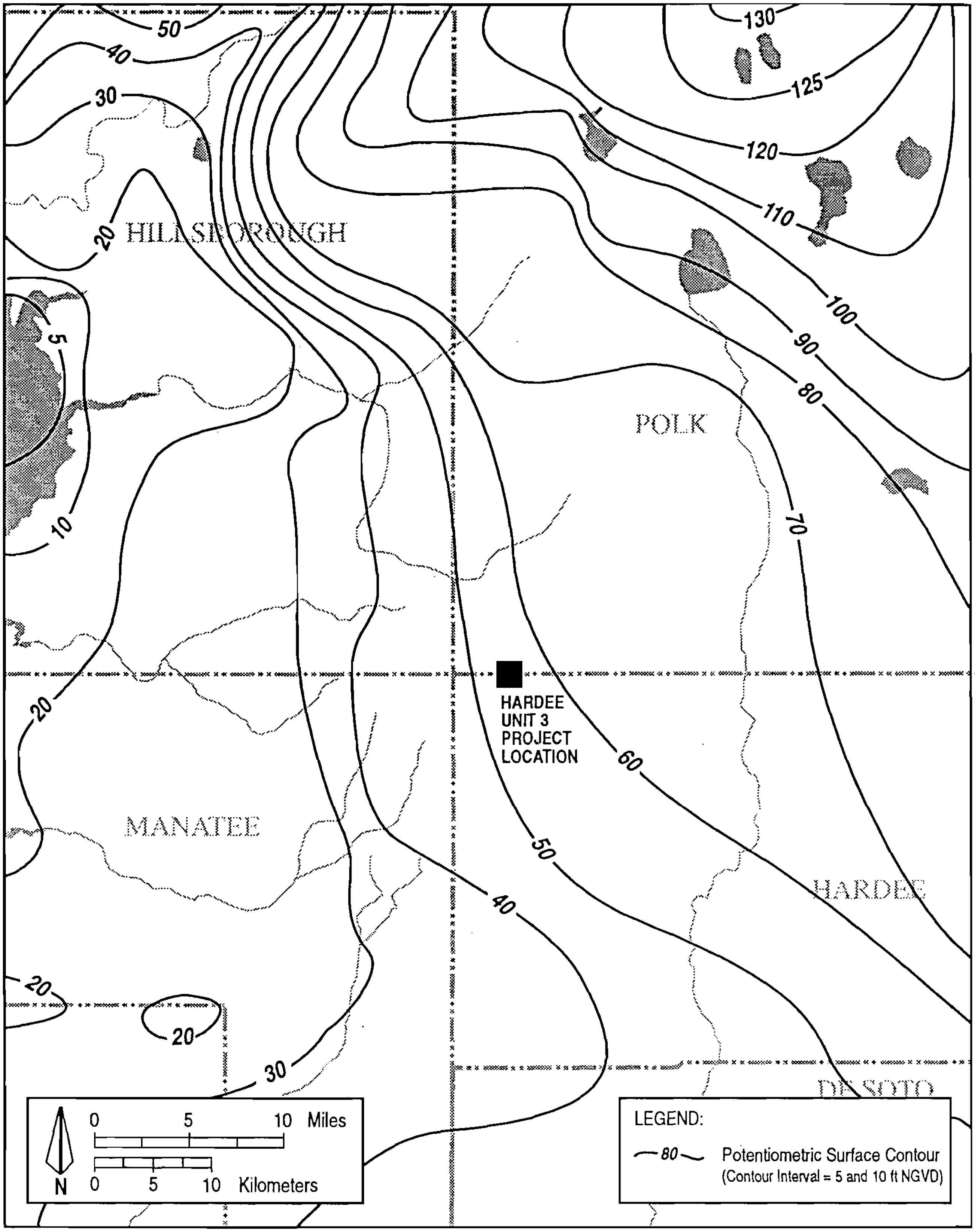

Figure 2.3.2-4
Potentiometric Surface of the Upper Floridan Aquifer in the Vicinity of the Hardee Unit 3 Site — September 1992

Sources: USGS, 1993b; KBN, 1994.

SEMINOLE ELECTRIC COOPERATIVE INCORPORATED

2.3.3 SITE WATER BUDGET AND AREA USERS

2.3.3.1 SITE WATER BUDGET

Components of the existing HPS site water budget include precipitation, evaporation and evapotranspiration, runoff, and groundwater recharge. The nearest long-term climatological data collection station is located at Wauchula, Florida, approximately 14 km (9 miles) from the site.

Long-term monthly precipitation data at Wauchula for the period 1933 through 1988 were obtained from the SWFWMD and the National Oceanic and Atmospheric Administration (NOAA). Data on long-term monthly averages, maximums, and minimums are summarized in Table 2.3.3-1. The annual precipitation averages 135 cm (53.33 inches) per year with the highest precipitation in the summer months (June, July, August, and September) and the lowest in late fall/winter (November and December); however, the entire period from October to May is subject to periods of extended and significant drought.

The estimated monthly evapotranspiration rates for the HPS site are given in Table 2.3.3-2. Evapotranspiration estimates were prepared using published potential evapotranspiration rates for Tampa, Florida (Institute of Food and Agricultural Sciences, 1983) and an average annual plant coefficient of 70 percent. The estimated monthly evapotranspiration rates range from 4.6 cm (1.8 inches) per month in December to 11.2 cm (4.4 inches) per month in May. Monthly temperature normals were also available at Wauchula for the period 1941 to 1970, and are presented in Table 2.3.3-2. Highest temperature normals occur in July and August of 27.4 and 27.6°C (81.3 and 81.6°F) and lowest in January of 16.6°C (61.8°F). The additional climatic parameters of dewpoint temperature, relative humidity, evapotranspiration, and wind speed were also determined for the site area and are summarized in Table 2.3.3-2.

2.3.3.2 AREA USERS

There are no major municipal water users within 8 km (5 miles) of the HPS site. The Bowling Green municipal waterworks is the closest major wellfield to the site. This wellfield is permitted for an average pumpage of less than 18.9 million liters (5 million gallons) per day. The Bowling Green wellfield is 9.7 to 11.3 km (6 to 7 miles) east of the HPS site.

Review of current water use permits issued by SWFWMD (1994a) for the area within 8 km (5 miles) of the HPS site identified industrial, agricultural and residential water users. Permitted industrial water users within this area include Agrico Chemical Company, CF Industries, Inc., Cargill Fertilizer, Inc., IMC-Agrico Company, and U.S. Agri-Chemicals Corporation. Water use descriptions identified for these industrial facilities include: phosphate ore processing, phosphate pit dewatering, phosphate water table dewatering, personal sanitary use, ornamental container grown nurseries, and other (unmetered). Numerous water use permits identified within this same area include the following descriptions: cattle (pastured), citrus, cucumbers (spring and fall), grains (small), sod, strawberries, sweet corn, tomatoes (spring), and vegetables (spring and fall).

The sole water use permit within 8 km (5 miles) of the HPS site that included a residential use description was for the Florida Department of Corrections facility (Hardee Correctional Institute) located in Section 21, Township 33 south, Range 23 east. This facility is about 6 km (4 miles) southwest of the HPS site. Two 25-centimeter (cm) (10-inch) diameter production wells were installed to depths of 274 and 290 m (900 and 950 ft). The water use permit issued for the site includes average daily withdrawal of 1,078,840 liters per day (Lpd) [285,000 gallons per day (gpd)] and maximum daily withdrawal of 2,157,680 Lpd (570,000 gpd).

Three production wells were installed to provide raw water for the HPS existing units. The three 41-cm (16-inch) diameter wells are open to the Floridan aquifer and are authorized under the original certification for average daily withdrawal of 14.4 million Lpd (3.8 mgd) and maximum daily withdrawal of 32.7 million Lpd (8.64 mgd).

Review of current well construction permits issued by SWFWMD identified 101 wells with 8 different use codes within one mile of the HPS site. Well use codes identified for this area, presented in decreasing order, include: plugged or abandoned (31), sealing water wells (25), observation or monitor (22), test or piezometer (10), industrial (5), domestic (4), public supply (3), and irrigation (1). The three existing production wells at the HPS site are identified with a public supply use code. Selected information from the well construction permit list (SWFWMD, 1994b) that describes permit number, locations, well use code, well depth, and well diameter is presented in Table 2.3.3-3.

Table 2.3.3-1. Monthly and Annual Precipitation Averages and Extremes at Wauchula, Florida, 1933-1988

Month	Precipitation (inches)		
	Average	Maximum	Minimum
January	2.15	7.84	0.03
February	2.85	8.92	0.19
March	3.12	9.22	0.08
April	2.48	8.26	0.00
May	4.30	11.32	0.01
June	8.88	18.42	2.40
July	8.69	15.54	2.21
August	7.24	15.53	2.66
September	7.29	18.06	1.19
October	2.81	10.36	0.00
November	1.74	11.18	0.02
December	1.76	5.51	0.00
Annual	53.33	83.48	36.66

Note: inches x 2.54 = centimeters (cm).

Sources: SWFWMD, 1988.
TPS/SECI, 1989.

Table 2.3.3-2. Estimated Climatic Conditions at the HPS Site

Parameter	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Average
Monthly Temperature Normals[a]	°F	61.8	63.1	67.1	72.1	76.6	80.2	81.3	81.6	80.2	74.7	67.4	62.7	–	72.4
Average Dewpoint Temperature	°F	53	54	57	60	67	72	73	73	72	66	58	54	–	63.3
Relative Humidity	%	73	72	70	66	72	76	76	75	76	74	72	73	–	73
Daily Average Wind Speed	mph	7	8	9	8	7	6	6	6	6	7	7	8	–	7
Evapotranspiration															
Potential	inches/month	2.70	3.27	4.48	5.56	6.29	5.87	5.68	5.32	4.80	4.32	3.18	2.61	54.08	–
Estimated Actual[b]	inches/month	1.9	2.3	3.1	3.9	4.4	4.1	4.0	3.7	3.4	3.0	2.2	1.8	37.9	–

Note: miles per hour (mph) x 1.6 = kilometers per hour (km/hr).
inches per month x 2.54 = centimeters (cm) per month.
degrees Fahrenheit (°F) - 32 x 5/9 = degrees Celsius (°C).

[a] Temperature normals based on 1941-70 data from Wauchula station.
[b] Actual evapotranspiration based on an average annual crop coefficient of 0.7.

Sources: IFAS, 1979.
IFAS, 1983.
TPS/SECI, 1989.

Table 2.3.3-3. Well Construction Permits Within 1 Mile of the HPS Site (Page 1 of 5)

Permit Number	Township	Range	Section	Well Use Code[a]	Well Depth (feet)	Well Diameter (inches)
362163.01	T32S	R23E	25	SWW	380	6
362164.01	T32S	R23E	25	SWW	600	6
412278.01	T32S	R23E	25	Y	600	6
432016.01	T32S	R23E	25	SWW	600	6
432017.01	T32S	R23E	25	SWW	600	6
432019.01	T32S	R23E	25	SWW	600	6
432020.01	T32S	R23E	25	Y	380	6
500346.01	T32S	R23E	25	Y	600	6
528924.01	T32S	R23E	25	Y	600	6
534906.01	T32S	R23E	25	Y	600	6
534907.01	T32S	R23E	25	Y	600	6
433278.01	T32S	R23E	26	SWW	600	6
528345.01	T32S	R23E	26	Y	600	6
382585.01	T32S	R23E	34	O	27	6
382586.01	T32S	R23E	34	O	37	6
444612.01	T32S	R23E	34	SWW	600	6
444613.01	T32S	R23E	34	SWW	600	6
538016.01	T32S	R23E	34	Y	600	6
544095.01	T32S	R23E	34	Y	575	6
511344.01	T32S	R23E	35	O	24	4
444609.01	T32S	R23E	36	SWW	600	6
477945.01	T32S	R23E	36	SWW	600	6
517562.01	T32S	R23E	36	O	42	2

Table 2.3.3-3. Well Construction Permits Within 1 Mile of the HPS Site (Page 2 of 5)

Permit Number	Township	Range	Section	Well Use Code[a]	Well Depth (feet)	Well Diameter (inches)
517562.02	T32S	R23E	36	O	42	2
517562.03	T32S	R23E	36	O	42	2
388591.01	T32S	R24E	30	SWW	600	6
409378.01	T32S	R24E	30	SWW	600	6
409379.01	T32S	R24E	30	SWW	600	6
332018.01	T32S	R24E	30	SWW	600	6
435385.01	T32S	R24E	30	SWW	600	6
435892.01	T32S	R24E	30	Y	600	6
477946.01	T32S	R24E	30	SWW	600	6
521344.01	T32S	R24E	30	I	320	4
523966.01	T32S	R24E	30	Y	320	4
526097.01	T32S	R24E	30	Y	600	6
528922.01	T32S	R24E	30	Y	600	6
528923.01	T32S	R24E	30	Y	600	6
530332.01	T32S	R24E	30	Y	600	6
530333.01	T32S	R24E	30	Y	600	6
409380.01	T32S	R24E	31	SWW	600	6
425462.01	T32S	R24E	31	SWW	600	6
440299.01	T32S	R24E	31	Y	600	6
440300.01	T32S	R24E	31	Y	520	6
485532.01	T32S	R24E	31	Y	600	6
331684.01	T33S	R23E	1	I	125	4

Table 2.3.3-3. Well Construction Permits Within 1 Mile of the HPS Site (Page 3 of 5)

Permit Number	Township	Range	Section	Well Use Code[a]	Well Depth (feet)	Well Diameter (inches)
471411.01	T33S	R23E	1	O	21	2
471412.01	T33S	R23E	1	O	21	2
471413.01	T33S	R23E	1	O	21	2
471414.01	T33S	R23E	1	O	21	2
471415.01	T33S	R23E	1	O	21	2
472078.01	T33S	R23E	1	O	238	2
472080.01	T33S	R23E	1	O	246	2
473508.01	T33S	R23E	1	Y	150	2
473679.01	T33S	R23E	1	Y	500	6
480184.01	T33S	R23E	1	Y	200	2
480185.01	T33S	R23E	1	Y	21	2
514464.01	T33S	R23E	1	P	1,200	16
514465.01	T33S	R23E	1	P	1,200	16
514466.01	T33S	R23E	1	P	1,200	16
517561.01	T33S	R23E	1	O	28	2
517561.02	T33S	R23E	1	O	28	2
517561.03	T33S	R23E	1	O	28	2
444614.01	T33S	R23E	2	SWW	600	6
444615.01	T33S	R23E	2	SWW	600	6
496358.01	T33S	R23E	2	Y	600	6
543639.01	T33S	R23E	2	T	15	2
543639.02	T33S	R23E	2	T	20	2
543639.03	T33S	R23E	2	T	27	2

Table 2.3.3-3. Well Construction Permits Within 1 Mile of the HPS Site (Page 4 of 5)

Permit Number	Township	Range	Section	Well Use Code[a]	Well Depth (feet)	Well Diameter (inches)
543639.04	T33S	R23E	2	T	25	2
543639.05	T33S	R23E	2	T	25	2
543639.06	T33S	R23E	2	T	25	2
543639.07	T33S	R23E	2	T	25	2
543640.01	T33S	R23E	2	T	15	4
543640.02	T33S	R23E	2	T	25	4
331682.01	T33S	R23E	3	I	125	4
378572.01	T33S	R23E	3	Y	915	10
522372.01	T33S	R23E	3	SWW	600	6
523688.01	T33S	R23E	3	SWW	600	6
545933.01	T33S	R23E	3	SWW	510	6
324042.01	T33S	R23E	11	D	260	4
324043.01	T33S	R23E	11	D	260	4
511921.01	T33S	R23E	11	SWW	600	6
511992.01	T33S	R23E	11	SWW	600	6
520395.01	T33S	R23E	11	Y	600	6
530482.01	T33S	R23E	11	Y	600	6
384602.01	T33S	R24E	6	I	275	4
423405.01	T33S	R24E	6	Y	125	4
471408.01	T33S	R24E	6	O	21	2
472077.01	T33S	R24E	6	O	223	2
544204.01	T33S	R24E	6	Y	245	4

Table 2.3.3-3. Well Construction Permits Within 1 Mile of the HPS Site (Page 5 of 5)

Permit Number	Township	Range	Section	Well Use Code[a]	Well Depth (feet)	Well Diameter (inches)
544204.02	T33S	R24E	6	Y	200	4
544205.01	T33S	R24E	6	Y	300	6
328764.01	T33S	R24E	7	T	31	6
329524.01	T33S	R24E	7	D	310	4
335749.01	T33S	R24E	7	I	1,205	24
355801.01	T33S	R24E	7	D	310	4
473418.01	T33S	R24E	7	O	18	2
473419.01	T33S	R24E	7	O	18	2
473420.01	T33S	R24E	7	O	18	2
473421.01	T33S	R24E	7	O	18	2
476859.01	T33S	R24E	7	IRR	41	4

Note: feet (ft) x 0.3 = meters (m).
inches x 2.54 = centimeters (cm).

[a] Well Use Code:
D = domestic.
I = industrial.
O = observation or monitor.
IRR = irrigation.
SWW = sealing water well.
P = public supply.
T = test well/piezometer.
Y = plugged or abandoned.

Source: SWFWMD, 1994b.

2.3.4 SURFICIAL HYDROLOGY

This section is based primarily on the data collection and analyses performed in conjunction with the HPS EA/SCA (TPS/SECI, 1989). Additional data collection efforts center on water quality sampling and analyses tasks and are identified as *1993 sampling*.

2.3.4.1 HYDROLOGIC CHARACTERIZATION

2.3.4.1.1 Physical Characteristics

The HPS site is in the Polk Upland physiographic region with land surface elevations ranging from 30 to 40 m (100 to 130 ft) above sea level (SWFWMD, 1988). The site is near the headwaters of Payne Creek, approximately 16 km (10 miles) from the confluence of the creek with the Peace River. This confluence is approximately 129 km (80 miles) from the mouth of the Peace River at Charlotte Harbor on the Gulf of Mexico. Prominent site features are the existing HPS units [covering approximately 20 ha (50 acres)] and the 230-ha (570-acre) cooling reservoir.

Existing Cooling Reservoir

The existing 230-ha (570-acre) cooling reservoir was designed and constructed to satisfy at a minimum the engineering design and operational criteria (e.g., sufficient water supply and heat rejection capabilities) for the 660-MW HPS.

The existing cooling reservoir was designed conservatively to meet the following engineering criteria:

1. The cooling reservoir shall be capable of rejecting a minimum of 1.95×10^9 Btu/hr continuously.
2. The cooling reservoir shall be capable of supplying a daily average water temperature of 95°F (35°C) or cooler to the condenser at all times under design ambient conditions and 100 percent load. Additionally, the condenser back pressure shall not exceed 4.5 inches Hg (114.3 mm Hg).
3. The cooling reservoir water quality shall be maintained at satisfactory quality to allow continuous condenser cooling operation.

The cooling reservoir was constructed on reclaimed phosphate land as part of reclamation efforts by Agrico for its approved and ongoing mining operations (Figures 2.3.4-1, 2.3.4-2, and 2.3.4-3). The northeastern portion of the reservoir is below grade (i.e., the reservoir water surface is below the adjacent reclaimed ground surface). The south and western edges of the reservoir are above grade (i.e., the reservoir water surface is above the adjacent reclaimed and/or undisturbed ground surface). In these areas, the reservoir has been created and maintained by the construction of a wide berm. The outside slope is 20:1, and the inside slope is 4:1. This very flat, outside slope was selected to create a stable structure with low maintenance and seepage control requirements. Based on Agrico's previous reclamation and reservoir construction experience in the area, this very flat slope provides ideal, stable and low maintenance conditions for the creation of ponds and reservoirs. The minimum cooling reservoir water depth is approximately 10 ft.

Analytical results from a water quality sample obtained from the cooling reservoir in October 1993 are presented in Table 2.3.4-1. In general, water quality in the cooling reservoir was found to be good.

In addition to providing the condenser cooling water supply for the HPS existing units, the cooling reservoir also functions as the fundamental component of the heat dissipation/rejection system. In the circulating water system, cooling water from the cooling reservoir is pumped through the condenser to condense the turbine exhaust steam for the HPS existing units. This heated water is discharged back to the reservoir, where it is cooled through evaporative, radiant, and other natural cooling mechanisms as it flows through the reservoir. After cooling, the water is reused for additional condenser cooling. The existing cooling reservoir will be utilized for similar purposes for the Hardee Unit 3 facility.

Unnamed Tributary

The unnamed tributary to Payne Creek is located immediately to the west of the Hardee Unit 3 project site and receives runoff from the immediate surrounding area. Water levels in the tributary are a function of rainfall events and antecedent moisture conditions in the surrounding soils. Standing water is present year-round in the center portion of the tributary which was mined and reclaimed as an open water body. From the open water system, the tributary grades into a more meandering path through a small forested segment which was not mined. The hydrologic flow in the forested segment is more pronounced than in the open water portion of the tributary. From the project site, the tributary follows in a generally southern direction, eventually entering Payne Creek along the southwestern boundary of the HPS site.

Payne Creek

Payne Creek, in the site vicinity, is a meandering stream with a well-defined channel under average flow conditions. Stream dimensions vary from 3 to 6 m (10 to 20 ft) wide with a maximum channel depth of approximately 1.5 m (5 ft). Beyond the channel, the creek flows within a broad floodplain, as shown in Figure 2.3.4-4. Data in this figure were developed by combining onsite vertical survey information in the immediate vicinity of the creek with data from 1:24,000 USGS topographic maps.

Payne Creek and the Peace River to Charlotte Harbor are classified as Class III surface waters (Chapter 17-302, F.A.C.). Charlotte Harbor is classified as a Class II surface water (Chapter 17-302, F.A.C.).

The Hardee Unit 3 site consists of gently sloping terrain with gradients from 0 to 6 percent in the direction of Payne Creek (see Figure 2.3.4-5). Several wetland areas exist on or adjacent to the site with individual drainageways to Payne Creek. Portions of the HPS site and adjacent lands (on both sides of Payne Creek) have been mined for phosphate. After mining was completed, these areas were reclaimed in accordance with approved reclamation plans.

2.3.4.1.2 Hydrologic Characteristics

USGS has maintained a stream gauging station on Payne Creek near Bowling Green for 14 years (1964-1968 and 1980-present). The station (No. 02295420) is located on the U.S. 17 bridge over the creek approximately 2.4 km (1.5 miles) from the creek mouth at Peace River and is about 19 km (12 miles) southeast of the Hardee Unit 3 site. This station was used to estimate the mean, maximum, and minimum average daily streamflow in Payne Creek near the HPS site (see Table 2.3.4-2). The USGS station flows were multiplied by the ratio of drainage areas for the two locations to determine the flows in Payne Creek at the discharge location near the HPS site. These calculations yield an average annual Payne Creek flow near the HPS site of 0.62 cubic meter per second (m^3/s) [22 cubic feet per second (cfs)], or approximately 0.9 cfs per square mile.

The low flows in Payne Creek near the HPS site were estimated using low-flow frequency analyses of the low flows at the Payne Creek-Bowling Green USGS station (USGS, 1984), corrected to the HPS site location using the ratio of drainage areas. The low flows for durations from 1 to 183 days and recurrence intervals from 2 to 20 years are shown in Table 2.3.4-3. Seven-day low flows of 0.03 m^3/s (1.0 cfs) or less can be expected to occur with a recurrence interval of 2 years. Thirty-day low flows of 0.06 m^3/s (2.0 cfs) or less can be expected also to occur with a recurrence interval of 2 years. Given the relatively small drainage area of Payne Creek at the HPS site, regular periods of low flow routinely occur.

Flood flows in Payne Creek near the site were estimated from a technique described in USGS publication WRI 82-4012 (1982). USGS developed a series of regression equations from long-term discharge stations using the independent parameters drainage area, slope, and lake area in the basin. The regression equation applicable to the site area, the regression constants and exponents, and the resulting flows are given in Table 2.3.4-4 for recurrence intervals from 2 to 500 years. The peak 10-year flow at the HPS site is estimated to be 50.7 m^3/s (1,810 cfs); the peak 25-year flow is estimated to be 70.8 m^3/s (2,530 cfs).

Streamflow and stage measurements were taken on Payne Creek as part of the monitoring program developed in support of the TPS/SECI (1989) application (see Section 2.3.4.2). The discharge hydrograph for the monitoring period on Payne Creek near the HPS site is shown in Figure 2.3.4-6.

During the period of site-specific stream gauging (October 11, 1988, through April 13, 1989), the Payne Creek discharge varied substantially. The highest Payne Creek discharge (1.05 m^3/s; 37.6 cfs) was observed on January 25, 1989; the lowest Payne Creek discharge (0.04 m^3/s; 1.6 cfs) was observed on April 11-13, 1989. The Payne Creek discharge hydrograph is presented in Figure 2.3.4-6.

Based on this streamflow hydrograph, there was a slow and steady decrease in the baseflow (i.e., non-storm event runoff) from October to April, with occasional short-term rises due to area rainfall. The creek network drains the watershed relatively rapidly; frequent or sustained rain, such as the summer months' rainfall, is required to increase this baseflow.

Streamflow measurements were taken once a month near the HPS site from October 1988 through April 1989 (PC-2) and downstream of the site near Bowling Green from December 1988 through April 1989 (PC-4, USGS Station No. 02295420). The locations of these two stations are presented in Figure 2.3.4-7. Table 2.3.4-5 gives a summary of the recorded stages and streamflows at Station PC-2, near the HPS site.

2.3.4.1.3 Chemical Characteristics

Prior studies of surface water quality in the site vicinity have been performed by phosphate mining companies as part of permit approval or monitoring programs for Development of Regional Impacts (DRIs), National Pollutant Discharge Elimination System (NPDES) permit approval programs, mining and reclamation plans, and related environmental permits. Two different water quality studies were conducted in Payne Creek near the site, by Agrico and by CFI (conducted by Dames and Moore). The Agrico study consists of four annual reports for the period 1983-1986. The CFI (Dames and Moore) study encompassed the period from July 1975 through January 1976. Water quality samples collected during these two studies represent data collected from four different station locations (Stations 1, 2, 3, and 4). Data from the two studies are combined and summarized in Table 2.3.4-6. These four station locations are shown in Figure 2.3.4-8. The complete data set for the period was provided in the original SCA (TPS/SECI, 1989).

For this previous data, the mean values (at any station) for 5 of the 46 parameters tested exceeded Chapter 17-3, F.A.C., Class III water quality standards. These parameters included: dissolved oxygen, chromium, iron, lead, and zinc. The mean dissolved oxygen concentration failed to meet Class III water quality criteria at three stations. The remaining parameters (i.e., chromium, iron, lead, and zinc) exceeded Class III water quality criteria at two stations and were based on a relatively few number of observations. Table 2.3.4-7 presents the *in situ* data.

In 1993, SECI collected two sets of water quality samples at three of the former water quality stations used in support of the TPS/SECI (1989) application (i.e., Stations PC-1, PC-2, and PC-3; see Figure 2.3.4-9). The results of the 1993 analyses are shown in Tables 2.3.4-8, 2.3.4-9, and 2.3.4-10 for Stations PC-1, PC-2, and PC-3, respectively. These tables include the previous monitoring data for comparison purposes.

In general, water quality monitored in Payne Creek as part of the 1993 monitoring program is very good. Only four exceedances of the Class III mercury standard were observed, and one exceedance of the Class III zinc standard was observed.

As seen in Tables 2.3.4-8, 2.3.4-9, and 2.3.4-10, water quality in Payne Creek is essentially unchanged over the past 4 years. Exceedances of Class III water quality standards were observed in both data sets for ammonia nitrogen and in the 1993 data for silver at Station PC-3 and radium 226 at Stations PC-1 and PC-3. Based on these analyses, it can still be concluded that the water quality in Payne Creek in very good, and exceedances of Class III water quality standards are random in both a spatial and temporal sense.

2.3.4.2 MEASUREMENT PROGRAMS

The following surface water hydrology and water quality field studies were conducted to supply the information needed for impact assessments.

Continuous Water Level Recording (Conducted in 1988 and 1989 only)--A continuous water level recording station location was installed on Payne Creek adjacent to the HPS site; this station (PC-2) was operated as part of the original study for a period of 8 months during 1988 through 1989. This gauging station location is shown in Figure 2.3.4-9. The station consisted of a Leupold and Stevens Type A Continuous Water-Level Recorders and vertically mounted PVC stilling wells. The recorders show changes in water level and water flow. The water level recorder was serviced and the charts removed each month with 100 percent data recovery. The charts were digitized and the data stored in computer files. The original charts were cataloged and filed as a permanent record.

In addition, the USGS maintains a gauging station on Payne Creek below the proposed site, near Bowling Green (USGS No. 02295420). The drainage area to this gauge is approximately 313 square kilometers (km^2) [121 square miles (mi^2)] and includes the HPS site. The current data from this station (i.e., for the study period) were obtained.

Cross-Section Survey (Conducted in 1988 and 1989 only)--A cross-section was conducted at a representative site near the additional water level gauging stations on Payne Creek to determine river/creek morphology in the vicinity of probable points of discharge. The data were as collected using a sounding rod and surveyor's level. Since no disturbance of the creek bed has occurred, the results of this survey should closely approximate existing conditions.

Water Quality Sampling--The baseline water quality monitoring program used in support of the original application (TPS/SECI, 1989) was structured to provide the necessary database on existing water quality at the site for evaluation of impacts and mitigative measures. The locations of the water quality sampling stations are shown in Figure 2.3.4-9. Samples were collected from four stations on Payne Creek; one located upstream of the proposed HPS site, one located adjacent to the proposed site; and two stations located downstream of the proposed HPS site. All samples were surface grab samples.

Water quality sampling for most water quality parameters (including Chapter 17-3, F.A.C. Class III water quality parameters, except organics, and other classical water quality parameters) was conducted monthly for 6 months at four stations. Chapter 17-3, F.A.C. Class III organics (e.g., pesticides) were sampled twice (November 1988 and February 1989). All analyses (except total dissolved solids) were done on a total or unfiltered basis.

For the 1993 sampling in support of the Hardee Unit 3 application, confirmatory water quality samples were obtained from three stations in a manner consistent as described above. Any changes in FDEP sampling and analysis protocols were included in the 1993 sampling efforts. When evaluating the 1993 sampling results, the most recent FDEP water quality standards were used.

Synoptic Streamflow Studies (Conducted in 1988 and 1989 only)--Streamflow was measured at the HPS site and USGS gauging stations once every month for the monitoring period of 8 months. The two gauging stations are shown in Figure 2.3.4-9. The discharge measurements were made using either Teledyne-Gurley pygmy and Price flow meters or Marsh-McBerney flow meters in accordance with standard USGS stream gauging techniques. The measurements were coordinated with the water quality sampling efforts and completed within 2 days to ensure consistency among stations.

Table 2.3.4-1. Summary of Water Quality Conditions in the HPS Cooling Reservoir at the Intake--1993 (Page 1 of 6)

Parameter	Class III Standard	September 1993 Data
Water Quality Data		
Alkalinity (Bicarbonate), mg $CaCO_3$/L	>20	96
Alkalinity (Carbonate), mg $CaCO_3$/L		
Cyanide, mg/L	≤0.0052	<0.005
Fluoride, mg/L	≤10	1.81
Hardness, mg/L as $CaCO_3$		101
Methylene Blue Active Substances, mg/L		
Total Kjeldahl Nitrogen, mg/L		1.57
Ammonia Nitrogen, mg/L		0.046
Organic Nitrogen, mg/L		
Unionized Ammonia, mg/L	≤0.02	<0.005
Nitrate+Nitrite-Nitrogen, mg/L		0.009
Total Nitrogen, mg/L		1.58
Oil and Grease, mg/L	<5	<5
Carbonaceous Biochemical Oxygen Demand, (5-day) mg/L		4.0
Chemical Oxygen Demand, mg/L		44
Orthophosphorus, mg/L		0.347
Total Phosphorus, mg/L		0.816
Sulfate, mg/L		35.3
Turbidity, NTU	<29[a]	10
Aluminum, μg/L		
Antimony, μg/L	≤4,300	<5
Arsenic, μg/L	≤50	<5
Beryllium, μg/L	≤0.13[b]	<0.1
Cadmium, μg/L	0.82[c]	<5
Calcium, mg/L		20.4
Chromium, μg/L	148[c]	<5
Chromium +6, μg/L	≤11	<10
Copper, μg/L	8.3[c]	<10
Iron, μg/L	≤1,000	162
Lead, μg/L	1.9[c]	<5
Magnesium, mg/L		12.2
Manganese, μg/L		<5
Mercury, μg/L	≤0.012	<0.2
Nickel, μg/L	111.5[c]	<30

Table 2.3.4-1. Summary of Water Quality Conditions in the HPS Cooling Reservoir at the Intake--1993 (Page 2 of 6)

Parameter	Class III Standard	September 1993 Data
Water Quality Data (Continued)		
Potassium, mg/L		0.6
Selenium, mg/L	≤0.005	<5
Silver, μg/L	≤0.07	<0.07
Sodium, mg/L		24.8
Strontium, Total, μg/L		88
Thallium, μg/L	≤48	<5
Zinc, μg/L	74.9[c] (≤1,000)	73
Total Coliforms, colonies/100 mL	≤1,000[d], ≤2,400 max	3,700
Fecal Coliforms, colonies/100 mL	200[d], 800 max	<1
Chloride, mg/L		17.8
Total Suspended Solids mg/L		16
Total Dissolved Solids, mg/L		185
Silica, dissolved reactive, mg/L		<1
Radiation Data		
Alpha, Gross (pCi/L) (gross alpha + Radium 226)	≤15	12.5
Beta, Gross (pCi/L)		
Radium 226 (pCi/L) (Radium 226+Radium 228)	≤5	1.0
Radium 228 (pCi/L) (Radium 226+Radium 228)	≤5	<1.0
Volatile Organics (all units μg/L, all compound were analyzed for, but none detected at the specified value)		
Chloromethane	≤470.8[b]	<1
Bromomethane		<1
Dichlorodifluoromethane		<1
Vinyl Chloride		<1
Chloroethane		<1
Methylene Chloride	≤1,580[b]	<1
Trichlorofluoromethane		<1
1,1-Dichloroethene	≤3.2[b]	<1
1,1-Dichloroethane		<1
trans-1,2-Dichloroethene		<1
Chloroform	≤470.8[b]	<1

Table 2.3.4-1. Summary of Water Quality Conditions in the HPS Cooling Reservoir at the Intake--1993 (Page 3 of 6)

Parameter	Class III Standard	September 1993 Data
<u>Volatile Organics (Continued)</u>		
1,2-Dichloroethane		<1
1,1,1-Trichloroethane	≤173,000	<1
Carbon Tetrachloride	≤4.42[b]	<1
Bromodichloromethane		<1
1,2-Dichloropropane		<1
Benzene	≤71.28[b]	<1
Trichloroethene	≤80.7[b]	<1
Dibromochloromethane	≤22[b]	<1
1,1,2-Trichloroethane		<1
cis-1,3-Dichloropropene		<1
2-Chloroethylvinyl ether		<1
Bromoform	≤360[b]	<1
1,1,2,2-Tetrachloroethane	≤10.8[b]	<1
Tetrachloroethene		<1
Toluene		<1
Chlorobenzene		<1
Ethylbenzene		<1
1,3-Dichlorbenzene		<1
1,2-Dichlorbenzene		<1
1,4-Dichlorbenzene		<1
para and meta Xylenes		<1
ortho Xylene		<1
Styrene		<1
NTBE		<5
<u>Semivolatile Organics (all units μg/L, all 1993 compounds were analyzed for, but none were detected at the specified value except for *)</u>		
phenol	≤4,600,000	<5
2-chlorophenol	≤400	<5
1,3-dichlorobenzene		<5
1,4-dichlorobenzene		<5
1,2-dichlorobenzene		<5
2-methylphenol		<5
4-methylphenol		<5
hexachloroethane		<5
2-nitrophenol		<5

Table 2.3.4-1. Summary of Water Quality Conditions in the HPS Cooling Reservoir at the Intake--1993 (Page 4 of 6)

Parameter	Class III Standard	September 1993 Data
Semivolatile Organics (Continued)		
2,4-dimethylphenol		<5
2,4-dichlorophenol	≤790	<5
1,2,4-trichlorobenzene		<5
naphthalene		<5
hexachlorobutadiene	≤49.7[b]	<5
4-chloro-3-methyphenol		<5
2-methylnaphthalene		<5
hexachlorocyclopentadiene		<5
2,4,6-trichlorophenol	≤6.5[b]	<5
2,4,5-trichlorophenol		<25
2-chloronapthalene		<5
Diethyl Phthalate		<5
Acenaphthene	≤2,700	<5
Acenaphtylene		<5
2,4-Dinitrophenol	≤14.26	<25
dimethyl phthalate		<5
fluorene	≤14,000	<5
4,6-dinitro-2-methyphenol		<5
hexachlorobenzene		<5
pentachlorophenol	≤8.2[b], ≤30 max	<5
phenanthrene	≤0.031	<5
anthracene	≤110,000	<5
di-n-butyl phthalate		32[a]
fluoranthene	≤370	<5
pyrene	≤11,000	<5
butyl benzyl phthalate		<5
benzo(a)anthracene	≤0.031[b]	<5
bis(2-ethylhexyl)phthalate		<5
chrysene	≤0.031[b]	<5
di-n-octyl phthalate		<5
benzo(b)fluoranthene	≤0.031[b]	<5
benzo(k)fluoranthene	≤0.031[b]	<5
benzo(a)pyrene	≤0.031[b]	<5
Indeno(1,2,3-cd)pyrene	≤0.031[b]	<5
dibenzo(a,h)anthracene	≤0.031[b]	<5

Table 2.3.4-1. Summary of Water Quality Conditions in the HPS Cooling Reservoir at the Intake--1993 (Page 5 of 6)

Parameter	Class III Standard	September 1993 Data
Semivolatile Organics (Continued)		
benzo(g,h,i)perylene	≤0.031[b]	<5
Pesticides/PCBs & Herbicides (all units μg/L, all 1993 compounds were analyzed for, but none were detected at the specified value)		
alpha-BHC		<0.05
beta-BHC	≤0.046[b]	<0.05
delta-BHC		<0.05
Lindane	≤0.063[b], <0.08 max	<0.05
Heptachlor	≤0.00021[b], <0.0038 max	<0.05
Aldrin	≤0.00014[b], <3 max	<0.05
Heptachlor epoxide		<0.05
Endosulfan I		<0.05
Dieldrin	≤0.00014[b], <0.0019 max	<0.1
4,4'-DDE		<0.1
Endrin	0.0023	<0.1
Endosulfan II		<0.1
4,4'-DDD		<0.1
Endosulfan sulfate		<0.1
4,4'DDT	0.00059[b], <0.001 max	<0.1
Methoxychlor		<0.5
Endrin ketone		<0.1
alpha-chlordane		<0.5
gamma-chlordane		<0.5
Toxaphene	≤0.0002	<1
PCB-1016		<0.5
PCB-1221		<0.5
PCB-1232		<0.5
PCB-1242		<0.5
PCB-1248		<0.5
PCB-1254		<0.5
PCB-1260		<1
Mirex	≤0.001	<0.5
Chlordane	≤0.00059[b], <0.0043 max	NA
Demeton	≤0.1	NA
Endosulfan	≤0.056	NA
Guthion	≤0.01	NA

Table 2.3.4-1. Summary of Water Quality Conditions in the HPS Cooling Reservoir at the Intake--1993 (Page 6 of 6)

Parameter	Class III Standard	September 1993 Data
Pesticides/PCBs and Herbicides (Continued)		
Malathion	≤0.1	NA
Parathion	≤0.04	NA
Silvex		NA
2,4-D		<1
2,4,5-TP		<1
Organophosphate Pesticides (all units μg/L, all 1993 compounds were analyzed for, but none were detected at the specified value)		
Azinphos methyl		<5
Bolstar		<1
Chloropyriphos		<0.5
Chloropyriphos methyl		<1
Diazinon		<1
Dichlorvos		<1
Disulfoton		<1
Ethoprop		<0.5
Fensulfothion		<5
Fenthion		<1
Merphos		<1
Mevinphos		<5
Perathion methyl		<1
Phorate		<1
Ronnel		<1
Stirofos		<1
Tokuthion		<0.5
Demeton	≤0.1	<1
Coumaphos		<2
Naled		<1
Trichlronate		<1

[a] Above natural background conditions.
[b] Annual average.
[c] Standard calculated according to equation in DEP 17-302.530 and using overall minimum hardness of 66.4 mg/L as $CaCO_3$.
[d] Monthly average.

Sources: TPS/SECI, 1989.
KBN, 1994.

Table 2.3.4-2. Summary of Historical Flows on Payne Creek at Bowling Green and Estimated Flows at the HPS Site

Water Year	Daily Streamflow (cfs) Mean	Maximum	Minimum
At Bowling Green			
1964	111	928	3.6
1965	118	2,060	1.9
1966	71	892	4.3
1967	78	1,310	1.2
1968	171	1,920	2.0
1980	109	981	25
1981	48	276	6.4
1982	125	2,500	11
1983	165	1,380	27
1984	73	357	11
1985	64	635	4.4
Annual[a]	103	981	4.4
At HPS Site (estimated)			
1964	24	197	0.8
1965	25	438	0.4
1966	15	189	0.9
1967	17	278	0.3
1968	36	408	0.4
1980	23	208	5.3
1981	10	59	1.4
1982	27	531	2.3
1983	35	293	5.7
1984	16	76	2.3
1985	14	135	0.9
Annual[a]	22	208	0.9

Note: Cubic feet per second (cfs) x 0.028 = cubic meters per second (m^3/s).

[a] Annual "average" for maximum and minimum streamflow values for both the Bowling Green and HPS site stations are given as the median values for the period of record.

Source: TPS/SECI, 1989.

Table 2.3.4-3. Estimated Low Flows on Payne Creek Near the HPS Site

Recurrence Interval (years)	Low-Flow Discharge (cfs) for Various Durations (days)								
	1	3	7	14	30	60	90	120	183
2	0.7	0.8	1.0	1.2	1.7	2.8	3.8	4.9	7.6
5	0.3	0.4	0.5	0.5	0.7	1.1	1.8	2.5	3.8
10	0.3	0.3	0.3	0.4	0.4	0.6	1.2	1.9	2.5
20	0.2	0.2	0.3	0.3	0.3	0.4	0.8	1.5	1.7

Note: Cubic feet per second (cfs) x 0.028 = cubic meters per second (m^3/s).

Source: TPS/SECI, 1989.

Table 2.3.4-4. Estimated Flood Flows on Payne Creek at the HPS Site

Recurrence Interval (years)	Regression Constant C	Regression Exponents B1	B2	B3	Estimated Flood Flow (cfs)
2	93.4	0.756	0.268	-0.803	690
5	192	0.722	0.255	-0.759	1,310
10	274	0.708	0.248	-0.738	1,810
25	395	0.696	0.24	-0.717	2,530
50	496	0.690	0.234	-0.705	3,130
100	609	0.685	0.227	-0.695	3,780
200	779	0.674	0.205	-0.694	4,510
500	985	0.668	0.196	-0.687	5,550

Note: Drainage Area = 25.7 square miles.
Slope = 5 ft/mi.
Non-Contributing Lake Area = 0 percent.

Regression Equation:

$$QT = C\ DA^{B1}\ SL^{B2}\ (LK + 3.0)^{B3}$$

Cubic feet per second (cfs) x 0.028 = cubic meters per second (m^3/s).

Source: TPS/SECI, 1989.

Table 2.3.4-5. Stage and Flow Data for Payne Creek at Station PC-2 Near the HPS Site

Date	Stage (ft)	Flow (cfs)
October 11, 1988	2.62	12.2
November 8, 1988	2.52	11.6
December 8, 1988	2.06	4.7
January 11, 1989	1.76	2.3
February 15, 1989	1.81	3.0
March 15, 1989	1.85	4.2
April 13, 1989	1.59	1.9

Note: cubic feet per second (cfs) x 0.028 = cubic meters per second (m^3/s).
feet (ft) x 0.3 = meters (m).

Source: TPS/SECI, 1989.

Table 2.3.4-6. Summary of Historic Payne Creek Surface Water Quality in the Vicinity of HPS, 1975-1986 (all available data) (Page 1 of 6)

Parameter/Location	Concentration[a] Average	Maximum	Minimum	Number of Samples
Flow (cfs)				
Station 1	7.00	12.50	2.00	4
Station 2	- -	- -	- -	0
Station 3	- -	- -	- -	0
Station 4	55.80	105.20	10.60	4
Temperature (°F)				
Station 1	74.0	84.2	60.0	22
Station 2	72.9	85.0	59.0	8
Station 3	71.4	85.0	58.0	11
Station 4	72.1	82.0	58.0	22
Total Suspended Solids				
Station 1	5.6	10.4	3.4	12
Station 2	6.4	26.3	1.2	8
Station 3	5.1	28.3	1.0	8
Station 4	2.4	4.2	1.0	12
Total Dissolved Solids				
Station 1	273	374	188	8
Station 2	191	252	141	8
Station 3	194	284	120	11
Station 4	186	244	126	10
Dissolved Oxygen				
Station 1	1.7	4.2	0.1	22
Station 2	2.1	5.0	0.4	8
Station 3	3.2	9.5	0.1	11
Station 4	7.1	9.0	4.4	22
pH				
Station 1	7.1	7.8	6.6	16
Station 2	6.8	7.1	6.3	8
Station 3	7.0	7.2	6.5	11
Station 4	7.4	7.8	6.9	16
Specific Conductivity (μmho/cm)				
Station 1	347	577	191	8
Station 2	215	258	142	8
Station 3	288	860	156	11
Station 4	228	271	135	8

Table 2.3.4-6. Summary of Historic Payne Creek Surface Water Quality in the Vicinity of HPS, 1975-1986 (all available data) (Page 2 of 6)

Parameter/Location	Concentration[a] Average	Maximum	Minimum	Number of Samples
Calcium				
Station 4	25	34	15	2
Magnesium				
Station 4	9.4	12.0	6.9	2
Sodium				
Station 4	8.1	9.0	7.1	2
Total Hardness				
Station 4	100	134	65	2
Bicarbonate Alkalinity (mg/L as $CaCO_3$)				
Station 1	155	283	56	8
Station 2	61	72	50	8
Station 3	64	90	46	11
Station 4	63	98	29	8
Sulfate				
Station 1	22	68	1	4
Station 2	35	59	18	4
Station 3	32	50	17	4
Station 4	37	61	15	4
Chloride				
Station 4	15	17	13	2
Biochemical Oxygen Demand (5-day)				
Station 1	4.88	6.7	2.8	8
Station 2	1.61	4.0	0.9	8
Station 3	1.23	3.0	0.4	11
Station 4	2.46	7.1	0.8	10
Chemical Oxygen Demand				
Station 4	30	47	12	2
Fecal Strep (Number per 100 mL)				
Station 4	183	360	5	2

Table 2.3.4-6. Summary of Historic Payne Creek Surface Water Quality in the Vicinity of HPS, 1975-1986 (all available data) (Page 3 of 6)

Parameter/Location	Concentration[a] Average	Maximum	Minimum	Number of Samples
Fluoride				
Station 1	1.32	1.88	0.74	16
Station 2	0.82	1.88	0.46	8
Station 3	0.94	1.91	0.56	11
Station 4	1.16	1.78	0.37	16
Silicon				
Station 1	2.22	3.30	1.20	4
Station 2	- -	- -	- -	0
Station 3	- -	- -	- -	0
Station 4	3.02	3.84	2.60	4
Sulfide				
Station 4	0.02	0.04	0.00	2
Turbidity (NTU)				
Station 1	2.9	6.2	0.5	16
Station 2	3.6	15.0	1.0	8
Station 3	2.9	18.0	0.8	11
Station 4	2.3	10.0	0.5	18
Ammonia				
Station 1	0.16	0.51	<0.02	8
Station 2	0.29	0.90	0.03	8
Station 3	0.15	0.36	0.02	8
Station 4	0.04	0.09	0.02	8
Nitrate				
Station 1	0.90	5.90	<0.01	11
Station 2	0.15	0.36	<0.01	8
Station 3	0.33	1.25	<0.01	11
Station 4	0.18	1.00	<0.01	12
Nitrite				
Station 1	0.01	0.02	<0.01	8
Station 2	0.06	0.39	<0.01	8
Station 3	0.02	0.05	<0.01	8
Station 4	0.01	0.02	<0.01	8

Table 2.3.4-6. Summary of Historic Payne Creek Surface Water Quality in the Vicinity of HPS, 1975-1986 (all available data) (Page 4 of 6)

Parameter/Location	Concentration[a] Average	Maximum	Minimum	Number of Samples
Total Kjeldahl Nitrogen				
Station 1	0.79	1.14	0.37	8
Station 2	0.62	1.44	0.17	8
Station 3	0.34	0.63	0.16	8
Station 4	0.59	2.70	0.22	10
Total Nitrogen				
Station 1	2.31	12.70	0.41	12
Station 2	0.83	1.76	0.37	8
Station 3	0.71	2.65	0.23	11
Station 4	0.51	1.42	0.02	12
Total Phosphate				
Station 1	0.51	0.60	0.42	4
Station 2	- -	- -	- -	0
Station 3	0.36	0.50	0.18	3
Station 4	0.45	0.58	0.28	4
Total Phosphorus				
Station 1	0.74	1.12	0.35	8
Station 2	0.62	1.80	0.29	8
Station 3	0.45	0.72	0.15	8
Station 4	0.47	0.79	0.25	8
Arsenic				
Station 1	0.009	0.030	<0.001	4
Station 2	0.009	0.030	<0.001	4
Station 3	0.009	0.030	<0.001	4
Station 4	0.006	0.030	<0.001	6
Barium				
Station 1	- -	- -	- -	0
Station 2	- -	- -	- -	0
Station 3	<0.01	<0.01	<0.01	3
Station 4	- -	- -	- -	0
Beryllium				
Station 1	- -	- -	- -	0
Station 2	- -	- -	- -	0
Station 3	0.24	0.69	<0.01	3
Station 4	- -	- -	- -	0

Table 2.3.4-6. Summary of Historic Payne Creek Surface Water Quality in the Vicinity of HPS, 1975-1986 (all available data) (Page 5 of 6)

Parameter/Location	Concentration[a] Average	Maximum	Minimum	Number of Samples
Cadmium				
Station 1	0.01	0.02	<0.005	4
Station 2	0.01	0.02	<0.005	4
Station 3	0.01	0.01	<0.005	4
Station 4	0.01	0.01	<0.002	6
Chromium				
Station 1	- -	- -	- -	0
Station 2	- -	- -	- -	0
Station 3	0.07	0.10	<0.01	3
Station 4	0.03	0.03	<0.02	2
Copper				
Station 1	- -	- -	- -	0
Station 2	- -	- -	- -	0
Station 3	0.01	0.01	<0.01	3
Station 4	0.02	0.03	<0.01	2
Iron				
Station 1	1.21	2.94	0.22	8
Station 2	1.30	5.60	0.32	8
Station 3	0.81	4.77	0.05	11
Station 4	0.33	1.01	0.10	10
Lead				
Station 1	0.02	0.05	<0.01	4
Station 2	0.02	0.05	<0.01	4
Station 3	0.07	0.20	<0.01	7
Station 4	0.02	0.05	<0.01	6
Manganese				
Station 1	0.03	0.05	0.02	8
Station 2	0.03	0.06	0.01	8
Station 3	0.02	0.05	0.01	8
Station 4	0.02	0.05	0.01	8
Nickel				
Station 4	0.01	0.01	<0.002	2
Selenium				
Station 4	0.0025	0.005	<0.014	2

Table 2.3.4-6. Summary of Historic Payne Creek Surface Water Quality in the Vicinity of HPS, 1975-1986 (all available data) (Page 6 of 6)

Parameter/Location	Concentration[a] Average	Maximum	Minimum	Number of Samples
Zinc				
Station 1	- -	- -	- -	0
Station 2	- -	- -	- -	0
Station 3	0.04	0.05	<0.01	3
Station 4	0.07	0.10	0.04	2
Hexane Solubles				
Station 4	22	24	20	2
Methyl Blue Active Substances				
Station 4	0.13	0.25	<0.01	2
Phenols				
Station 4	0.01	0.03	0.00	2
Gross Alpha (pCi/L)				
Station 1	4.7	14.0	<0.1	8
Station 2	1.5	7.5	<0.1	8
Station 3	2.1	8.4	<0.1	11
Station 4	3.2	10.2	<0.1	8

Note: All values are total concentrations unless noted.
Cubic feet per second (cfs) x 0.028 = cubic meters per second (m^3/s).
Degrees Fahrenheit (°F) - 32 x 5/9 = degrees Celsius (°C).

[a] All values mg/L unless otherwise noted.

Source: TPS/SECI, 1989.

Table 2.3.4-7. *In Situ* Water Quality Data for Payne Creek, 1988-1989 and 1993

		1988 - 1989 Data				1993 Data	
Station	Parameter	Minimum	Maximum	Mean	Standard Deviation	October	December
PC-1	Temperature (°C)	17.3	25.1	20.3	2.5	23.9	15.93
	pH	6.0	6.7	6.4	0.3	6.1	6.3
	Dissolved Oxygen (mg/L)	1.0	6.9	4.9	1.9	4.64	10.04
	Conductivity (μmho/cm)	148	208	183	21.2	204	243
	Secchi (ft)	NA	>2.5	NA	NA	NA	NA
	Total Chlorine (mg/L)	0.0	<0.1	<0.1	NA	NA	NA
PC-2	Temperature (°C)	16.9	25.0	19.6	2.6	24.2	16.78
	pH	6.4	7.1	6.7	0.3	6.4	7.1
	Dissolved Oxygen (mg/L)	4.1	7.7	6.6	1.2	5.91	11.64
	Conductivity (μmho/cm)	174	214	193	14.7	256	283
	Secchi (ft)	NA	>3	NA	NA	NA	NA
	Total Chlorine (mg/L)	<0.1	<0.2	<0.1	NA	NA	NA
PC-3	Temperature (°C)	17.3	25.7	20.4	2.7	26.03	17.21
	pH	6.5	7.2	6.7	0.2	6.6	6.9
	Dissolved Oxygen (mg/L)	5.5	7.0	6.4	0.5	6.93	10.89
	Conductivity (μmho/cm)	197	247	216	17.7	274	288
	Secchi (ft)	NA	>4	NA	NA	NA	NA
	Total Chlorine (mg/L)	<0.1	<0.2	<0.1	NA	NA	NA
PC-4	Temperature (°C)	18.1	24.9	20.2	2.2	NA	NA
	pH	6.5	7.2	6.9	0.2	NA	NA
	Dissolved Oxygen (mg/L)	5.7	7.9	7.3	1.6	NA	NA
	Conductivity (μmho/cm)	243	334	286	97.8	NA	NA
	Secchi (ft)	NA	>3	NA	NA	NA	NA
	Total Chlorine (mg/L)	0.0	<0.2	<0.1	NA	NA	NA

Note: NA = not available or not applicable.
Feet (ft) x 0.3 = meters (m).

Sources: TPS/SECI, 1989.
KBN, 1994.

Table 2.3.4-8. Summary of Water Quality Conditions in Payne Creek--PC-1, 1988 - 1989 and 1993 (Page 1 of 5)

Parameter	Class III Standard	1988-1989 Data			1993 Data	
		Max	Min	Mean	September	December
Water Quality Data						
Alkalinity (Bicarbonate), mg $CaCO_3$/L	>20	60	48	50.67	56	64
Alkalinity (Carbonate), mg $CaCO_3$/L		<0.5	<0.5	<0.5	–	<1
Cyanide, mg/L	≤0.0052	<0.004	<0.004	0.004	<0.005	<0.005
Fluoride, mg/L	≤10	0.8	0.6	0.7	0.247	0.419
Hardness, mg/L as $CaCO_3$		85.4	77.8	74.98	66.4	79.7
Methylene Blue Active Substances, mg/L		0.05	<0.025	0.029	–	–
Total Kjeldahl Nitrogen, mg/L		0.864	0.338	0.656	0.5	0.38
Ammonia Nitrogen, mg/L		0.345	<0.005	0.084	0.01	<0.005
Organic Nitrogen, mg/L		0.743	0.323	0.574	–	0.38
Unionized Ammonia, mg/L	≤0.02	–	–	–	<0.005	<0.005
Nitrate+Nitrite-Nitrogen, mg/L		0.608	0.19	0.358	0.047	0.166
Total Nitrogen, mg/L		1.42	0.772	1.014	0.55	0.55
Oil and Grease, mg/L	<5	<5	<5	<5	<5	<5
Carbonaceous Biochemical Oxygen Demand, 5-day, mg/L		<1	<1	<1	1.2	<1.0
Chemical Oxygen Demand, mg/L		66	<10	29.5	61	30
Orthophosphorus, mg/L		0.5	0.288	0.38	0.518	0.256
Total Phosphorus, mg/L		0.573	0.318	0.392	0.629	0.284
Sulfate, mg/L		25	9.2	19.98	18.2	27.4
Turbidity, NTU	<29[a]	1.6	0.8	1.142	1.4	0.6
Aluminum, µg/L		137	45	83.17	78	27
Antimony, µg/L	≤4,300	<10	<10	10	<5	–
Arsenic, µg/L	≤50	<5	<5	<5	<5	<5
Beryllium, µg/L	≤0.13[b]	<3	<3	<3	<0.1	<0.1
Cadmium, µg/L	0.82[c]	<0.4	<0.4	0.4	<5	<5
Calcium, mg/L		17.4	12.3	15.37	12.9	16
Chromium, µg/L	148[c]	<10	<10	10	<5	<5
Chromium +6, µg/L	≤11	–	–	–	<10	<10
Copper, µg/L	8.3[c]	<7	<6	6.333	<10	<10
Iron, µg/L	≤1,000	648	224	338.5	661	171
Lead, µg/L	1.9[c]	6.7	<5	5.283	<5	6.7
Magnesium, mg/L		10.2	7	8.9	8.31	–
Manganese, µg/L		16	3	6.533	18	6.7
Mercury, µg/L	≤0.012	0.5	<0.200	0.25	<0.200	<0.2
Nickel, µg/L	111.5[c]	<17	<12	14.83	<30	<30
Potassium, mg/L		0.9	<0.5	0.7	<0.500	<0.5
Selenium, mg/L	≤0.005	<5	<5	<5	<5	<5
Silver, µg/L	≤0.07	<0.08	<0.08	0.08	<0.070	<0.07
Sodium, mg/L		9.8	6.3	7.783	10.3	13.2
Thallium, µg/L	≤48	–	–	–	<5	<5
Zinc, µg/L	74.9[c] (≤1,000)	7.0	<5	5.333	<10	10

Table 2.3.4-8. Summary of Water Quality Conditions in Payne Creek--PC-1, 1988 - 1989 and 1993 (Page 2 of 5)

Parameter	Class III Standard	1988-1989 Data Max	Min	Mean	1993 Data September	December
Water Quality Data (Continued)						
Total Coliforms, colonies/100 mL	≤1,000[d], ≤2,400 max	364	46	153.2	400	1,000
Fecal Coliforms, colonies/100 mL	200[d], 800 max	73	<1	28.83	<1	180
Radiation Data						
Alpha, Gross (pCi/L) gross alpha + Radium 226	≤15	3.6	0.5	1.967	0.8	<0.6
Beta, Gross (pCi/L)		2.3	0	0.917	0.8	<1.4
Radium 226 (pCi/L) Radium 226 + Radium 228	≤5	0.8	0.3	0.667	0.4	0.4
Radium 228 (pCi/L) Radium 226 + Radium 228	≤5	1.3	0	0.433	<1.000	<1.000
Strontium-90 (pCi/L)		<0.500	<0.500	0.5	<1.000	<1.2
Chlorophyll-a, mg/m^3		<1	<1	<1	3.2	<1.0
Chloride, mg/L		12.6	12.6	12.6	--	--
Total Dissolved Solids, mg/L		126	126	126	--	--
Silica, dissolved reactive, mg/L		3.1	3.1	3.1	6.44	6.14
Volatile Organics (all units μg/L, all compound were analyzed for, but none detected at the specified value)						
Chloromethane	≤470.8[b]	--	--	--	<1	NA
Bromomethane		--	--	--	<1	NA
Dichlorodifluoromethane		--	--	--	<1	NA
Vinyl Chloride		--	--	--	<1	NA
Chloroethane		--	--	--	<1	NA
Methylene Chloride	≤1,580[b]	--	--	--	<1	NA
Trichlorofluoromethane		--	--	--	<1	NA
1,1-Dichloroethene	≤3.2[b]	--	--	--	<1	NA
1,1-Dichloroethane		--	--	--	<1	NA
trans-1,2-Dichloroethene		--	--	--	<1	NA
Chloroform	≤470.8[b]	--	--	--	<1	NA
1,2-Dichloroethane		--	--	--	<1	NA
1,1,1-Trichloroethane	≤173,000	--	--	--	<1	NA
Carbon Tetrachloride	≤4.42[b]	--	--	--	<1	NA
Bromodichloromethane		--	--	--	<1	NA
1,2-Dichloropropane		--	--	--	<1	NA
Benzene	≤71.28[b]	--	--	--	<1	NA
Trichloroethene	≤80.7[b]	--	--	--	<1	NA
Dibromochloromethane	≤22[b]	--	--	--	<1	NA
1,1,2-Trichloroethane		--	--	--	<1	NA
cis-1,3-Dichloropropene		--	--	--	<1	NA
2-Chloroethylvinyl ether		--	--	--	<1	NA
Bromoform	≤360[b]	--	--	--	<1	NA
1,1,2,2-Tetrachloroethane	≤10.8[b]	--	--	--	<1	NA
Tetrachloroethene		--	--	--	<1	NA
Toluene		--	--	--	<1	NA

Table 2.3.4-8. Summary of Water Quality Conditions in Payne Creek–PC-1, 1988 - 1989 and 1993 (Page 3 of 5)

Parameter	Class III Standard	1988-1989 Data Max	1988-1989 Data Min	1988-1989 Data Mean	1993 Data September	1993 Data December
Volatile Organics (Continued)						
Chlorobenzene		–	–	–	<1	NA
Ethylbenzene		–	–	–	<1	NA
1,3-Dichlorbenzene		–	–	–	<1	NA
1,2-Dichlorbenzene		–	–	–	<1	NA
1,4-Dichlorbenzene		–	–	–	<1	NA
para and meta Xylenes		–	–	–	<1	NA
ortho Xylene		–	–	–	<1	NA
Styrene		–	–	–	<1	NA
NTBE		–	–	–	<5	NA
Semivolatile Organics (all units μg/L, all 1993 compounds were analyzed for, but none were detected at the specified value)						
phenol	≤4,600,000	<5	<5	<5	<5	NA
2-chlorophenol	≤400	–	–	–	<5	NA
1,3-dichlorobenzene		<10	<10	<10	<5	NA
1,4-dichlorobenzene		<10	<10	<10	<5	NA
1,2-dichlorobenzene		<10	<10	<10	<5	NA
2-methylphenol		–	–	–	<5	NA
4-methylphenol		–	–	–	<5	NA
hexachloroethane		<10	<10	<10	<5	NA
2-nitrophenol		–	–	–	<5	NA
2,4-dimethylphenol		–	–	–	<5	NA
2,4-dichlorophenol	≤790	–	–	–	<5	NA
1,2,4-trichlorobenzene		<10	<10	<10	<5	NA
naphthalene		–	–	–	<5	NA
hexachlorobutadiene	≤49.7[b]	<10	<10	<10	<5	NA
4-chloro-3-methyphenol		–	–	–	<5	NA
2-methylnaphthalene		–	–	–	<5	NA
hexachlorocyclopentadiene		<10	<10	<10	<5	NA
2,4,6-trichlorophenol	≤6.5[b]	–	–	–	<5	NA
2,4,5-trichlorophenol		–	–	–	<2.5	NA
2-chloronaphthalene		<10	<10	<10	<5	NA
Diethyl Phthalate		–	–	–	<5	NA
Acenaphthene	≤2,700	–	–	–	<5	NA
Acenaphtylene		–	–	–	<5	NA
2,4-Dinitrophenol	≤14.26	–	–	–	<2.5	NA
dimethyl phthalate		–	–	–	<5	NA
fluorene	≤14,000	–	–	–	<5	NA
4,6-dinitro-2-methylphenol		–	–	–	<5	NA
hexachlorobenzene		–	–	–	<5	NA
pentachlorophenol	≤8.2[b], ≤30 max	–	–	–	<5	NA
phenanthrene	≤0.031	–	–	–	<5	NA
anthracene	≤110,000	–	–	–	<5	NA

Table 2.3.4-8. Summary of Water Quality Conditions in Payne Creek--PC-1, 1988 - 1989 and 1993 (Page 4 of 5)

Parameter	Class III Standard	1988-1989 Data Max	Min	Mean	1993 Data September	December
Semivolatile Organics (Continued)						
di-n-butyl phthalate		--	--	--	<5	NA
fluoranthene	≤370	--	--	--	<5	NA
pyrene	≤11,000	--	--	--	<5	NA
butyl benzyl phthalate		--	--	--	<5	NA
benzo(a)anthracene	≤0.031[b]	--	--	--	<5	NA
bis(2-ethylhexyl)phthalate		--	--	--	<5	NA
chrysene	≤0.031[b]	--	--	--	<5	NA
di-n-octyl phthalate		--	--	--	<5	NA
benzo(b)fluoranthene	≤0.031[b]	--	--	--	<5	NA
benzo(k)fluoranthene	≤0.031[b]	--	--	--	<5	NA
benzo(a)pyrene	≤0.031[b]	--	--	--	<5	NA
Indeno(1,2,3-cd)pyrene	≤0.031[b]	--	--	--	<5	NA
dibenzo(a,h)anthracene	≤0.031[b]	--	--	--	<5	NA
benzo(g,h,i)perylene	≤0.031[b]	--	--	--	<5	NA
Pesticides/PCBs & Herbicides (all units µg/L, all 1993 compounds were analyzed for, but none were detected at the specified value)						
alpha-BHC		--	--	--	<0.05	NA
beta-BHC	≤0.046[b]	--	--	--	<0.05	NA
delta-BHC		--	--	--	<0.05	NA
Lindane	≤0.063[b], <0.08 max	<0.010	<0.010	<0.010	<0.05	NA
Heptachlor	≤0.00021[b], <0.0038 max	<0.001	<0.001	<0.001	<0.05	NA
Aldrin	<0.00014[b], <3 max	<0.003	<0.003	<0.003	<0.05	NA
Heptachlor epoxide		--	--	--	<0.05	NA
Endosulfan I		--	--	--	<0.05	NA
Dieldrin	≤0.00014[b], <0.0019 max	<0.003	<0.003	<0.003	<0.1	NA
4,4'-DDE		--	--	--	<0.1	NA
Endrin	0.0023	0.004	0.004	0.004	<0.1	NA
Endosulfan II		--	--	--	<0.1	NA
4,4'-DDD		--	--	--	<0.1	NA
Endosulfan sulfate		--	--	--	<0.1	NA
4,4'DDT	0.00059[b], <0.001 max	<0.001	<0.001	<0.001	<0.1	NA
Methoxychlor		<0.030	<0.030	<0.030	<0.5	NA
Endrin ketone		--	--	--	<0.1	NA
alpha-chlordane		--	--	--	<0.5	NA
gamma-chlordane		--	--	--	<0.5	NA
Toxaphene	≤0.0002	<0.005	<0.005	<0.005	<1	NA
PCB-1016		<0.001	<0.001	<0.001	<0.5	NA
PCB-1221		<0.001	<0.001	<0.001	<0.5	NA
PCB-1232		<0.001	<0.001	<0.001	<0.5	NA
PCB-1242		<0.001	<0.001	<0.001	<0.5	NA
PCB-1248		<0.001	<0.001	<0.001	<0.5	NA
PCB-1254		<0.001	<0.001	<0.001	<0.5	NA

Table 2.3.4-8. Summary of Water Quality Conditions in Payne Creek–PC-1, 1988 - 1989 and 1993 (Page 5 of 5)

Parameter	Class III Standard	1988-1989 Data Max	1988-1989 Data Min	1988-1989 Data Mean	1993 Data September	1993 Data December
Pesticides/PCBs and Herbicides (Continued)						
PCB-1260		<0.001	<0.001	<0.001	<1	NA
Mirex	≤0.001	<0.001	<0.001	<0.001	<0.5	NA
Chlordane	≤0.00059[b], <0.0043 max	<0.010	<0.010	<0.010	–	NA
Demeton	≤0.1	<0.100	<0.100	<0.100	–	NA
Endosulfan	≤0.056	<0.003	<0.003	<0.003	–	NA
Guthion	≤0.01	<0.010	<0.010	<0.010	–	NA
Malathion	≤0.1	<0.100	<0.100	<0.100	–	NA
Parathion	≤0.04	<0.040	<0.040	<0.040	–	NA
Silvex		<20	<20	<20	–	NA
2,4-D		<10	<10	<10	<1	NA
2,4,5-TP		–	–	–	<1	NA
Organophosphate Pesticides (all units µg/L, all 1993 compounds were analyzed for, but none were detected at the specified value)						
Azinphos methyl		–	–	–	<5	NA
Bolstar		–	–	–	<1	NA
Chloropyriphos		–	–	–	<0.5	NA
Chloropyriphos methyl		–	–	–	<1	NA
Diazinon		–	–	–	<1	NA
Dichlorvos		–	–	–	<1	NA
Disulfoton		–	–	–	<1	NA
Ethoprop		–	–	–	<0.5	NA
Fensulfothion		–	–	–	<5	NA
Fenthion		–	–	–	<1	NA
Merphos		–	–	–	<1	NA
Mevinphos		–	–	–	<5	NA
Perathion methyl		–	–	–	<1	NA
Phorate		–	–	–	<1	NA
Ronnel		–	–	–	<1	NA
Stirofos		–	–	–	<1	NA
Tokuthion		–	–	–	<0.5	NA
Demeton	≤0.1	–	–	–	<1	NA
Coumaphos		–	–	–	<2	NA
Naled		–	–	–	<1	NA
Trichlronate		–	–	–	<1	NA

Note: NA = not applicable.

[a] Above natural background conditions.
[b] Annual average.
[c] Standard calculated according to equation in DEP 17-302.530 and using overall minimum hardness of 66.4 mg/L as $CaCO_3$.
[d] Monthly average.

Sources: TPS/SECI, 1989.
KBN, 1994.

Table 2.3.4-9. Summary of Water Quality Conditions in Payne Creek--PC-2, 1988 - 1989 and 1993 (Page 1 of 5)

Parameter	Class III Standard	1988-1989 Data			1993 Data	
		Max	Min	Mean	September	December
Water Quality Data						
Alkalinity (Bicarbonate), mg $CaCO_3$/L	>20	68	44	54.67	77	83
Alkalinity (Carbonate), mg $CaCO_3$/L		<0.5	<0.5	<0.5	--	<1
Cyanide, mg/L	≤0.0052	<0.004	<0.004	0.004	<0.005	<0.005
Fluoride, mg/L	≤10	0.9	0.6	0.75	0.772	0.738
Hardness, mg/L as $CaCO_3$		84.7	68.5	77.32	67.9	80.6
Methylene Blue Active Substances, mg/L		0.054	<0.025	0.03	--	--
Total Kjeldahl Nitrogen, mg/L		0.883	0.245	0.645	0.53	0.42
Ammonia Nitrogen, mg/L		0.325	<0.005	0.066	0.015	<0.005
Organic Nitrogen, mg/L		0.747	0.239	0.579	--	0.42
Unionized Ammonia, mg/L	≤0.02	--	--	--	<0.005	<0.005
Nitrate+Nitrite-Nitrogen, mg/L		0.845	0.209	0.456	0.125	0.131
Total Nitrogen, mg/L		1.73	0.631	1.099	0.66	0.55
Oil and Grease, mg/L	<5	<5	<5	<5	<5	<5
Carbonaceous Biochemical Oxygen Demand, 5-day, mg/L		1.7	<1	1.117	1.13	<1.0
Chemical Oxygen Demand, mg/L		75	<10	31.67	50	44
Orthophosphorus, mg/L		0.509	0.243	0.368	0.53	0.312
Total Phosphorus, mg/L		0.624	0.332	0.399	0.634	0.354
Sulfate, mg/L		25.3	17.4	22.25	18.6	30.5
Turbidity, NTU	<29[a]	2.3	0.8	1.533	2.1	1.1
Aluminum, µg/L		220	32	111.7	108	36
Antimony, µg/L	≤4,300	<10	<10	10	<5	--
Arsenic, µg/L	≤50	<5	<5	<5	<5	<5
Beryllium, µg/L	≤0.13[b]	<3	<3	<3	<0.1	<0.1
Cadmium, µg/L	0.82[c]	0.5	<0.4	0.417	<5	<5
Calcium, mg/L		17.1	13.6	15.97	13.6	16.6
Chromium, µg/L	148[c]	<10	<10	10	<5	5.3
Chromium +6, µg/L	≤11	--	--	--	<10	<10
Copper, µg/L	8.3[c]	12	<6	7.667	<10	<10
Iron, µg/L	≤1,000	542	210	279.3	452	172
Lead, µg/L	1.9[c]	9.8	<5	7.1	<5	9.1
Magnesium, mg/L		10.2	7.6	9.05	8.24	--
Manganese, µg/L		16	3.2	7.133	10	7.2
Mercury, µg/L	≤0.012	0.5	<0.200	0.25	<0.200	<0.2
Nickel, µg/L	111.5[c]	35	<12	17.83	<30	<30
Potassium, mg/L		0.9	<0.5	0.78	<0.500	<0.5
Selenium, mg/L	≤0.005	<5	<5	<5	<5	<5
Silver, µg/L	≤0.07	<0.08	<0.08	0.08	<0.070	<0.07
Sodium, mg/L		8.8	6.8	7.933	19.5	22.2
Thallium, µg/L	≤48	--	--	--	<5	<5
Zinc, µg/L	74.9[c] (≤1,000)	36	<5	11	50	22
Total Coliforms, colonies/100 mL	≤1,000[d], ≤2,400 max	600	<1	236.7	1200	2,600

Table 2.3.4-9. Summary of Water Quality Conditions in Payne Creek--PC-2, 1988 - 1989 and 1993 (Page 2 of 5)

Parameter	Class III Standard	1988-1989 Data			1993 Data	
		Max	Min	Mean	September	December
Water Quality Data (Continued)						
Fecal Coliforms, colonies/100 mL	200[d], 800 max	64	9	53	<1	20
Radiation Data						
Alpha, Gross (pCi/L) gross alpha + Radium 226	≤15	3	0.2	1.683	1.4	1.4
Beta, Gross (pCi/L)		5.5	1	2.4	1.1	<1.5
Radium 226 (pCi/L) Radium 226+Radium 228	≤5	0.6	0.1	0.517	0.2	0.3
Radium 228 (pCi/L) Radium 226+Radium 228	≤5	0.1	0	0.017	<1	<1.0
Strontium-90 (pCi/L)		<0.500	<0.500	0.5	<1.000	<1.2
Chlorophyll-a, mg/m^3		<1	<1	<1	2.7	<1.0
Chloride, mg/L		11.6	11.6	11.6	--	--
Total Dissolved Solids, mg/L		125	125	125	--	--
Silica, dissolved reactive, mg/L		2.8	2.8	2.8	6	4.81
Volatile Organics (all units μg/L, all compound were analyzed for, but none detected at the specified value)						
Chloromethane	≤470.8[b]	--	--	--	<1	NA
Bromomethane		--	--	--	<1	NA
Dichlorodifluoromethane		--	--	--	<1	NA
Vinyl Chloride		--	--	--	<1	NA
Chloroethane		--	--	--	<1	NA
Methylene Chloride	≤1,580[b]	--	--	--	<1	NA
Trichlorofluoromethane		--	--	--	<1	NA
1,1-Dichloroethene	≤3.2[b]	--	--	--	<1	NA
1,1-Dichloroethane		--	--	--	<1	NA
trans-1,2-Dichloroethene		--	--	--	<1	NA
Chloroform	≤470.8[b]	--	--	--	<1	NA
1,2-Dichloroethane		--	--	--	<1	NA
1,1,1-Trichloroethane	≤173,000	--	--	--	<1	NA
Carbon Tetrachloride	≤4.42[b]	--	--	--	<1	NA
Bromodichloromethane		--	--	--	<1	NA
1,2-Dichloropropane		--	--	--	<1	NA
Benzene	≤71.28[b]	--	--	--	<1	NA
Trichloroethene	≤80.71[b]	--	--	--	<1	NA
Dibromochloromethane	≤22[b]	--	--	--	<1	NA
1,1,2-Trichloroethane		--	--	--	<1	NA
cis-1,3-Dichloropropene		--	--	--	<1	NA
2-Chloroethylvinyl ether		--	--	--	<1	NA
Bromoform	≤360[b]	--	--	--	<1	NA
1,1,2,2-Tetrachloroethane	≤10.8[b]	--	--	--	<1	NA
Tetrachloroethene		--	--	--	<1	NA
Toluene		--	--	--	<1	NA
Chlorobenzene		--	--	--	<1	NA
Ethylbenzene		--	--	--	<1	NA

Table 2.3.4-9. Summary of Water Quality Conditions in Payne Creek–PC-2, 1988 - 1989 and 1993 (Page 3 of 5)

Parameter	Class III Standard	1988-1989 Data			1993 Data	
		Max	Min	Mean	September	December
Volatile Organics (Continued)						
1,3-Dichlorbenzene		–	–	–	<1	NA
1,2-Dichlorbenzene		–	–	–	<1	NA
1,4-Dichlorbenzene		–	–	–	<1	NA
para and meta Xylenes		–	–	–	<1	NA
ortho Xylene		–	–	–	<1	NA
Styrene		–	–	–	<1	NA
NTBE		–	–	–	<5	NA
Semivolatile Organics (all units µg/L, all 1993 compounds were analyzed for, but none were detected at the specified value)						
phenol	≤4,600,000	<5	<5	<5	<5	NA
2-chlorophenol	≤400	–	–	–	<5	NA
1,3-dichlorobenzene		<10	<10	<10	<5	NA
1,4-dichlorobenzene		<10	<10	<10	<5	NA
1,2-dichlorobenzene		<10	<10	<10	<5	NA
2-methylphenol		–	–	–	<5	NA
4-methylphenol		–	–	–	<5	NA
hexachloroethane		<10	<10	<10	<5	NA
2-nitrophenol		–	–	–	<5	NA
2,4-dimethylphenol		–	–	–	<5	NA
2,4-dichlorophenol	≤790	–	–	–	<5	NA
1,2,4-trichlorobenzene		<10	<10	<10	<5	NA
naphthalene		–	–	–	<5	NA
hexachlorobutadiene	≤49.7[b]	<10	<10	<10	<5	NA
4-chloro-3-methyphenol		–	–	–	<5	NA
2-methylnaphthalene		–	–	–	<5	NA
hexachlorocyclopentadiene		<10	<10	<10	<5	NA
2,4,6-trichlorophenol	≤6.5[b]	–	–	–	<5	NA
2,4,5-trichlorophenol		–	–	–	<2.5	NA
2-chloronaphthalene		<10	<10	<10	<5	NA
Diethyl Phthalate		–	–	–	<5	NA
Acenaphthene	≤2,700	–	–	–	<5	NA
Acenaphtylene		–	–	–	<5	NA
2,4-Dinitrophenol	≤14.26	–	–	–	<2.5	NA
dimethyl phthalate		–	–	–	<5	NA
fluorene	≤14,000	–	–	–	<5	NA
4,6-dinitro-2-methylphenol		–	–	–	<5	NA
hexachlorobenzene		–	–	–	<5	NA
pentachlorophenol	≤8.2[b], ≤30 max	–	–	–	<5	NA
phenanthrene	≤0.031	–	–	–	<5	NA
anthracene	≤110,000	–	–	–	<5	NA
di-n-butyl phthalate		–	–	–	<5	NA
fluoranthene	≤370	–	–	–	<5	NA
pyrene	≤11,000	–	–	–	<5	NA

Table 2.3.4-9. Summary of Water Quality Conditions in Payne Creek--PC-2, 1988 - 1989 and 1993 (Page 4 of 5)

Parameter	Class III Standard	1988-1989 Data Max	1988-1989 Data Min	1988-1989 Data Mean	1993 Data September	1993 Data December
Semivolatile Organics (Continued)						
butyl benzyl phthalate		--	--	--	<5	NA
benzo(a)anthracene	≤0.031[b]	--	--	--	<5	NA
bis(2-ethylhexyl)phthalate		--	--	--	<5	NA
chrysene	≤0.031[b]	--	--	--	<5	NA
di-n-octyl phthalate		--	--	--	<5	NA
benzo(b)fluoranthene	≤0.031[b]	--	--	--	<5	NA
benzo(k)fluoranthene	≤0.031[b]	--	--	--	<5	NA
benzo(a)pyrene	≤0.031[b]	--	--	--	<5	NA
Indeno(1,2,3-cd)pyrene	≤0.031[b]	--	--	--	<5	NA
dibenzo(a,h)anthracene	≤0.031[b]	--	--	--	<5	NA
benzo(g,h,i)perylene	≤0.031[b]	--	--	--	<5	NA
Pesticides/PCBs & Herbicides (all units µg/L, all 1993 compounds were analyzed for, but none were detected at the specified value)						
alpha-BHC		--	--	--	<0.05	NA
beta-BHC	≤0.046[b]	--	--	--	<0.05	NA
delta-BHC		--	--	--	<0.05	NA
Lindane	≤0.063[b], <0.08 max	<0.010	<0.010	<0.010	<0.05	NA
Heptachlor	≤0.00021[b], <0.0038 max	<0.001	<0.001	<0.001	<0.05	NA
Aldrin	≤0.00014[b], <3 max	<0.003	<0.003	<0.003	<0.05	NA
Heptachlor epoxide		--	--	--	<0.05	NA
Endosulfan I		--	--	--	<0.05	NA
Dieldrin	≤0.00014[b], <0.0019 max	<0.003	<0.003	<0.003	<0.1	NA
4,4'-DDE		--	--	--	<0.1	NA
Endrin	0.0023	0.004	0.004	0.004	<0.1	NA
Endosulfan II		--	--	--	<0.1	NA
4,4'-DDD		--	--	--	<0.1	NA
Endosulfan sulfate		--	--	--	<0.1	NA
4,4'DDT	0.00059[b], <0.001 max	<0.001	<0.001	<0.001	<0.1	NA
Methoxychlor		<0.030	<0.030	<0.030	<0.5	NA
Endrin ketone		--	--	--	<0.1	NA
alpha-chlordane		--	--	--	<0.5	NA
gamma-chlordane		--	--	--	<0.5	NA
Toxaphene	≤0.0002	<0.005	<0.005	<0.005	<1	NA
PCB-1016		<0.001	<0.001	<0.001	<0.5	NA
PCB-1221		<0.001	<0.001	<0.001	<0.5	NA
PCB-1232		<0.001	<0.001	<0.001	<0.5	NA
PCB-1242		<0.001	<0.001	<0.001	<0.5	NA
PCB-1248		<0.001	<0.001	<0.001	<0.5	NA
PCB-1254		<0.001	<0.001	<0.001	<0.5	NA
PCB-1260		<0.001	<0.001	<0.001	<1	NA
Mirex	≤0.001	<0.001	<0.001	<0.001	<0.5	NA
Chlordane	≤0.00059[b], <0.0043 max	<0.010	<0.010	<0.010	--	NA
Demeton	≤0.1	<0.100	<0.100	<0.100	--	NA

Table 2.3.4-9. Summary of Water Quality Conditions in Payne Creek—PC-2, 1988 - 1989 and 1993 (Page 5 of 5)

Parameter	Class III Standard	1988-1989 Data			1993 Data	
		Max	Min	Mean	September	December
Pesticides/PCBs and Herbicides (Continued)						
Endosulfan	≤0.056	<0.003	<0.003	<0.003	–	NA
Guthion	≤0.01	<0.010	<0.010	<0.010	–	NA
Malathion	≤0.1	<0.100	<0.100	<0.100	–	NA
Parathion	≤0.04	<0.040	<0.040	<0.040	–	NA
Silvex		<20	<20	<20	–	NA
2,4-D		<10	<10	<10	<1	NA
2,4,5-TP		–	–	–	<1	NA
Organophosphate Pesticides (all units µg/L, all 1993 compounds were analyzed for, but none were detected at the specified value)						
Azinphos methyl		–	–	–	<5	NA
Bolstar		–	–	–	<1	NA
Chloropyriphos		–	–	–	<0.5	NA
Chloropyriphos methyl		–	–	–	<1	NA
Diazinon		–	–	–	<1	NA
Dichlorvos		–	–	–	<1	NA
Disulfoton		–	–	–	<1	NA
Ethoprop		–	–	–	<0.5	NA
Fensulfothion		–	–	–	<5	NA
Fenthion		–	–	–	<1	NA
Merphos		–	–	–	<1	NA
Mevinphos		–	–	–	<5	NA
Perathion methyl		–	–	–	<1	NA
Phorate		–	–	–	<1	NA
Ronnel		–	–	–	<1	NA
Stirofos		–	–	–	<1	NA
Tokuthion		–	–	–	<0.5	NA
Demeton	≤0.1	–	–	–	<1	NA
Coumaphos		–	–	–	<2	NA
Naled		–	–	–	<1	NA
Trichlronate		–	–	–	<1	NA

Note: NA = not applicable.

[a] Above natural background conditions.
[b] Annual average.
[c] Standard calculated according to equation in DEP 17-302.530 and using overall minimum hardness of 66.4 mg/L as $CaCO_3$.
[d] Monthly average.

Sources: TPS/SECI, 1989.
KBN, 1994.

Table 2.3.4-10. Summary of Water Quality Conditions in Payne Creek--PC-3, 1988 - 1989 and 1993 (Page 1 of 5)

Parameter	Class III Standard	1988-1989 Data			1993 Data	
		Max	Min	Mean	September	December
Water Quality Data						
Alkalinity (Bicarbonate), mg $CaCO_3$/L	>20	60	36	53	73	78
Alkalinity (Carbonate), mg $CaCO_3$/L		<0.5	<0.5	<0.5	--	<1
Cyanide, mg/L	≤0.0052	<0.004	<0.004	0.004	<0.005	<0.005
Fluoride, mg/L	≤10	1.3	0.5	0.867	1.04	0.707
Hardness, mg/L as $CaCO_3$		112	71.9	86.63	77	82.5
Methylene Blue Active Substances, mg/L		0.033	<0.025	0.026	--	--
Total Kjeldahl Nitrogen, mg/L		1.53	0.566	0.87	0.93	0.52
Ammonia Nitrogen, mg/L		0.486	<0.005	0.106	0.03	0.020
Organic Nitrogen, mg/L		1.53	0.542	0.766	--	0.5
Unionized Ammonia, mg/L	≤0.02				<0.005	<0.005
Nitrate+Nitrite-Nitrogen, mg/L		0.951	0.4	0.619	0.335	0.488
Total Nitrogen, mg/L		2.17	1.06	1.49	1.26	1.01
Oil and Grease, mg/L	<5	<5	<5	<5	<5.0	<5.0
Carbonaceous Biochemical Oxygen Demand, 5-day, mg/L		2.4	<1	1.3	2.4	<1.0
Chemical Oxygen Demand, mg/L		78	<10	40.33	61	55
Orthophosphorus, mg/L		0.572	0.378	0.482	0.739	0.457
Total Phosphorus, mg/L		0.703	0.444	0.529	0.946	0.511
Sulfate, mg/L		49.7	16.9	30.08	25.4	29.6
Turbidity, NTU	<29[a]	6.1	1	2.567	2.7	1.8
Aluminum, µg/L		169	74	117.7	576	216
Antimony, µg/L	≤4,300	<10	<10	10	<5	--
Arsenic, µg/L	≤50	<5	<5	<5	<5	<5
Beryllium, µg/L	≤0.13[b]	<3	<3	<3	<0.1	<0.1
Cadmium, µg/L	0.82[c]	<0.4	<0.4	0.4	<5	<5
Calcium, mg/L		24.9	15.7	18.65	17	17.4
Chromium, µg/L	148[c]	<10	<10	10	5.1	6.8
Chromium +6, µg/L	≤11	--	--	--	<10	<10
Copper, µg/L	8.3[c]	<7	<6	6.333	<10	<10
Iron, µg/L	≤1,000	440	215	261.5	617	745
Lead, µg/L	1.9[c]	9.6	<5	5.967	<5	6.3
Magnesium, mg/L		12	7.7	9.717	8.39	--
Manganese, µg/L		15	7	9.95	12	21
Mercury, µg/L	≤0.012	0.4	<0.200	0.233	<0.200	<0.2
Nickel, µg/L	111.5[c]	<17	<12	14.83	<30	<30
Potassium, mg/L		2.6	1.7	2.2	1.3	1.5
Selenium, mg/L	≤0.005	<5	<5	<5	<5	<5
Silver, µg/L	≤0.07	<0.08	<0.08	0.08	0.21	0.21
Sodium, mg/L		11	7.5	9.15	20.7	20.7
Thallium, µg/L	≤48	--	--	--	<5	<5
Zinc, µg/L	74.9[c] (≤1,000)	8.8	<5	5.983	18	26
Total Coliforms, colonies/100 mL	≤1,000[d], ≤2,400 max	2,000	45	698.5	8,400	1,600

Table 2.3.4-10. Summary of Water Quality Conditions in Payne Creek--PC-3, 1988 - 1989 and 1993 (Page 2 of 5)

Parameter	Class III Standard	1988-1989 Data			1993 Data	
		Max	Min	Mean	September	December
Water Quality Data (Continued)						
Fecal Coliforms, colonies/100 mL	200[d], 800 max	327	36	169.5	60	200
Radiation Data						
Alpha, Gross (pCi/L) (gross alpha + Radium 226)	≤15	3.5	0	1.583	3.5	1.8
Beta, Gross (pCi/L)		6.1	1.8	3.517	2.9	3.0
Radium 226 (pCi/L) (Radium 226+Radium 228)	≤5	1.1	0	0.7	0.4	0.5
Radium 228 (pCi/L) (Radium 226+Radium 228)	≤5	1.7	0	0.75	<1	<1.0
Strontium-90 (pCi/L)		<0.500	<0.500	0.5	<1	<1.2
Chlorophyll-a, mg/m³		<1	<1	6.78	8.5	1.9
Chloride, mg/L		15.2	15.2	15.2	--	--
Total Dissolved Solids, mg/L		149	149	149	--	--
Silica, dissolved reactive, mg/L		4.8	4.8	4.8	5.9	5.98
Volatile Organics (all units µg/L, all compound were analyzed for, but none detected at the specified value)						
Chloromethane	≤470.8[b]	--	--	--	<1	NA
Bromomethane		--	--	--	<1	NA
Dichlorodifluoromethane		--	--	--	<1	NA
Vinyl Chloride		--	--	--	<1	NA
Chloroethane		--	--	--	<1	NA
Methylene Chloride	≤1,580[b]	--	--	--	<1	NA
Trichlorofluoromethane		--	--	--	<1	NA
1,1-Dichloroethene	≤3.2[b]	--	--	--	<1	NA
1,1-Dichloroethane		--	--	--	<1	NA
trans-1,2-Dichloroethene		--	--	--	<1	NA
Chloroform	≤470.8[b]	--	--	--	<1	NA
1,2-Dichloroethane		--	--	--	<1	NA
1,1,1-Trichloroethane	≤173,000	--	--	--	<1	NA
Carbon Tetrachloride	≤4.42[b]	--	--	--	<1	NA
Bromodichloromethane		--	--	--	<1	NA
1,2-Dichloropropane		--	--	--	<1	NA
Benzene	≤71.28[b]	--	--	--	<1	NA
Trichloroethene	≤80.7[b]	--	--	--	<1	NA
Dibromochloromethane	≤22[b]	--	--	--	<1	NA
1,1,2-Trichloroethane		--	--	--	<1	NA
cis-1,3-Dichloropropene		--	--	--	<1	NA
2-Chloroethylvinyl ether		--	--	--	<1	NA
Bromoform	≤360[b]	--	--	--	<1	NA
1,1,2,2-Tetrachloroethane	≤10.8[b]	--	--	--	<1	NA
Tetrachloroethene		--	--	--	<1	NA
Toluene		--	--	--	<1	NA
Chlorobenzene		--	--	--	<1	NA
Ethylbenzene		--	--	--	<1	NA

Table 2.3.4-10. Summary of Water Quality Conditions in Payne Creek--PC-3, 1988 - 1989 and 1993 (Page 3 of 5)

Parameter	Class III Standard	1988-1989 Data			1993 Data	
		Max	Min	Mean	September	December
Volatile Organics (Continued)						
1,3-Dichlorbenzene		--	--	--	<1	NA
1,2-Dichlorbenzene		--	--	--	<1	NA
1,4-Dichlorbenzene		--	--	--	<1	NA
para and meta Xylenes		--	--	--	<1	NA
ortho Xylene		--	--	--	<1	NA
Styrene		--	--	--	<1	NA
NTBE		--	--	--	<5	NA
Semivolatile Organics (all units µg/L, all 1993 compounds were analyzed for, but none were detected at the specified value)						
phenol	≤4,600,000	<5	<5	<5	<5	NA
2-chlorophenol	≤400	--	--	--	<5	NA
1,3-dichlorobenzene		<10	<10	<10	<5	NA
1,4-dichlorobenzene		<10	<10	<10	<5	NA
1,2-dichlorobenzene		<10	<10	<10	<5	NA
2-methylphenol		--	--	--	<5	NA
4-methylphenol		--	--	--	<5	NA
hexachloroethane		<10	<10	<10	<5	NA
2-nitrophenol		--	--	--	<5	NA
2,4-dimethylphenol		--	--	--	<5	NA
2,4-dichlorophenol	≤790	--	--	--	<5	NA
1,2,4-trichlorobenzene		<10	<10	<10	<5	NA
naphthalene		--	--	--	<5	NA
hexachlorobutadiene	≤49.7[b]	<10	<10	<10	<5	NA
4-chloro-3-methyphenol		--	--	--	<5	NA
2-methylnaphthalene		--	--	--	<5	NA
hexachlorocyclopentadiene		<10	<10	<10	<5	NA
2,4,6-trichlorophenol	≤6.5[b]	--	--	--	<5	NA
2,4,5-trichlorophenol		--	--	--	<2.5	NA
2-chloronaphthalene		<10	<10	<10	<5	NA
Diethyl Phthalate		--	--	--	<5	NA
Acenaphthene	≤2,700	--	--	--	<5	NA
Acenaphtylene		--	--	--	<5	NA
2,4-Dinitrophenol	≤14.26	--	--	--	<2.5	NA
dimethyl phthalate		--	--	--	<5	NA
fluorene	≤14,000	--	--	--	<5	NA
4,6-dinitro-2-methylphenol		--	--	--	<5	NA
hexachlorobenzene		--	--	--	<5	NA
pentachlorophenol	≤8.2[b], ≤30 max	--	--	--	<5	NA
phenanthrene	≤0.031	--	--	--	<5	NA
anthracene	≤110,000	--	--	--	<5	NA
di-n-butyl phthalate		--	--	--	<5	NA
fluoranthene	≤370	--	--	--	<5	NA
pyrene	≤11,000	--	--	--	<5	NA

Table 2.3.4-10. Summary of Water Quality Conditions in Payne Creek--PC-3, 1988 - 1989 and 1993 (Page 4 of 5)

Parameter	Class III Standard	1988-1989 Data			1993 Data	
		Max	Min	Mean	September	December
Semivolatile Organics (Continued)						
butyl benzyl phthalate		--	--	--	<5	NA
benzo(a)anthracene	≤0.031[b]	--	--	--	<5	NA
bis(2-ethylhexyl)phthalate		--	--	--	<5	NA
chrysene	≤0.031[b]	--	--	--	<5	NA
di-n-octyl phthalate		--	--	--	<5	NA
benzo(b)fluoranthene	≤0.031[b]	--	--	--	<5	NA
benzo(k)fluoranthene	≤0.031[b]	--	--	--	<5	NA
benzo(a)pyrene	≤0.031[b]	--	--	--	<5	NA
Indeno(1,2,3-cd)pyrene	≤0.031[b]	--	--	--	<5	NA
dibenzo(a,h)anthracene	≤0.031[b]	--	--	--	<5	NA
benzo(g,h,i)perylene	≤0.031[b]	--	--	--	<5	NA
Pesticides/PCBs & Herbicides (all units µg/L, all 1993 compounds were analyzed for, but none were detected at the specified value)						
alpha-BHC		--	--	--	<0.05	NA
beta-BHC	≤0.046[b]	--	--	--	<0.05	NA
delta-BHC		--	--	--	<0.05	NA
Lindane	≤0.063[b], <0.08 max	<0.010	<0.010	<0.010	<0.05	NA
Heptachlor	≤0.00021[b], <0.0038 max	<0.001	<0.001	<0.001	<0.05	NA
Aldrin	≤0.00014[b], <3 max	<0.003	<0.003	<0.003	<0.05	NA
Heptachlor epoxide		--	--	--	<0.05	NA
Endosulfan I		--	--	--	<0.05	NA
Dieldrin	≤0.00014[b], <0.0019 max	<0.003	<0.003	<0.003	<0.1	NA
4,4'-DDE		--	--	--	<0.1	NA
Endrin	0.0023	0.004	0.004	0.004	<0.1	NA
Endosulfan II		--	--	--	<0.1	NA
4,4'-DDD		--	--	--	<0.1	NA
Endosulfan sulfate		--	--	--	<0.1	NA
4,4'DDT	0.00059[b], <0.001 max	<0.001	<0.001	<0.001	<0.1	NA
Methoxychlor		<0.030	<0.030	<0.030	<0.5	NA
Endrin ketone		--	--	--	<0.1	NA
alpha-chlordane		--	--	--	<0.5	NA
gamma-chlordane		--	--	--	<0.5	NA
Toxaphene	≤0.0002	<0.005	<0.005	<0.005	<1	NA
PCB-1016		<0.001	<0.001	<0.001	<0.5	NA
PCB-1221		<0.001	<0.001	<0.001	<0.5	NA
PCB-1232		<0.001	<0.001	<0.001	<0.5	NA
PCB-1242		<0.001	<0.001	<0.001	<0.5	NA
PCB-1248		<0.001	<0.001	<0.001	<0.5	NA
PCB-1254		<0.001	<0.001	<0.001	<0.5	NA
PCB-1260		<0.001	<0.001	<0.001	<1	NA
Mirex	≤0.001	<0.001	<0.001	<0.001	<0.5	NA
Chlordane	≤0.00059[b], <0.0043 max	<0.010	<0.010	<0.010	--	NA
Demeton	≤0.1	<0.100	<0.100	<0.100	--	NA

Table 2.3.4-10. Summary of Water Quality Conditions in Payne Creek—PC-3, 1988 - 1989 and 1993 (Page 5 of 5)

Parameter	Class III Standard	1988-1989 Data			1993 Data	
		Max	Min	Mean	September	December
Pesticides/PCBs and Herbicides (Continued)						
Endosulfan	≤0.056	<0.003	<0.003	<0.003	–	NA
Guthion	≤0.01	<0.010	<0.010	<0.010	–	NA
Malathion	≤0.1	<0.100	<0.100	<0.100	–	NA
Parathion	≤0.04	<0.040	<0.040	<0.040	–	NA
Silvex		<20	<20	<20	–	NA
2,4-D		<10	<10	<10	<1	NA
2,4,5-TP		–	–	–	<1	NA
Organophosphate Pesticides (all units μg/L, all 1993 compounds were analyzed for, but none were detected at the specified value)						
Azinphos methyl		–	–	–	<5	NA
Bolstar		–	–	–	<1	NA
Chloropyriphos		–	–	–	<0.5	NA
Chloropyriphos methyl		–	–	–	<1	NA
Diazinon		–	–	–	<1	NA
Dichlorvos		–	–	–	<1	NA
Disulfoton		–	–	–	<1	NA
Ethoprop		–	–	–	<0.5	NA
Fensulfothion		–	–	–	<5	NA
Fenthion		–	–	–	<1	NA
Merphos		–	–	–	<1	NA
Mevinphos		–	–	–	<5	NA
Perathion methyl		–	–	–	<1	NA
Phorate		–	–	–	<1	NA
Ronnel		–	–	–	<1	NA
Stirofos		–	–	–	<1	NA
Tokuthion		–	–	–	<0.5	NA
Demeton	≤0.1	–	–	–	<1	NA
Coumaphos		–	–	–	<2	NA
Naled		–	–	–	<1	NA
Trichlronate		–	–	–	<1	NA

Note: NA = not applicable.

[a] Above natural background conditions.
[b] Annual average.
[c] Standard calculated according to equation in DEP 17-302.530 and using overall minimum hardness of 66.4 mg/L as $CaCO_3$.
[d] Monthly average.

Sources: TPS/SECI, 1989.
KBN, 1994.

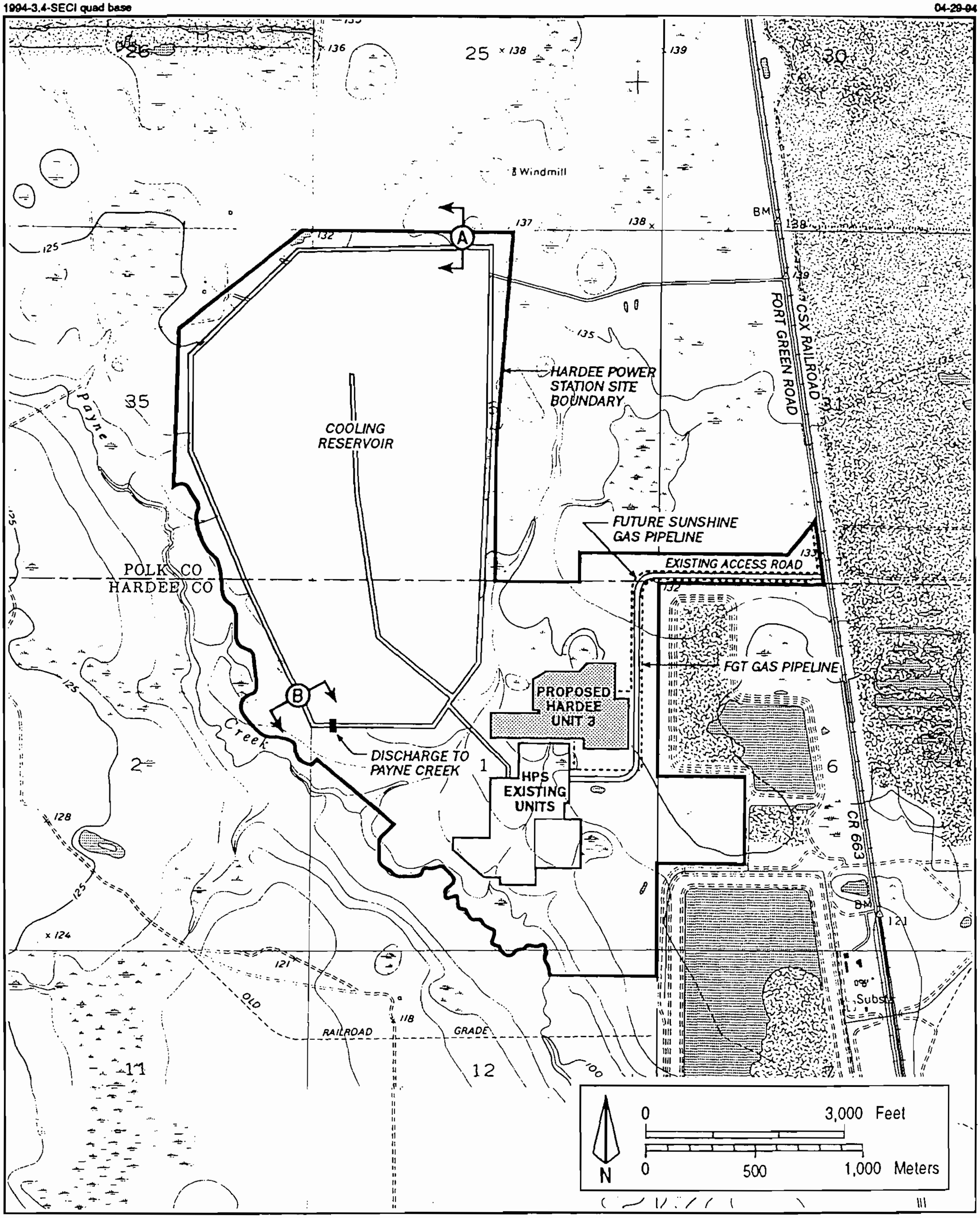

Figure 2.3.4-1
Plan Location of Cooling Reservoir Edge Cross Sections

Sources: USGS, 1987; TPS/SECI, 1989; KBN, 1994.

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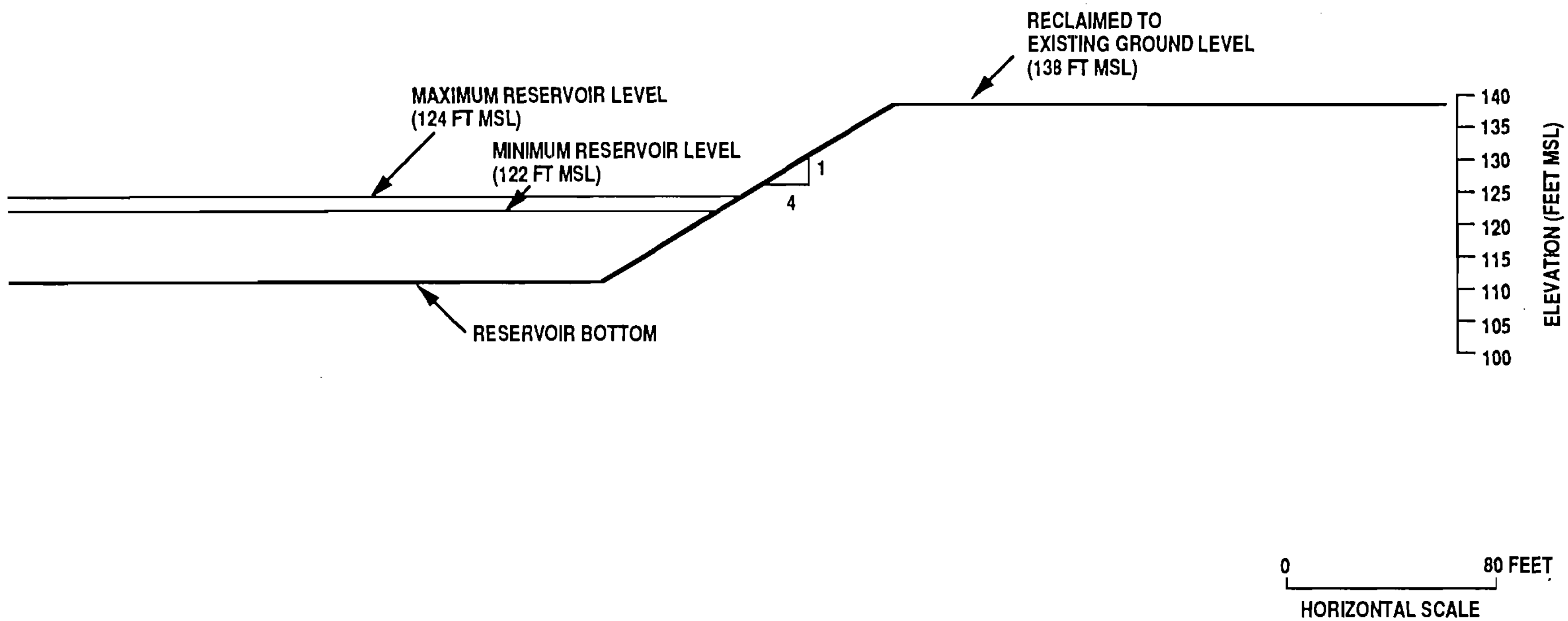

Figure 2.3.4-2
Cross Section A: Typical Belowgrade Edge of Reservoir

Source: TPS/SECI, 1989.

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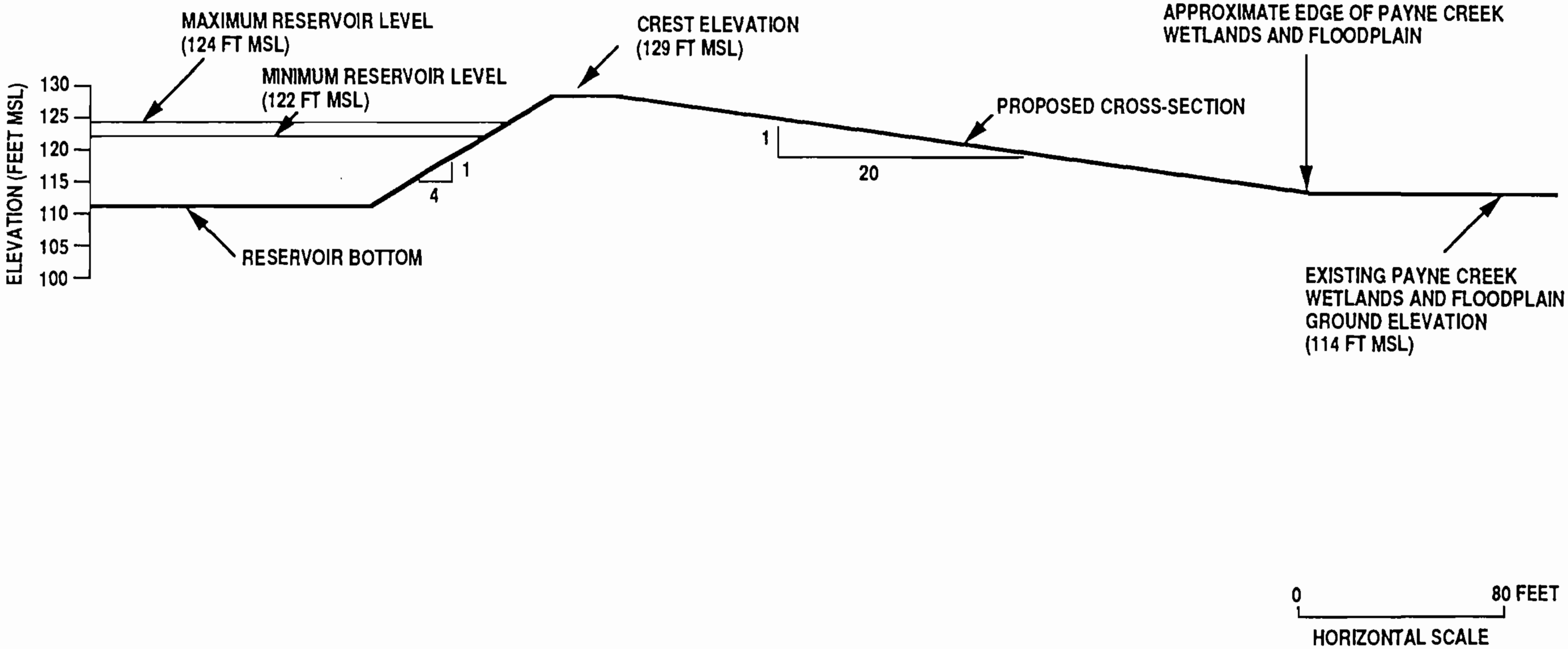

Figure 2.3.4-3
Cross Section B: Typical Abovegrade Edge of Reservoir
(Adjacent to Payne Creek)

Source: TPS/SECI, 1989.

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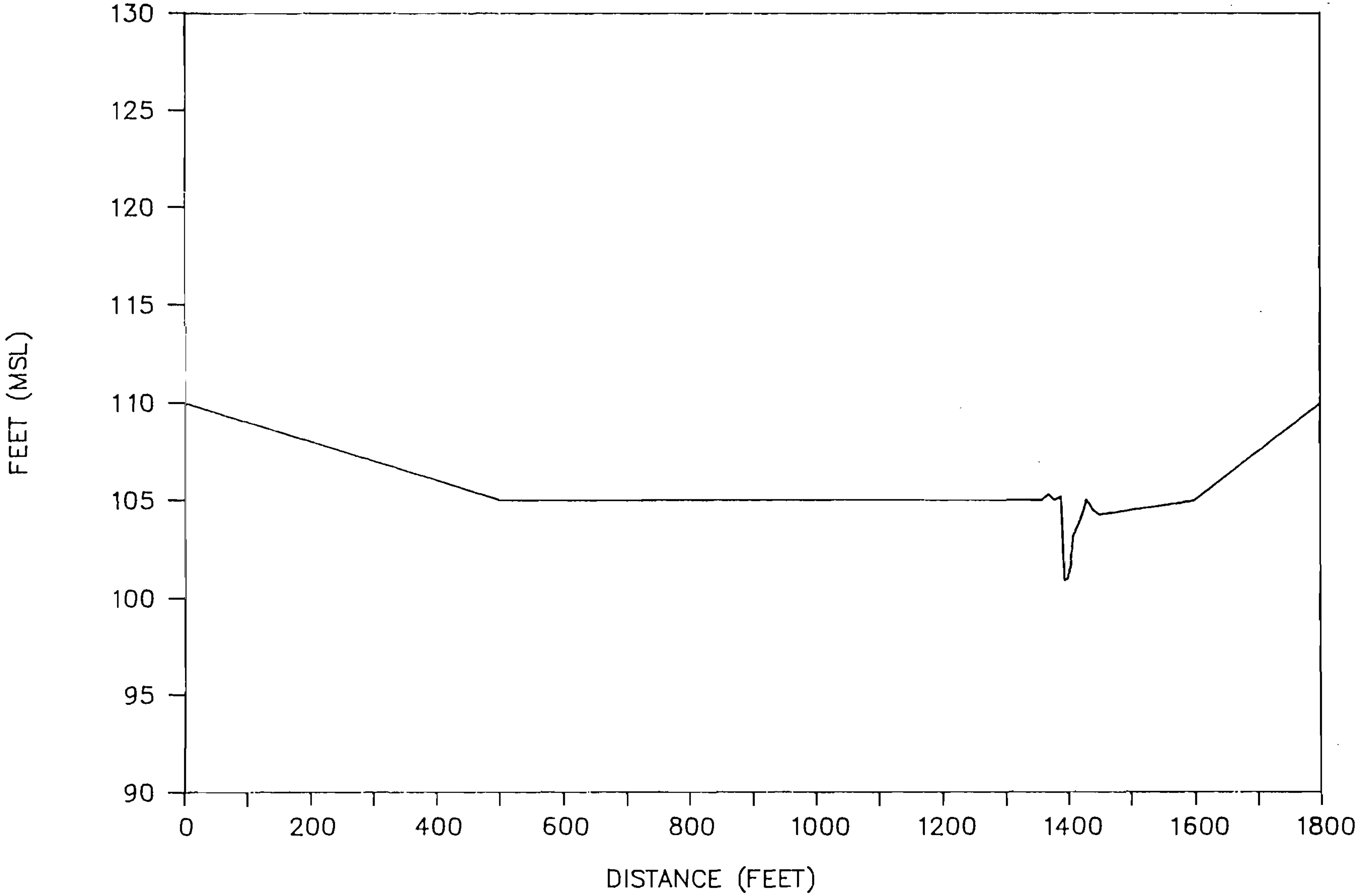

Figure 2.3.4-4
Typical Cross Section of Payne Creek and Floodplain Near the HPS Site
(Looking Upstream)

Source: TPS/SECI, 1989.

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NOTE: Elevations are in feet above mean sea level.

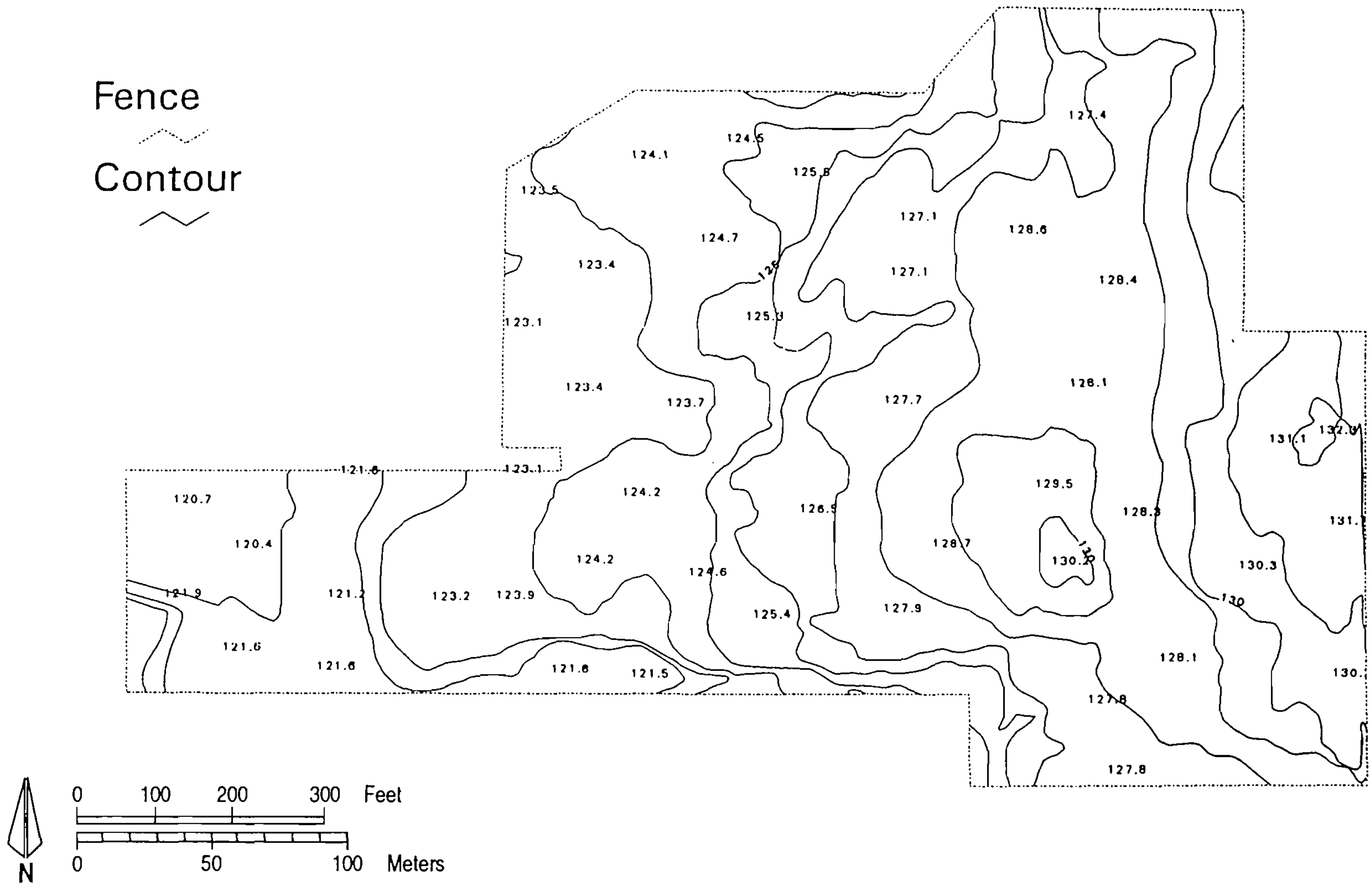

Figure 2.3.4-5
Topography of the Hardee Unit 3 Site

Source: KBN, 1994.

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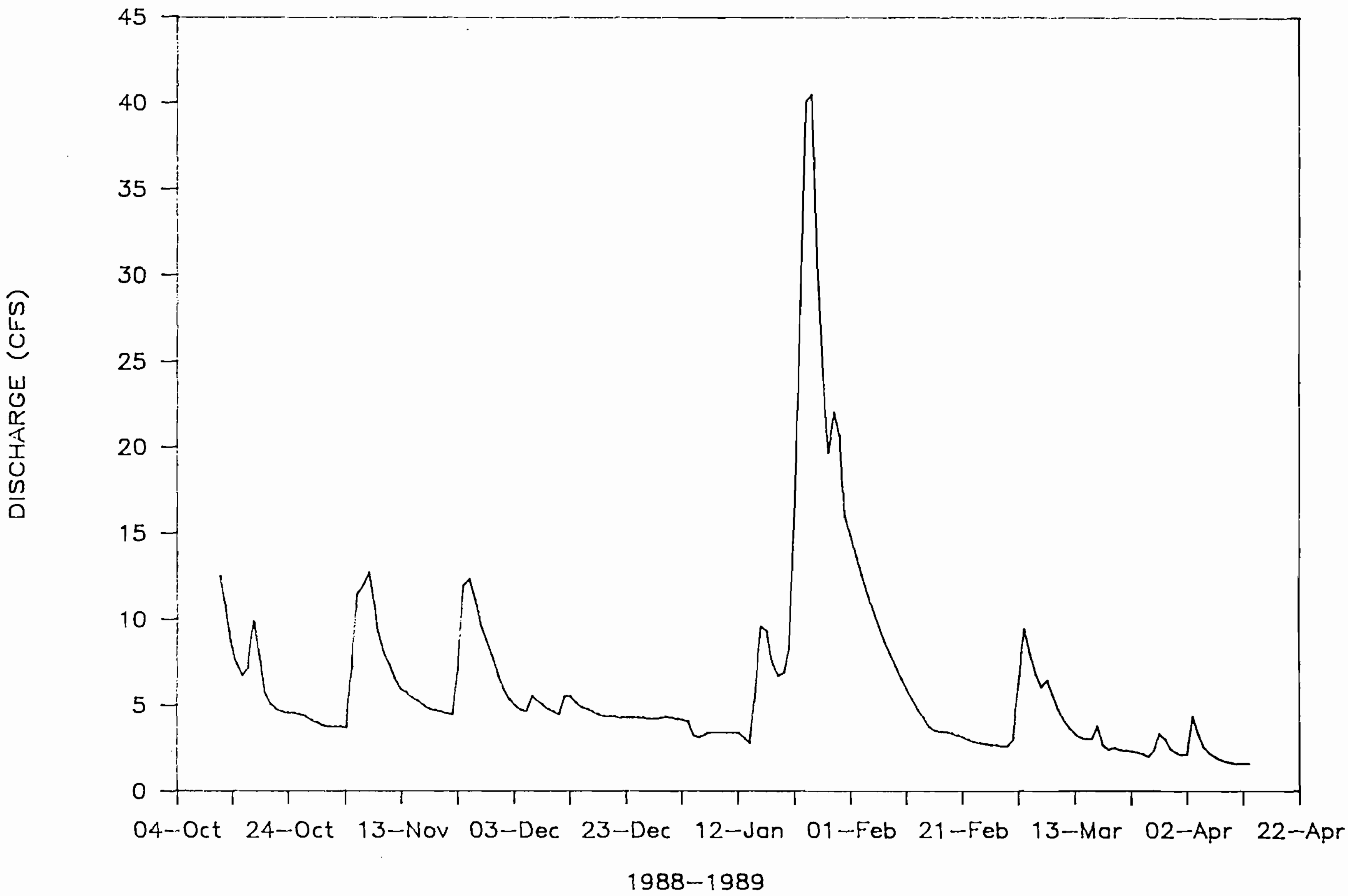

Figure 2.3.4-6
Discharge Hydrograph for Payne Creek Near the HPS Site

Source: TPS/SECI, 1989.

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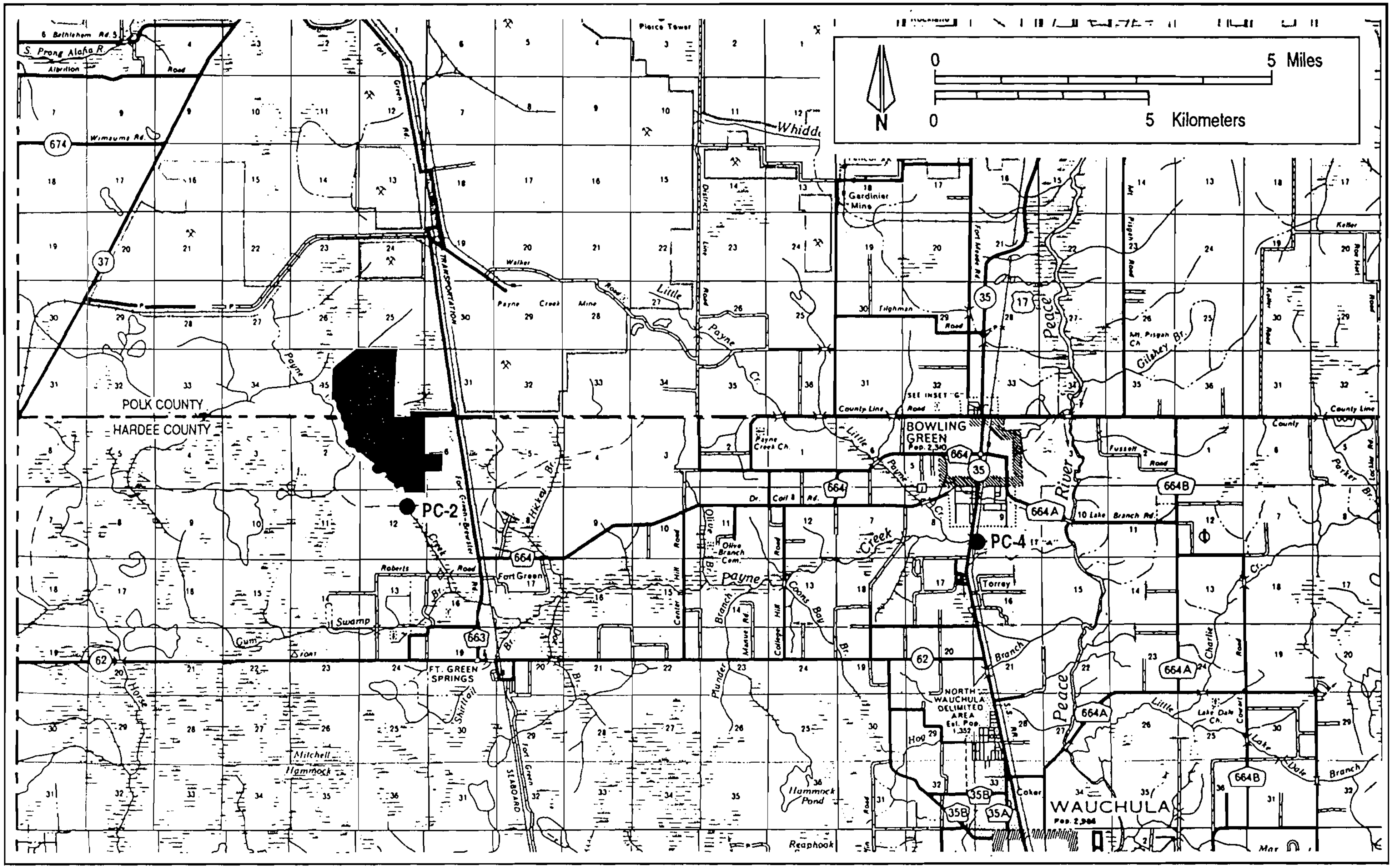

Figure 2.3.4-7
Payne Creek Streamflow Measurement Locations

Source: TPS/SECI, 1989.

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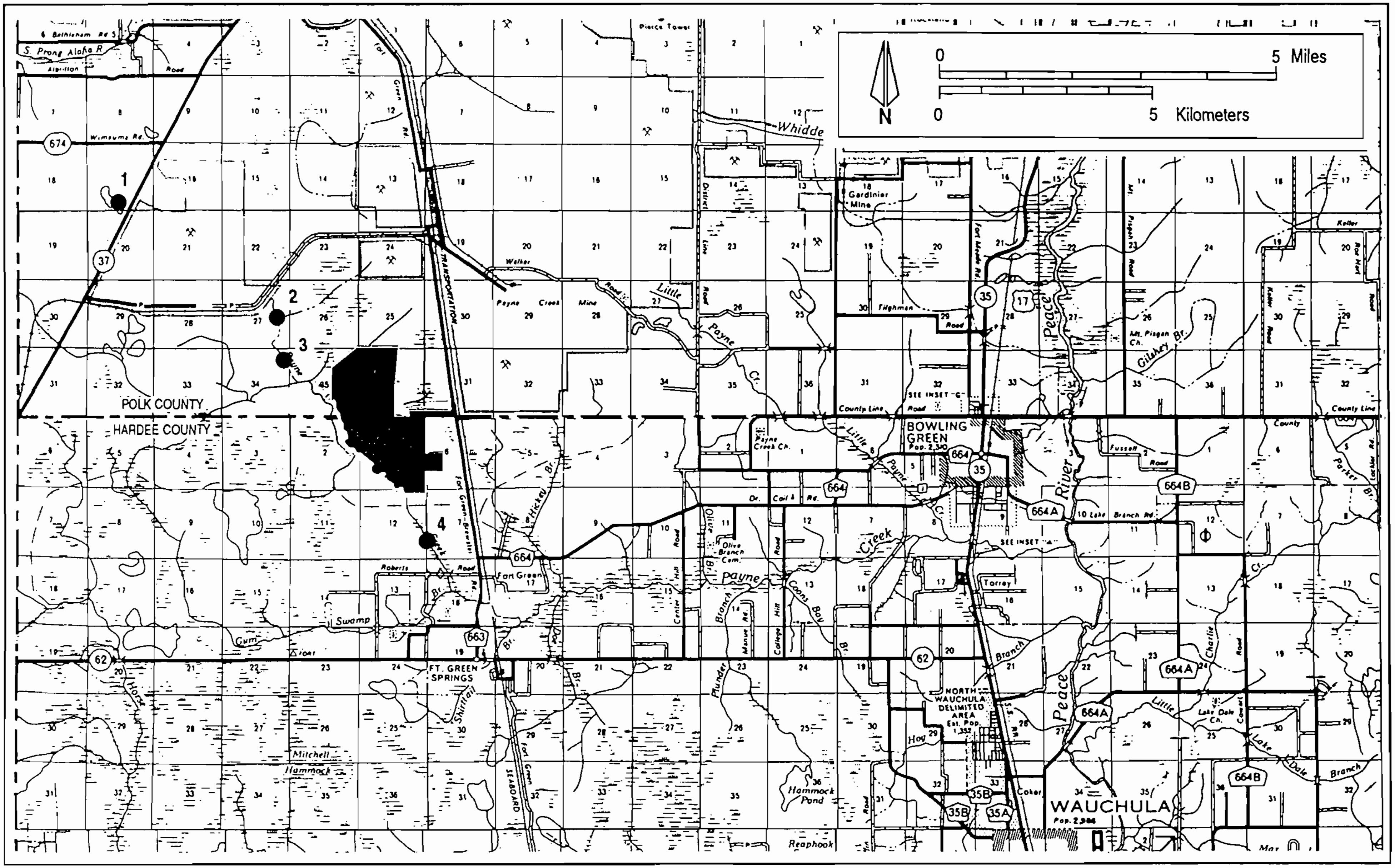

Figure 2.3.4-8
Historic Surface Water Quality Monitoring Locations
for Agrico and Dames & Moore Studies (1975–1986)

Source: TPS/SECI, 1989.

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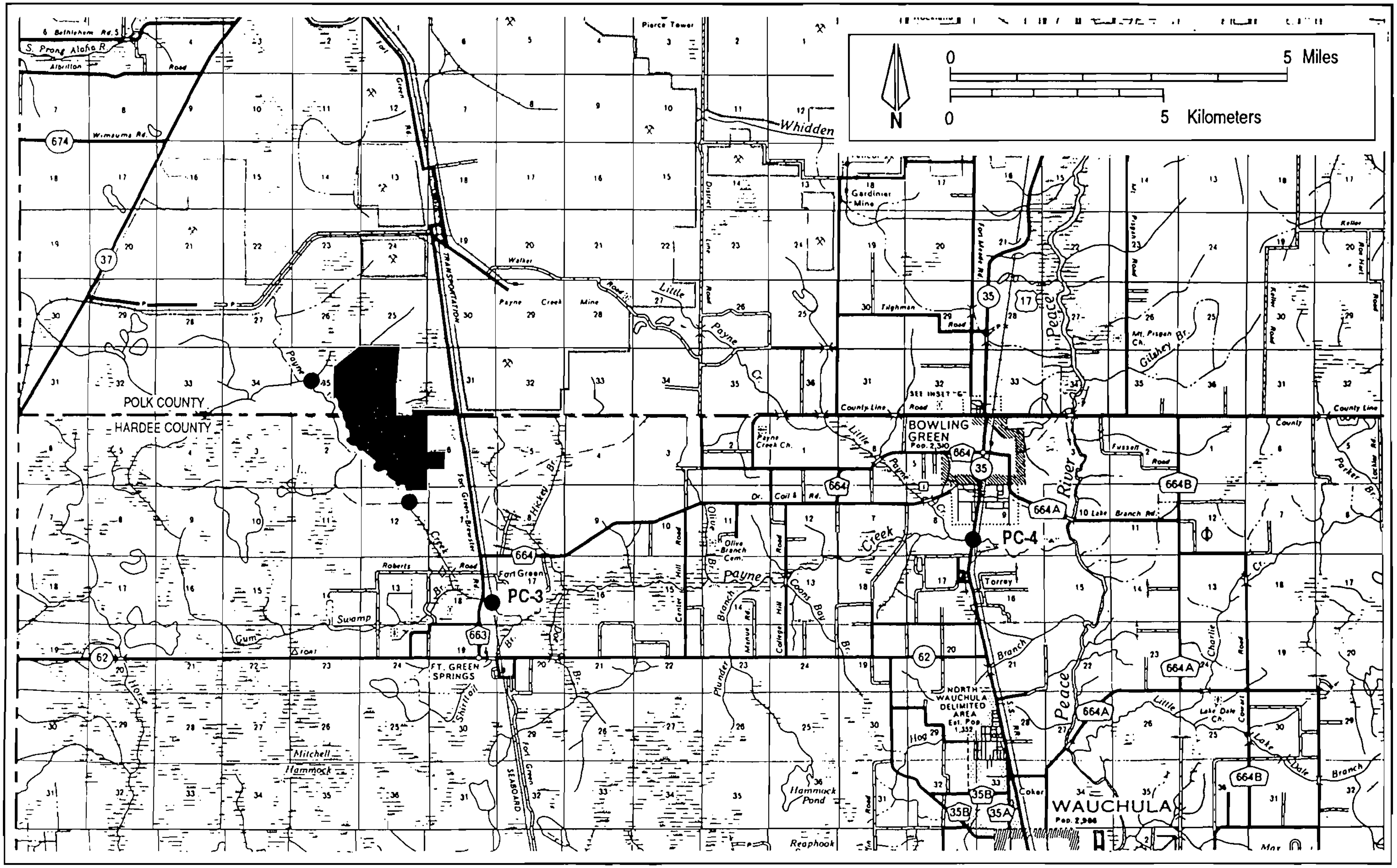

Figure 2.3.4-9
Surface Water Quality Monitoring Locations
(October 1988–March 1989 and September 1993)

Sources: TPS/SECI, 1989; KBN, 1994.

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2.3.5 VEGETATION/LAND USE

The Hardee Unit 3 facility site is sited primarily in reclaimed upland pasture (Figure 2.3.5-1). Based on detailed field studies in 1988 and 1989 and field reconnaissance in 1993, major land uses and vegetative communities onsite include reclaimed mined lands, a disturbed unnamed wetland tributary crossing the northern portion of the site and continuing toward the southwest where it connects to Payne Creek, and several small weedy shrub wetlands inadvertently for during reclamation. The Payne Creek floodplain, which is located south and west of the Hardee Unit 3 Project site and separated from the site by the HPS existing units and cooling reservoir, is a combination of forested wetland and pine flatwoods.

The Florida Land Use, Cover, and Forms Classification System (FLUCFCS) Level III code for reclaimed land, bottomlands, and bottomlands/pine flatwoods communities are 165, 615, and 615/411, respectively. Figure 2.3.5-2 shows the vegetation communities and the areas adjoining the Hardee Unit 3 site. Each community is described in detail in Section 2.3.6.1. All species observed in each community are listed in Table 2.3.5-1.

Table 2.3.5-1. Plant Species Associated With the HPS Site (Page 1 of 2)

Scientific Name	Common Name	Pasture	Flatwoods	Wetlands[a]
Trees				
Acer rubrum	Red maple			x
Diospyros virginiana	Persimmon			x
Fraxinus caroliniana	Pop ash			x
Gordonia lasianthus	Loblolly bay			x
Liquidambar styraciflua	Sweetgum			x
Magnolia virginiana	Sweetbay magnolia			x
Nyssa sylvatica var. *biflora*	Black gum			x
Persea borbonia	Red bay			
Quercus laurifolia	Swamp laurel oak			x
Quercus nigra	Water oak			x
Quercus virginiana	Live oak	x	x	
Pinus elliottii	Slash pine	x	x	x
Pinus palustris	Longleaf pine	x	x	
Salix caroliniana	Carolina willow			x
Shrubs and Vines				
Ampelopsis arborea	Pepper vine			x
Baccharis glomeruliflora	Stalkless groundsel bush			x
Cephalanthus occidentalis	Buttonbush			x
Gelsemium sempervirens	Yellow jessamine			x
Ilex cassine	Dahoon holly			x
Itea virginica	Virginia willow			x
Liquidambar styraciflua	Sweetgum	x		
Myrica cerifera	Wax myrtle		x	x
Osmanthus americana	Wild olive			x
Rhododendron viscosum	Swamp honeysuckle			x
Serenoa repens	Saw palmetto	x	x	x
Smilax auriculata	Catbrier		x	x
Smilax bona-nox	Greenbrier		x	x
Smilax laurifolia	Bamboo vine			x
Toxicodendron radicans	Poison ivy			x
Vaccinium corymbosum	Highbush blueberry			x
Viburnum obovatum	Small viburnum			x
Vitis sp.	Grape			x
Herbaceous Species				
Aeschynomeme americana	Aeschynomeme	x		
Andropogon brachystachyus	Shortspike broomgrass		x	
Andropogon glomeratus	Bushy broomgrass	x		
Andropogon virginicus	Broom grass	x		
Aristida spiciformis	Bottlebrush grass		x	
Aster subulatus	Annual marsh aster	x		
Blechnum serrulatum	Swamp fern			x
Canna flaccida	Golden canna			x
Cassia nictitans var. *aspera*	Wild sensitive plant	x		
Centella asiatica	Coinwort	x		
Conyza canadensis	Horseweed	x		
Cyperus polystachyos	Texas sedge	x		
Desmodium incanum	Creeping beggarweed	x		
Desmodium triflorum	Sagotia beggarweed	x		
Digitaria ciliaris	Southern crab grass	x		

Table 2.3.5-1. Plant Species Associated With the HPS Site (Page 2 of 2)

Scientific Name	Common Name	Pasture	Flatwoods	Wetlands[a]
Herbaceous Species (Continued)				
Diodia teres	Poor joe	x		
Eichornia crassipes	Water hyacinth			x
Eleocharis sp.	Spikerush	x		
Elephantopus elatus	Florida elephant's foot	x		
Encyclia tampensis	Butterfly orchid			x
Eremechloa ophiuroides	Centipede grass	x		
Eupatorium capillifolium	Dog fennel	x		
Euthamia minor	Flattop goldenrod	x		
Habenaria repens[b]	Water spider orchid			x
Hartwrightia floridana[b]	Hartwrightia			x
Heterotheca subaxillaris	Camphor weed	x		
Hypoxis juncea	Yellow star grass		x	
Indigofera hersuta	Hairy indigo	x		
Juncus scirpoides	Rush			x
Ludwigia peruviana	Primrose willow			x
Mitchella repens	Partridge berry			x
Murdannia nudiflora	Dove weed	x		
Osmunda cinnamomea[b]	Cinnamon fern			x
Panicum anceps	Beaked panicum			x
Panicum rigidulum	Redtop panicum			x
Paspalum distichum	Knot grass	x		
Paspalum notatum	Bahia grass	x		
Paspalum urvillei	Vasey grass	x		
Phlebodium aureum[b]	Golden polypody			x
Polygonum hydropiperoides	Smartweed			x
Pontederia cordata	Pickerelweed			x
Pteridium aquilinum	Braken	x		
Pteroglossapsis ecristata[b]	Wild coco		x	
Rhynchelytrum repens	Natal grass			
Sacciolepis indica	Cupscale	x		
Saururus cernuus	Lizards-tail			x
Scirpus validus	Bulrush			x
Sesbania vesicaria	Bladderpod	x		
Thalia geniculata	Fireflag			x
Thelypteris hispidula[b]	Hairy maiden fern			x
Thelypteris interrupta[b]	Spreading tri-vein fern			x
Tillandsia fasciculata	Wild pine			x
Tillandsia recurvata	Ball-moss	x		x
Tillandsia setacea[b]	Red needle-leaf air plant			x
Tillandsia usneoides	Spanish moss	x	x	x
Typha sp.	Cattail			x
Urena lobata	Caesar weed	x		x
Vittaria lineata[b]	Shoestring fern			x
Woodwardia areolata	Chain fern			x
Woodwardia virginiana	Virginia chain fern			x
Xyris platylepis	Broadscale yellow-eyed-grass	x		

[a] Includes Payne Creek, wetland tributary, and shrub wetlands.
[b] Listed species; see Table 2.3.6-9.

Sources: TPS/SECI, 1989.
KBN, 1994.

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Figure 2.3.5-1
Aerial Photograph of Hardee Unit 3 Project Location

Source: SECI, 1994.

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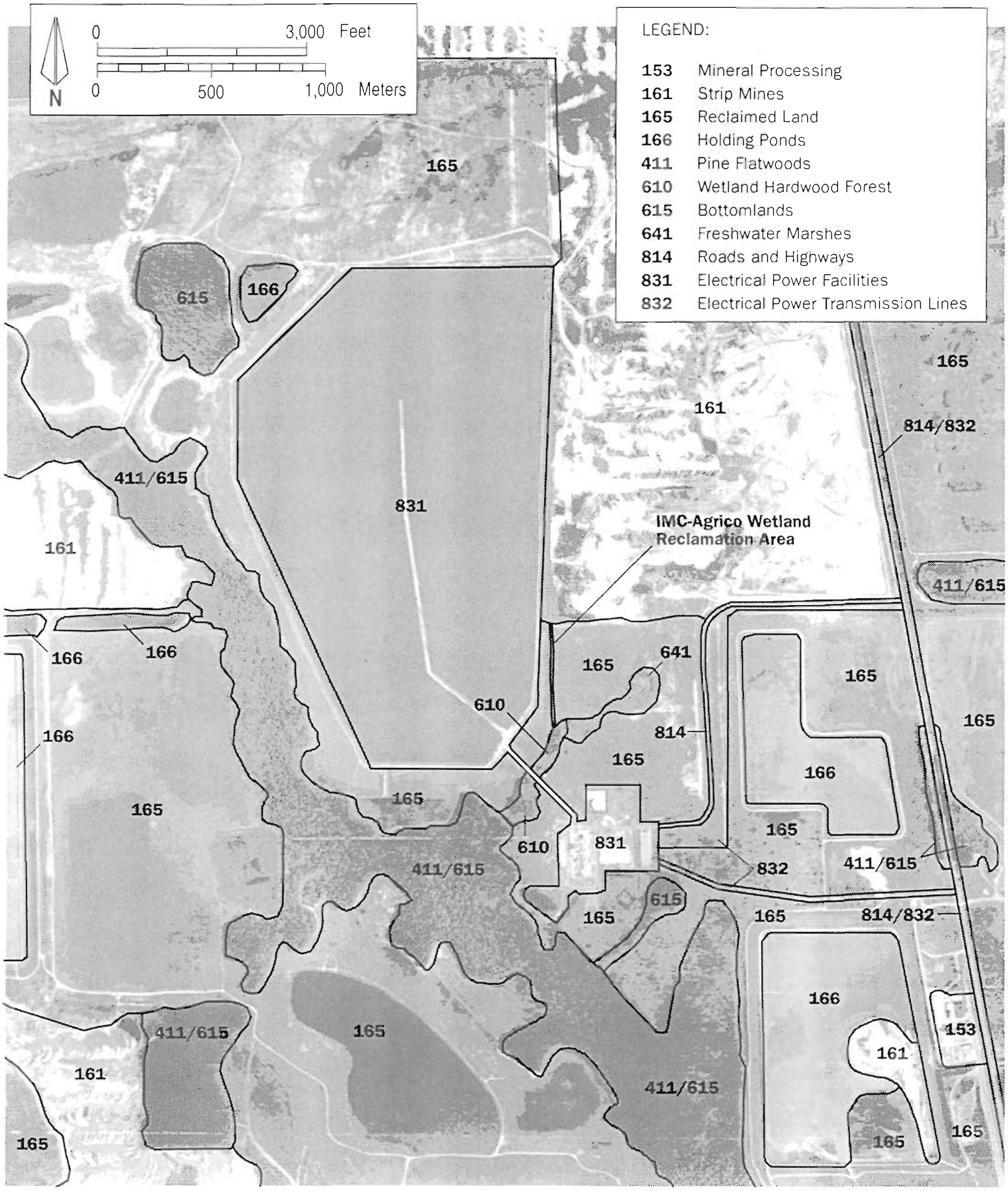

Figure 2.3.5-2
Land Use and Vegetation of the Hardee Unit 3 Site
and Associated Facilities

Source: KBN, 1994.

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2.3.6 ECOLOGY

An ecological assessment of the overall HPS site and Payne Creek was included in the SCA/EA document prepared for the original HPS (TPS/SECI, 1989). Detailed site-specific data were collected on both aquatic and terrestrial ecological resources including threatened and endangered species. The data collected for the HPS site are considered to be representative of the Hardee Unit 3 Project site. The field reconnaissance conducted in 1993 confirmed the conditions of the detailed surveys and provided the basis for the description of the current project area in this section.

2.3.6.1 SPECIES-ENVIRONMENTAL RELATIONSHIPS

2.3.6.1.1 Aquatic Systems

Payne Creek and its unnamed tributaries are the only natural aquatic systems in the immediate vicinity of the Hardee Unit 3 facility. Payne Creek is a relatively shallow stream situated on the western boundary of the HPS site. Mining and reclamation activities have occurred on both sides of the Payne Creek floodplain (see the following terrestrial systems discussion). The creek bottom is typically a combination of detritus, sand, and silt. The Payne Creek floodplain has been subject to hydrologic change resulting from sedimentation, ditching of its tributaries for agricultural operations, and mining. Field reconnaissance conducted in 1993 showed conditions in Payne Creek to be similar to those reported in the original SCA (TPS/SECI, 1989).

Fishes

Based on the results of the ichthyofaunal sampling in 1988 and 1989 (see Figure 2.3.6-1) Payne Creek is characterized as a typical, and relatively healthy stream ecosystem. From the standpoint of ichthyofaunal composition, the species captured represented the typical suite of fishes expected in a south-central peninsular Florida stream. Although large-mouth bass (*Micropterus salmoides*) was not found in the samples collected, it is likely to occur in Payne Creek. The predominance of two salt-tolerant secondary freshwater species, the flagfish (*Jordanella floridae*) and the sailfin molly (*Poecilia latipinna*), collected in 1988 at the upstream sampling Station (PC-1) and the presence of the walking catfish (*Clarias batrachus*) at this station indicate connections to drainage ditches, which traditionally host this exotic and the previous two species.

Mosquitofishes (*Gambusia holbrooki*), predictably, dominated the catches numerically during the 1988 sampling. This species is ecologically tolerant and is the most abundant fish in Florida freshwaters. The brook silverside (*Labidesthes sicculus*) and the golden shiner (*Notemigonus crysoleucas*), when found in an appropriate habitat such as the upstream station, are frequently abundant. The golden topminnow (*Fundulus chrysotus*) and least killifish (*Heterandria formosa*) are characteristically common components of vegetated habitats.

Ecologically, the ichthyofauna of Payne Creek can be broken down into three major assemblages (Table 2.3.6-1). The dominant grouping involves killifish (families Cyprinodontidae and Poeciliidae), sunfish (Centrarchidae), and gar (Lepisosteidae). This assemblage characteristically occupies vegetated habitats, including areas with submergent, emergent, and overhanging plants. Next in importance is an open-water group consisting of minnows (Cyprinidae) and a silverside (Atherinidae), plus sunfishes. Adult centrarchids frequently assemble at the interface between vegetated habitats and open water. The third assemblage, involving catfishes (Ictaluridae and Clariidae) and darters (Percidae), is closely associated with the bottom.

Benthic Macroinvertebrates

Macroinvertebrate sampling for the HPS site emphasized benthic infaunal and epifaunal communities (TPS/SECI, 1989). These sampling efforts were carried out during October 1988 and February 1989, concurrent with the fish surveys (see Figure 2.3.6-1 for sampling locations). A total of 153 macroinvertebrate taxa were collected from Payne Creek during the study.

A total of 90 taxa were collected by the artificial substrates. The midge family Chironomidae were the numerically dominant group of invertebrates collected on the artificial substrates in Payne Creek. This family comprised from 64 to 91 percent of all invertebrates collected (Table 2.3.6-2). *Polypedilum* was the most common genus of Chironomidae occurring on the artificial substrates, and *Polypedilum convictum* was the most common species at the two upstream sites, and occasionally comprised over 40 percent of the total fauna. Simpson and Bode (1980) state that these organisms are filter feeders and that their occurrence seems to be primarily governed by current speed and the amount of suspended material in the water. Other chironomids that were abundant were the *Endochironomus* group, the *Rheotanytarsus exiguus* group, *Tanytarsus* spp., the *Thienemanniella fusca* group, and occasionally the *Corynoneura taris* group. Of these, the *R. exiguus* group, the *T. fusca* group, and the *C. taris* group are also described as occurring in areas of moderate to high flow water containing high amounts of suspended organic matter.

The hydropsychid caddisfly larvae, *Cheumatopsyche* sp., was also very abundant. *Cheumatopsyche* are also filter-feeders that require current of adequate speed and substantial quantities of suspended organics. Simpson and Bode (1980) noted that *Cheumatopsyche* and *R. exiguus* are frequently found together and are indicative of a community having an abundance of suspended foodstuffs.

Mayflies and stoneflies are generally an indicator of clean environmental conditions. Although numerically they only comprised a small portion of the fauna (between 2 and 8 percent), due to their large size, as compared with the smaller chironomids, they are actually quite significant in terms of the total amount of food available for fish and the total productivity of the system. Common mayflies included *Stenacron interpunctatum, Stenonema exiguum,* and *Caenis diminuta*.

A total of 82 taxa were collected in 1988 and 1989 by ponar sampling from Payne Creek (Table 2.3.6-3). The rich infauna benthic populations observed in the upstream stations may be due to several reasons. First, much of the creek bottom in this area is covered with leaf packs which provides excellent habitat for these invertebrates. Second, the flow is moderate to swift, which keeps the area just above the substrate well oxygenated. Finally, the creek appears relatively undisturbed in the upstream areas sampled, even though mining and reclamation has occurred in the vicinity of both banks.

Macroinvertebrates from the dip net samples revealed over 50 taxa (Table 2.3.6-4) with grass shrimp, *Palaemonetes paludosus*, and chironomids dominated the vegetation, leaf packs, submerged roots and sticks in the streams. Cambarid crayfish were also abundant.

In summary, the macroinvertebrate community composition in Payne Creek also indicates that the creek is a typical central Florida small sandy bottom streams.

2.3.6.1.2 Terrestrial Systems--Flora

Reclaimed Pasture

Reclaimed upland pasture is the dominant community on the Hardee Unit 3 site (Figure 2.3.5-1, FLUCFCS Code 165). The power block and other facilities will be built on unmined and reclaimed upland pasture. The dominant grass in the pasture is bahia grass (*Paspalum notatum*).

The upland pasture has been colonized by early successional species which are indicative of highly disturbed habitats. These species include hairy indigo (*Indigofera hersuta*), natal grass (*Rhynchelytrum repens*), bahia grass, camphorweed (*Heterotheca subaxillaris*), dogfennel (*Eupatorium capillifolium*), flattop goldenrod (*Euthamia minor*), aeschynomeme (*Aeschynomeme americana*), and chalky bluestem (*Andropogon glomeratus*).

Areas of the upland pasture were mined for phosphate. Consequently, the soil is less permeable than during pre-mine conditions due to a higher clay content of overburden material. Many moisture-tolerant species occur among the pasture grasses, especially in the transitional areas adjacent to the depressional areas.

Several small depressional areas (ranging from 0.05 to 1.9 ha, or 0.13 to 4.6 acres in size) are present within the reclaimed pasture on the south side of the wetland tributary and were inadvertently created during the reclamation process. These wetlands were presumably historical uplands as suggested by a remaining live oak in the vicinity and photographs taken prior to mining. These depressional areas are described in the following paragraphs on onsite wetlands.

<u>Onsite Wetlands</u>

The wetland systems located on the Hardee Unit 3 site include a partially mined and reclaimed unnamed tributary wetland, a wetland reclamation site reclaimed by IMC/Agrico, and several low-lying areas which were inadvertently created during the reclamation process (Figure 2.3.6-3). A description of each wetland system follows.

The unnamed tributary wetland forms the northern boundary of the Hardee Unit 3 site. This wetland was partially mined and reclaimed by IMC/Agrico (Program AGR-PC-PC1, 1990). The headwaters of this remnant tributary wetland are fringed by a thick band of primrose willow. Scattered Carolina willow, saltbush (*Baccharis halimifolia*), wax myrtle (*Myrica cerifera*), and dogfennel contribute to this vegetation zone. The headwaters were historically a forested wetland as suggested by the existing dead trees.

The wetland extends southwest and grades into an open-water system. Although the wetland is void of plants in the center, it is lined with different species, including water hyacinth (*Eichornia* *crassipes*), pickerelweed (*Pontederia cordata*), bulrush (*Scirpus validus*), cattail, fireflag (*Thalia geniculata*), smartweed (*Polygonum hydropiperoides*), buttonbush (*Cephalanthes occidentalis*), primrose willow, and Carolina willow. Duckweed covers the water surface in many areas.

West of the headwater area is a forested segment of the tributary wetland. Live oaks (*Quercus virginiana*) surround the forested segment, and black gums (*Nyssa sylvatica* var. *biflora*) occupy the inner section. Saw palmettos (*Serenoa repens*) form clumps around the base of live oak trees. Although this segment represents an unmined segment of the wetland, the overall health is declining as evidenced by several dead trees. It appears that the natural hydroperiod has changed so the water levels remain high and are affecting the trees. Weedy wetland species are encroaching in and around this forested segment.

The second wetland system located on the Hardee Unit 3 site is an IMC/Agrico wetland reclamation area (Figure 2.3.6-3). Reclamation was required by the former Florida Department of Natural Resources (FDNR) for mining the site (Program AGR-PC-PC1, 1990). Additionally, several large reclamation areas are currently being constructed directly north of the project site. These reclamation areas will be connected to, and form the western end of, the unnamed tributary wetland.

Native trees were planted approximately 2 years ago at the onsite reclamation areas to reestablish the floodplain around the unnamed tributary wetland and to connect the reclamation areas north of the site to the unnamed tributary wetland. Species planted include slash pine (*Pinus elliottii*), live oak, laurel oak (*Quercus laurifolia*), American elm (*Ulmus americana*), dahoon holly (*Ilex cassine*), sweet bay (*Magnolia virginiana*), sweetgum (*Liquidambar styraciflua*), and red maple (*Acer rubrum*).

The third onsite wetland system consists of several small depressional areas scattered among the reclaimed pasture on the south side of the unnamed tributary wetland (Figure 2.3.6-3). These depressional areas were inadvertently created during the reclamation process. These wetlands were presumably historical uplands as suggested by a remaining live oak in the vicinity and photographs taken prior to mining. These depressional wetlands are very poor quality and are colonized primarily by primrose willow (*Ludwigia peruviana*), cattail (*Typha* spp.), and Carolina willow (*Salix caroliniana*). Hemp vine covers many plants.

Offsite Payne Creek Floodplain

Detailed observations of the Payne Creek floodplain were conducted in 1988 and 1989 for certification of the HPS existing units. The following description of Payne Creek floodplain is based on these earlier observations and is extracted from the SCA/EA (TPS/SECI, 1989). Field reconnaissance in October and November 1993 revealed that site conditions have not changed substantially since these earlier observations.

Since the 1990 certification, mining has ceased on both sides of the floodplain in the vicinity of the HPS site, and reclamation has been implemented. The creek has a clearly incised channel, although the channel becomes shallower and wider in some areas. Parts of the floodplain have terraced elevations with sloughs or channels behind the higher terraced areas. Near the mining operation, large areas of sand have deposited in the creek bed. The differences in elevation throughout the floodplain have resulted in very different plant communities adjacent to each other. Saw palmetto, slash pine, sweetgum and laurel oak occur at the higher elevations and pop ash (*Fraxinus caroliniana*), buttonbush, red maple, and other wetland species grow at the lower elevations (Figure 2.3.5-1 FLUCFCS Code 411/615). High dense saw palmetto or grasses (*Aristida stricta, Aristida spiciformis, Andropogon brachystachus*) are between the pasture and the forested wetland. These upland areas and the wetland bordering the creek comprise the floodplain. The property south of Payne Creek and its bordering vegetation has been mined for phosphate and reclaimed.

Detailed vegetation studies of the Payne Creek floodplain in 1988 and 1989 (TPS/SECI, 1989) showed the dominant tree in the upper floodplain was laurel oak, with an importance value of 82.4 percent (Table 2.3.6-5). The average basal area of this species was 711.5 cm^2. Sweetgum and red maple were also abundant. Total basal area of the tree canopy was 42.5 cm^2/m^2. Saw palmetto with an importance value of 32.6 percent was the most abundant shrub. Greenbrier (*Smilax* spp.) and groundsel tree (*Baccharis glomeruliflora*) were also abundant in the shrub layer. Redtop panicum (*Panicum rigidulum*) was a common groundcover in open areas of the floodplain. Epiphytes were common in the canopy trees and included Spanish moss, ball-moss, wild pine (*Tillandsia fasciculata*), and butterfly orchid (*Encyclia tampensis*). Red maple and sweetgum saplings were abundant in the understory and overtop the saw palmetto in many areas. This part of the floodplain is typical of flatwoods that have not burned for a long time; if fire continues to be excluded, a hardwood floodplain forest will replace much of the saw palmetto.

Species associations on the floodplain varied with slope and height as shown in a generalized depiction of these relationships (Figure 2.3.6-2). Cross-Section A shows the floodplain which was characterized as low banks with a terrace. The vegetation in this type of area was comprised of pickerelweed, redtop panicum, pop ash, and buttonbush. Adjacent to this was an area approximately 1 meter higher with saw palmetto, sweetgum and laurel oak, festooned with yellow jessamine. In areas with terraced banks (Cross-Section B), the vegetation pattern was characterized by a high shrubby area adjacent to the creek channel of grass, greenbrier, persimmon, yellow jessamine, groundselbush, grape, and wax myrtle with scattered young sweetgum, red maple and laurel oak. The few overstory trees were live oak and sweet gum. This zone was approximately 7 m (23 ft) wide. Adjacent to it, the bank rose sharply 1 to 2 m (3 to 7 ft) higher to a palmetto-pine-sweetgum zone. Lichen lines on the sweetgum tree trunks about 30 cm (12 in) from the ground surface indicated occasional flooding in this region.

Parts of the floodplain have low flat banks (Cross-Section D). They support pop ash, elm, and laurel oak. The understory is almost bare with no litter, shrubs, or groundcover. This zone is approximately 8 m (26 ft) wide and is adjacent to a 2 m (6.6 ft) wide zone of dense saw palmetto and some sweetgum trees which rises sharply to a high bank of poison ivy, greenbrier, and peppervine (*Ampelopsis arborea*).

Figure 2.3.6-2, Cross-Section D, depicts the floodplain in areas with high banks and swales. Lichen lines on sweetgum and laurel oak trees in swales behind the banks are approximately 1 m (3 ft) from the ground surface indicating that flooding to that height is sufficiently frequent to keep the lichens from growing any lower. Persimmon and primrose willow are growing on a large sandbar in the center of the creek.

The upper floodplain is a vegetation zone dominated by saw palmetto, yellow jessamine, bracken fern, sweetgum and laurel oak saplings, and swamp honeysuckle. Further upland is a zone with laurel oak, slash pine, sweetgum, and very dense saw palmetto. The lichen lines extend to the base of the trees indicating little flooding in this section. Many small drainages from the upland area of the site dissect this zone. Beyond this zone to the north, the saw palmetto drops out, there is slight litter on the ground, and groundsel bush, greenbrier, young sweetgum, water oak seedlings, and caesarweed predominate.

The Payne Creek floodplain near the southeast corner of the HPS site has a wide floodplain and the stream channel is less than 1 m (3 ft) deep. Large areas are dominated by ferns [cinnamon fern, swamp fern (*Blechnum serrulatum*), chain ferns], lizards-tail, and smartweed (*Polygonum hydropiperoides*). The most common tree is young red maple and red maple leaf litter approximately 10 cm (4 in) deep overlays the peat surface. Laurel oak, pop ash, and slash pine are also present. Moss-covered cypress knees are common, but live cypress has been historically timbered. Few shrubs were observed. The bases of the trees are above the ground exposing the roots; this could indicate peat subsidence due to a lowered water level, but the charred trunks of the older slash pine indicate a peat fire in the recent past.

2.3.6.1.3 Terrestrial Systems--Fauna

The wildlife habitat in the region surrounding the Hardee Unit 3 site has been severely altered by past phosphate mining and reclamation activity. The barren spoil piles and bare ground being reclaimed north of the site provide poor wildlife habitat. The water-filled ditches, excavated ponds, and settling ponds in the general area support wading birds and waterfowl feeding. Much of the previously mined land is being reclaimed to pasture which does not support diverse wildlife populations.

Remnant areas of important wildlife habitats exist in the forested wetlands along Payne Creek. This hardwood habitat supports a greater number of observed and potentially occurring species of animals than the other identified habitats (Tables 2.3.6-6, 2.3.6-7, and 2.3.6-8).

Ubiquitous species (those species actually observed in all habitats), included feral hog, nine-banded armadillo, downy woodpecker, and the blue jay (scientific names are listed in Tables 2.3.6-6 and 2.3.6-7). Feral hogs were abundant in all habitats, and their foraging has created much disturbance, particularly along forest edges.

Forested Wetland

Studies of the forested wetland in 1988 and 1989 and field reconnaissances in 1993 revealed mixed species flocks of migrant and resident small insectivorous birds, including yellow-rumped warblers, blue-gray gnatcatchers, ruby crowned kinglets, tufted titmice, and palm warblers.

Common omnivorous birds included the gray catbird, mockingbird, red-bellied woodpecker, and white-eyed vireo. Northern bobwhites were observed retreating into the forest from the adjacent pasture. The Eastern phoebe was common along the forest edge. The red-shouldered hawk, a carnivore, appeared to be fairly common, while the piscivorous belted king fisher perched in the forest along Payne Creek.

Tracks were found of bobcat and river otter, in this habitat. Tracks of raccoons and deer were also observed. The burrows of crayfish, important prey of river otters and raccoons, were present in the floodplain. Centrarchid fish, another important prey of the river otter, were common in Payne Creek (see Section 2.3.6.1.1).

Gray squirrels occur in the forested wetlands. Amphibians observed included green anoles, green tree frogs, bullfrogs, and southern leopard frogs.

Reclaimed Pasture

The most prominent birds in this habitat were the American kestrel, loggerhead shrike, Eastern meadowlark, and killdeer, all of which are typical species of pasture land.

Other birds observed included red-tailed hawk and the mockingbird. Where growths of dog-fennel provided cover, catbirds and house wrens were present. Small groups of the palm warbler, a species common in open habitats during winter, were observed foraging on the ground. Mammals common to the pasture habitats include various species of rodents, opossum, armadillo, rabbit, and wild hog.

2.3.6.1.4 Threatened and Endangered Species--Flora and Fauna

Species designated by the U.S. Fish and Wildlife Service (USFWS), the Florida Game and Fresh Water Fish Commission (FGFWFC) and the Florida Department of Agriculture and Consumer Services (FDA) as endangered, threatened, species of special concern, commercially exploited, or under review, were included in this category. Sources used to identify such plant and animal species that could potentially occupy the unmined areas of the site included the FNAI database, Florida Committee on Rare and Endangered Plants and Animals (FCREPA) reports, DRI applications for the Agrico site and the CFI mine south of the Agrico site, and endangered species surveys conducted for the HPS site. In October 1993, an endangered plant species survey was conducted on the Hardee Unit 3 site. Following are descriptions of species whose occurrence or range includes the Hardee Unit 3 site.

Flora

Species that occur or potentially occur on the Hardee Unit 3 site are listed in Table 2.3.6-9. The probability of their occurrence is assessed. Detailed descriptions and results of the search for these species follow.

Water Spider Orchid (*Habenaria repens*)--This plant is listed as threatened by the FDA and often occurs in the understory of tributary forests. It is common along the eastern part of the Payne Creek floodplain. Water spider orchid is a weedy species which is common throughout peninsula Florida. However, it was not found on the Hardee Unit 3 site. Although no plants were seen, this annual could easily establish itself during or after construction due to the wind blown dust-like seeds.

Hartwrightia (*Hartwrightia floridana*)--This species is under review (Category 2) for listing by USFWS and is listed as threatened by FDA. This plant occurs in natural, wet, open, boggy areas and seems to favor acidic conditions. The proposed site has been mined and does not seem to be a likely habitat.

Golden Polypody (*Phlebodium aureum*)--This plant is listed as threatened by FDA. This epiphytic fern occurs mostly in the boots at the bases of fronds of cabbage palm. This species is common throughout southern and central peninsula Florida. Its northward limit is determined by freezing temperatures. In years with warm winters, it extends almost to the Georgia border along the coast. This common species spreads by means of airborne spores. Although this species was not found on the Hardee Unit 3 site, it could probably be found on this site in warm years.

Wild Coco (*Pteroglossapsis ecristata*)--This plant is under review (Category 2) by USFWS and is listed as threatened by FDA. It is a tall, fall-blooming plant. Although found in the surrounding area in sandy habitats, it would not likely be found on the proposed site due to recent mining activities.

<u>Red Needle-Leaf Air Plant (*Tillandsia setacea*)</u>--This epiphyte is listed as threatened by FDA. It is quite common in the central and southern peninsula of Florida. This epiphyte has been observed in nearby forests. The only trees onsite of sufficient size to support this species are within the tributary on the western edge of the proposed site. A close examination of the trees in the tributary yielded no sightings. In some cases, the trees contained dense populations of ball-moss (*Tillandsia recurvata*) and Spanish-moss (*Tillandsia usneoides*); therefore, locating any red needle-leaf air plant was almost impossible.

<u>Shoestring Fern (*Vittaria lineata*)</u>--This epiphytic fern is listed as threatened by FDA. Like golden polypody, it occurs in central and southern peninsula Florida with its northern limit in the upper peninsula determined by freezing temperatures. It is of frequent occurrence and is often found on cabbage palm trunks. The only habitat protected from cold is the forested portion of the tributary along the west edge of the proposed site. No plants were seen, but this species could easily become established from wind-blown spores.

Three listed species of ferns were found within the forested areas of the tributary along the west boundary of the proposed site: cinnamon fern (*Osmunda cinnamomea*), listed as commercially exploited by FDA, hairy maiden fern (*Thelypteris hispidula*), and spreading tri-vein fern (*Thelypteris interrupta*). The latter two ferns are both listed as threatened by FDA. None of these species should be affected by construction because the tributary will be minimally disturbed. All three of these common ferns prefer moist to wet shady conditions. Their airborne spores allow them to occur throughout Florida.

<u>Fauna</u>

There are a number of federal and state listed animal species (Table 2.3.6-10) whose ranges include the site and areas around the site. The following describes those species whose ranges include the site area. The probability of their occurrence is assessed.

<u>Bachman's Sparrow (*Aimophila aestivalis*)</u>--The Bachman sparrow is under review for listing by USFWS but substantial evidence of vulnerability is lacking (C2). It occurs in upland habitat. The likelihood for occurrence is low because of the lack of suitable habitat onsite.

Limpkin (*Aramus guarauna*)--The limpkin is listed as a species of special concern by FGFWFC. It is a wetlands species. The likelihood for occurrence is moderate because of the presence of suitable habitat in the area.

Burrowing Owl (*Athene cunicularia*)--The burrowing owl, listed as a species of special concern by FGFWFC, was not observed during the HPS or the Hardee Unit 3 surveys. Suitable habitat (e.g. ruderal areas such as pasture) is present, but the likelihood of occurrence is low because of past and present mining activities.

Little Blue Heron (*Egretta caerulea*)--The little blue heron is under review for listing by USFWS; however, substantial evidence of vulnerability is lacking (C2), and it is listed as a species of special concern by FGFWFC. It is a wetlands species. The likelihood for occurrence is moderate because of the presence of suitable habitat in the area.

Snowy Egret (*Egretta thula*)--The snowy egret is listed as a species of special concern by FGFWFC. It is a wetlands species. The likelihood for occurrence is moderate because of the presence of suitable habitat in the area.

Tricolor Heron (*Egretta tricolor*)--The tricolor heron is listed as a species of special concern by FGFWFC. It is a wetlands species. The likelihood for occurrence is moderate because of the presence of suitable habitat in the area.

Peregrine Falcon (*Falco peregrinus*)--The peregrine falcon is listed as threatened by USFWS and as endangered by FGFWFC. It is found in upland and wetland habitats. The likelihood of occurrence onsite is low because of development activities associated with the site area.

Southeastern American Kestrel (*Falco sparverius paulus*)--The Southeastern American kestrel is listed as threatened by FGFWFC and is under review for listing by USFWS, but substantial evidence of vulnerability is lacking (C2). Two subspecies of kestrels occur in Florida. Eastern American kestrel is a winter resident only, while the Southeastern American kestrel is a year-round resident occupying upland and wetland habitats. In 1988 and 1989, American kestrels (*Falco sparverius*) were found to be fairly common in the open pasture of the HPS site, but their subspecies could not be determined. The likelihood of occurrence is low because of the low-quality habitat onsite.

Florida Sandhill Crane (*Grus canadensis pratensis*)--The Florida sandhill crane is listed as threatened by FGFWFC. It is a wetlands and dry prairie species.

Bald Eagle (*Haliaeetus leucocephalus*)--The bald eagle is listed as threatened by FGFWFC and endangered by USFWS. The closest nests are approximately 6.5 km (4 miles) southeast and 8 km (5 miles) north of the Hardee Unit 3 site. Bald eagles utilize open water habitats in the area for feeding. No nesting habitat occurs on the Hardee Unit 3 site. Some of the trees in the wetland tributary onsite may be large enough to be used for occasional roosting sites. The likelihood of occurrence onsite is very low because of the lack of suitable nesting habitat.

Wood Stork (*Mycteria americana*)--Listed as endangered by both FGFWFC and USFWS. Several birds were observed circling overhead during surveys. A rookery occurs several miles north of the site. Nesting habitat does not occur onsite. Suitable feeding habitat (e.g. wetland areas) is present onsite and in the vicinity. The likelihood of occurrence for feeding is considered moderate because of feeding habitats on the HPS site.

Audubon's Crested Caracara (*Polyboros plancus audobonii*)--The crested caracara is listed as threatened by both FGFWFC and USFWS. It was not observed during the 1988 and 1989 surveys, but has been recorded within 4.8 km (3 miles) of the study site, and suitable feeding habitat (e.g., pasture) occurs onsite. The likelihood of occurrence for feeding is considered low because of the development activities on the HPS site.

Florida Long-Tailed Weasel (*Musteal frenata peninsulae*)--The long-tailed weasel is listed as C2 by USFWS, and was not observed. However, mesic hardwood forest along creeks may provide suitable habitat. The likelihood of occurrence onsite is considered low because of the lack of suitable habitat.

Round-Tailed Muskrat (*Neofiber alleni*)--The round-tailed muskrat is listed as under review for listing by USFWS but substantial evidence of vulnerability is lacking (C2). It is found in wetland habitats, particularly floodplain marshes. The likelihood of occurrence onsite is low because of the development activities associated with the site.

<u>Eastern Indigo Snake (*Drymarchon corais couperi*)</u>--The eastern indigo snake is listed as threatened by both FGFWFC and USFWS. In 1988 and 1989 it was observed in palmetto on lands to be mined and has been reported in other areas within 8 km (5 miles) of study site. The mesic hardwood forest provide suitable habitat. The likelihood of occurrence onsite is low because of lack of suitable habitat.

<u>American Alligator (*Alligator mississippiensis*)</u>--The alligator is listed as threatened due to similarity of appearance by USFWS and listed as a species of special concern by FGFWFC. This species is commonly associated with wetland and freshwater areas and has been seen in the cooling reservoir and in the tributary wetland. The likelihood for occurrence on the Hardee Unit 3 site is high.

In summary, there are a number of federally and state listed plants and animals that are associated with the Hardee Unit 3 site. This is not surprising because of the presence of the adjacent wetland and the presence of these species in the vicinity of the site. The wetland tributary contains one commercially exploited fern species and two threatened species of fern. All three species are common in the area and can reestablish themselves from air-borne spores. A number of wetland dependent animal species have the potential to use the wetland tributary for resting and feeding. These species are also common to the area and use other similar habitats which are found throughout the surrounding region.

2.3.6.2 PRE-EXISTING STRESSES

2.3.6.2.1 <u>Aquatic Systems</u>

Payne Creek is located in an area of extensive phosphate mining. Prior to construction of the HPS site, extensive mining took place north and east of the HPS site on either side of Payne Creek. Since that time reclamation has occurred or is being completed in these areas. Historically, Payne Creek has been altered by ditching of its tributaries for agricultural operations, and, more recently, by the elimination of tributaries as a result of mining.

2.3.6.2.2 Terrestrial Systems

The greatest pre-existing stress to regional vegetation, including the site, is the result of extensive phosphate mining. Not only the vegetation, but the natural topography, soils, and hydrology are extensively altered. Wildlife habitat is disrupted and natural drainage features are modified. Active mining is occurring in the vicinity of the site. Areas surrounding the site have been reclaimed. Reclamation land uses consist predominantly of pasture, lakes, and wetlands.

Agriculture is another industry influencing natural vegetation and wildlife in the area. Agriculture is likely to be the dominant industry when mining operations are complete. Cattle ranching and citrus and vegetable farming are the major agricultural enterprises (TPS/SECI, 1989).

2.3.6.3 MEASUREMENT PROGRAMS

2.3.6.3.1 Aquatic Ecology

The baseline aquatic ecology program was designed to characterize the surface waters which may be potentially impacted by inputs of cooling reservoir discharges and stormwater runoff from the proposed plant. This program supplemented the biological data collected during the certification of the HPS (TPS/SECI, 1989). Because sufficient baseline aquatic ecology data were collected for the HPS existing units to characterize Payne Creek and associated tributaries, additional baseline monitoring was not conducted. Site reconnaissances of Payne Creek were made in October and November 1993 to verify the relative health of the stream ecosystem as compared to conditions in the 1988 study.

2.3.6.3.2 Terrestrial Ecology

The site has been mined, reclaimed, and the HPS existing units built. Therefore, site reconnaissances were made on October and November 1993 to confirm floral and faunal present, as well as listed species as described in the previous study (TPS/SECI, 1989).

Jurisdictional wetland boundaries were flagged in the fall of 1993 and confirmed by SWFWMD, FDEP, and USACE in February 1994 (see supplemental wetland information in Appendix 10.1.4).

Table 2.3.6-1. Characterization of Ecological Assemblages of Fishes Collected in Upper Payne Creek in 1988 and 1989

Scientific Name	Common Name	Ecological Assemblages		
		Vegetation	Open Water	Benthic
Elassoma evergladei	Everglades pygmi sunfish	X		
Fundulus chrysotus	Golden topminnow	X		
Fundulus seminolis	Seminole killifish	X		
Gambusia holbrooki	Mosquito fish	X		
Heterandria formosa	Least killifish	X		
Jordanella floridae	Flagfish	X		
Lepisosteus platyrinchus	Florida gar	X		
Lucania goodei	Bluefin killifish	X		
Poecilia latipinna	Sailfin molly	X		
Lepomis gulosus	Warmouth	X	X	
Lepomis macrochirus	Bluegill	X	X	
Lepomis marginatus	Dollar sunfish	X	X	
Lepomis microlophus	Redear sunfish	X	X	
Lepomis punctatus	Spotted sunfish	X	X	
Labidesthes sicculus	Brook silverside		X	
Notemigonus crysoleucas	Golden shiner		X	
Notropis emiliae	Pugnose minnow		X	
Notropis petersoni	Coastal minnow		X	
Clarias batrachus	Walking catfish			X
Etheostoma fusiforme	Swamp darter			X
Ictalurus natalis	Yellow bullhead			X
Noturus gyrinus	Tadpole madtom			X

Sources: TPS/SECI, 1989.
KBN, 1994.

Table 2.3.6-2. Density, Diversity, and Number of Taxa of Macroinvertebrates Collected from Payne Creek Using Artificial Substrates During October/November 1988 and February/March 1989

	October/November 1988			February/March 1989		
	PC-1	PC-2	PC-3	PC-1	PC-2	PC-3
Density[a]	14,296	23,247	[b]	31,821	23,385	7,006
Diversity	3.62	3.14	[b]	2.74	3.58	4.11
Number of Taxa	32	39	[b]	34	39	38
Percent Composition						
Ephemeroptera	5	2	[b]	<1	4	8
Chironomidae	64	89	[b]	80	91	81
Mollusca	<1	<1	[b]	<1	2	4
Other	30	8	[b]	18	3	7

[a] Per square meter.
[b] Samples vandalized.

Source: TPS/SECI, 1989.

Table 2.3.6-3. Density, Diversity, and Number of Taxa of Macroinvertebrates Collected from Payne Creek by Ponar Grab Samples in October 1988 and February 1989

	October/November 1988			February/March 1989		
	PC-1	PC-2	PC-3	PC-1	PC-2	PC-3
Density[a]	13,090	12,090	3,636	27,270	26,906	2,818
Diversity	3.38	4.50	2.07	4.02	4.14	3.75
Number of Taxa	35	47	11	32	35	18
Percent Composition						
Oligochaeta	28	12	61	14	6	19
Ephemeroptera	8	20	<1	3	5	1
Chironomidae	7	21	11	52	61	74
Mollusca	47	38	26	13	7	1
Other	10	9	1	18	21	5

[a] Per square meter.

Source: TPS/SECI, 1989.

Table 2.3.6-4. Macroinvertebrates Collected in Qualitative Dip Net Samples from Payne Creek During October 1988 and February 1989 (Page 1 of 2)

Scientific Name	Common Name	October 1988			February 1989		
		PC-1	PC-2	PC-3	PC-1	PC-2	PC-3
Turbellaria	Flatworm		F	F			
Prostoma rubrum	Probiscus worm			P			
Lumbriculidae	Aquatic earthworm						P
Tubificidae	Aquatic earthworm		P	P			
Hirunidea	Aquatic earthworm						P
Batracobdella phalera	leech	P		P			
Hyalella azteca	Scud	F	C	C		F	C
Gammaridae	Scud	P					
Cambarinae	Crayfish		C	P		F	
Palaenometes paludosus	Shrimp	P	C	AA	C	C	AA
Perlidae	Stonefly		P				
Baetis sp.	Mayfly	A	F				
Callibaetis floridanus	Mayfly			F			
Pseudocloeon alachua	Mayfly						P
Caenis diminuta	Mayfly	A		P			
Stenacron interpunctatum	Mayfly	F		C			
Stenonema spp.	Mayfly		P				
S. exiguum	Mayfly				F		
Chloroterpes hubbelli	Mayfly		F				
Tricorythodes albilineatus	Mayfly				P		
Hetaerina sp.	Damselfly						F
Argia sedula	Damselfly				F	P	F
Anomalagrion hastatum	Damselfly					F	
Nehallenia sp.	Damselfly	A		P	F	P	F
Aeschnidae	Dragonfly			P			
Gomphus minutus	Dragonfly		P		P		
Hagenius brevistypus	Dragonfly				P		
Brachymesia gravida	Dragonfly	F			P	F	
Macromia sp.	Dragonfly		P			F	F
M. taeniolata	Dragonfly				F	F	
Cheumatopsyche sp.	Caddisfly	AA			AA		
Hydropsyche sp.	Caddisfly						F
Hydroptilidae	Caddisfly						
Cyrnellus sp.	Caddisfly		F				
Polycentropus sp.	Caddisfly			P		F	
Homoptera	True bug			P			
Pelocoris sp.	True bug			F			
Ranatra sp.	True bug					C	F
Lepidoptera	Aquatic Caterpillar		F	P		F	F
Chrysomelidae	Weevil beetle		F				
Dubiraphia sp.	Riffle beetle	C					
Heterelmis vulnerata	Riffle beetle	P				P	
Stenelmis fusca group	Riffle beetle						
Gyrinidae	Whirligid beetle	F					
Dineutus sp. (larvae)	Whirligid beetle	F					P

Table 2.3.6-4. Macroinvertebrates Collected in Qualitative Dip Net Samples from Payne Creek During October 1988 and February 1989 (Page 2 of 2)

Scientific Name	Common Name	October 1988			February 1989		
		PC-1	PC-2	PC-3	PC-1	PC-2	PC-3
Haliplidae	Crawling beetle		F	C			
Helodida	Beetle			P	C	F	
Noteridae	Burrowing water beetle						F
Ceratopogonidae	Biting midges						
Chirionomidae	Midges	AA	AA	AA	AA	AA	A
Simulium sp.	Blackflies						P
Stratiomyiidae	Soldier flies			F			
Tabanidae	Horseflies		F				
Tipulidae	Craneflies			P		P	
Laevipex floridana	Limpet		P	P			
Pseudosuccinea columella	Pond snail		P				
Planorbella scalaris	Mesa rams-horn	P		P			
Pomacea paludosa	Apple snail			P			P
Corbicula fluminea	Asiatic clam		F		P	F	P

Note: AA = very abundant (>20 organisms).
A = abundant (11 to 20 organisms).
C = common (6 to 10 organisms).
F = few (2 to 5 organisms).
P = present (1 organism).

Source: TPS/SECI, 1989.

Table 2.3.6-5. Plant Species[a] Abundance in Payne Creek Floodplain at the HPS Site (number of plots = 4)

Stratum/Species	Abundance Measurements			
Trees	Total Basal Area (cm^2/m^2)	Average Basal Area (cm^2)	Total Density per m^2	Importance Value[b] (%)
Quercus laurifolia	15,652	711.5	22	82.4
Liquidambar styraciflua	1,074	214.8	5	11.2
Fraxinus caroliniana	50	25.1	2	3.1
Quercus nigra	77	76.9	1	1.7
Persea borbonia	23	22.9	1	1.6
Total	42.5		.08	

Shrubs Layer	Total Density	Frequency	Importance Value[c] (%)
Serenoa repens	57	100	32.6
Smilax bona-nox	47	50	22.5
Baccharis glomeruliflora	13	75	14.4
Smilax auriculata	23	50	14.4
Liquidambar styraciflua	5	75	11.6
Quercus laurifolia	3	25	4.5
Total	1.5		

Ground Layer	Percent Cover per m^2 plot	Frequency	Importance Value[d] (%)
Panicum rigidulum	80	25	39.1
Urena lobata	50	25	29.1
Acer rubrum	10	25	15.9
Pteridium aquilinum	10	25	15.9

[a] See Table 2.3.5-1 for common name.
[b] Importance value of trees = (Relative Basal Area + Relative Density) ÷ 2.
[c] Importance value of shrub layer = (Relative Density + Relative Frequency) ÷ 2.
[d] Importance value of ground layer = (Relative Percent Cover + Relative Frequency) ÷ 2.

Source: TPS/SECI, 1989.

Table 2.3.6-6. Mammal Species Observed or Which Potentially Occur in the Vicinity of the HPS Site

Common Name	Scientific Name	Mesic Hardwoods	Pasture	Upland Oak-Palmetto
Opossum	*Didelphis virginiana*	P	P	P
Least shrew	*Cryptotis parva*			
Shorttail shrew	*Blarina brevicauda*	P	P	P
Eastern mole	*Scalopus aquaticus*		P	P
Big brown bat	*Eptesicus fuscus*	P	P	P
Seminole bat	*Lasiurus seminolus*	P	P	P
Eastern yellow bat	*Lasiurns intermedius*	P	P	P
Evening bat	*Nycticeius humeralis*	P	P	P
Eastern big-eared bat	*Plectotus rafinesquei*		P	P
Mexican free-tailed bat	*Tadarida braziliensis*		P	P
Black bear	*Ursus braziliensis*	P		P
Raccoon	*Procyon lotor*	O		P
Longtail weasel[a]	*Mustela frenata*	P		
Mink	*Mustela vison*	P		
River otter	*Lutra canadensis*	O		
Spotted skunk	*Spilogale putorius*	P		P
Striped skunk	*Mephitis mephitis*	P		P
Gray fox	*Urocyon cinereoargenteus*	P	P	P
Bobcat	*Lynx rufus*	O	P	P
Eastern gray squirrel	*Sciurus carolinensis*	O		O
Eastern fox squirrel	*Sciurus niger*	P		P
Southern flying squirrel	*Glaucomys volans*	P		
Southeastern pocket gopher	*Geomys pinetis*		P	P
Eastern harvest mouse	*Reithrodontomys humulis*		P	
Cotton mouse	*Peromyscus gossypinus*	P		
Florida mouse	*Peromyscus floridanus*		P	P
Eastern woodrat	*Neotoma floridana*	P	P	P
Rice rat	*Oryzomys palustris*	P		
Hispid cotton rat	*Sigmodon hispidus*		P	P
Round-tailed muskrat[a]	*Neofiber alleni*	P		
Eastern cottontail	*Sylvilagus floridanus*	P	P	P
Marsh rabbit	*Sylvilagus palustris*	P		
White-tailed deer	*Odocoileus virginianus*	P	P	P
Armadillo	*Dasypus novemcinctus*	O	O	O
Wild hog	*Sus scrofa*	O	O	O

Note: O = observed on the site.
P = potentially occurring on the site.

[a] Listed species. See Table 2.3.6-10.

Source: TPS/SECI, 1989.

Table 2.3.6-7. Birds Observed or Which Potentially Occur in the Vicinity of the HPS Site (Page 1 of 2)

Common Name	Scientific Name	Forested Wetlands	Pasture	Upland Oak-Palmetto	Water Bodies	Seasonal Status[a]
Double-Crested Cormorant	*Phalacrocorax auritus*				P	P
White Pelican	*Pelecanus erythrorhynchos*				P	W
Limpkin[b]	*Aramus guarauna*	P			P	R
Little Blue Heron[b]	*Egretta caerulea*	P			O	R
Snowy Egret[b]	*Egretta thula*	P			O	R
Tricolored Heron[b]	*Egretta tricolor*	P			P	R
Florida Sandhill Crane[b]	*Grus canadensis pratensis*	P	P		O	R
Wood Stork[b]	*Mycteria americana*	P			O	R
Killdeer	*Charadrius vociferus*		O			RW
Red-Shouldered Hawk	*Buteo lineatus*	O	O	P		R
Red-Tailed Hawk	*Buteo jamaicensis*	P	O	P		R
American Kestrel[b]	*Falco sparverius*	P	O			RW
Peregrine Falcon[b]	*Falco peregrinus*	P	P		P	W
Bald Eagle[b]	*Haliaeetus leucocephalus*	P			O	R
Black Vulture	*Coragypes atratus*	P	P	P	O	RW
Audubon's Crested Caracara[b]	*Polyborus plancus*		P			R
Burrowing Owl[b]	*Athene cunicularia floridana*					R
Northern Bobwhite	*Colinus virginianus*	O	P	P		RW
Belted Kingfisher	*Megaceryle alcyon*	O				W
Red-Bellied Woodpecker	*Melanerpes carolinus*	O	O	P		R
Downy Woodpecker	*Picoides pubescens*	O	O	O		R
Pileated Woodpecker	*Dryocopus pileatus*	O				R
Yellow-Bellied Sapsucker	*Sphyrapicus varius*	O		P		W
Great Crested Flycatcher	*Myiarchus crinitus*	O				S
Eastern Phoebe	*Sayornis phoebe*	O				W
Tree Swallow	*Iridoprocne bicolor*	O		O		R
Blue Jay	*Cyanocitta cristata*	O	O	O		R
Tufted Titmouse	*Parus bicolor*	O		O		R
Carolina Wren	*Thyrothorus ludovicianus*	O		P		R
House Wren	*Troglodytes aedon*	O	O			W
Ruby Crowned Kinglet	*Regulus calendula*	O		O		W
Blue-Gray Gnatcatcher	*Polioptila caerulea*	O		O		RW
Brown Thrasher	*Toxostoma rufum*	O				R
Northern Mockingbird	*Mimus polyglottos*	O	O	P		R
Gray Catbird	*Dumetella carolinensis*	O	O			W

Table 2.3.6-7. Birds Observed or Which Potentially Occur in the Vicinity of the HPS Site (Page 2 of 2)

Common Name	Scientific Name	Forested Wetlands	Pasture	Upland Oak-Palmetto	Water Bodies	Seasonal Status[a]
Loggerhead Shrike	*Lanius ludovicianus*		O			R
White-Eyed Vireo	*Vireo griseus*	O	O			R
Black-and-White Warbler	*Mniotila varia*	O				W
Yellow-Throated Warbler	*Dendroica dominica*	O				W
Yellow-Rumped Warbler	*Dendroica coronata*	O				W
Palm Warbler	*Dendroica palmarum*	O	O	P		W
Common Yellowthroat	*Geothlypis trichas*	O				R
Red-Winged Blackbird	*Agelaius phoeniceus*		O			R
Eastern Meadowlark	*Sturnella magna*		O			R
Northern Cardinal	*Cardinalis cardinalis*	O		O		R
Rufous-Sided Towhee	*Pipilo erythropthalmus*	O	P	P		RW
Henslows Sparrow	*Ammodramus henslowii*		O			W
Bachman's sparrow[b]	*Aimophila aestivalis*		P			R

Note: O = observed on the site.
P = potentially occurring on the site.

[a] Seasonal Status:
W = winter resident.
S = summer resident.
R = year-round resident.
RW = resident in area but numbers augmented by wintering birds from the north.

[b] Listed species. See Table 2.3.6-10.

Source: TPS/SECI, 1989.

Table 2.3.6-8. Terrestrial Reptiles and Amphibians Observed or Which Potentially Occur in the Vicinity of the HPS Site (Page 1 of 2)

Common Name	Scientific Name	Mesic Hardwoods	Open Pine-Pasture	Upland Oak-Palmetto
Eastern coachwhip	*Masticophis flagellum*	P	P	P
Florida pine snake	*Pituophis melaneucus mugitus*			P
Yellow rat snake	*Elaphe obsoleta quadrivittata*	P		P
Corn snake	*Elaphe guttata guttata*	P	P	P
Florida scarlet snake	*Cemophora coccinea coccinea*		P	P
Scarlet king snake	*Lampropeltis triangulum elapsoides*			P
Florida king snake	*Lampropeltis getulus floridana*	P		
Short-tailed snake	*Stilosoma extenuatum*			P
Peninsula crowned snake	*Tantilla relicta*	P		P
Eastern Indigo snake[a]	*Drymarchon corais couperi*	P		P
Florida cottonmouth	*Agkistrodon piscivorous conanti*	P		
Dusky pygmy rattlesnake	*Sistrurus miliaris barbouri*	P	P	
Eastern diamondback rattlesnake	*Crotalus adamanteus*	P	P	P
Eastern coral snake	*Micrurus fulvius fulvius*	P	P	P
Southern dusky salamander	*Desmognathus auriculatus*	P		
Slimy salamander	*Plethodon glutinosus*	P		
Dwarf salamander	*Eurycea quadridigitata*	P		
Eastern spadefoot toad	*Scaphiopus holbrooki*		P	P
Eastern narrowmouth toad	*Gastrophyrne carolinensis*	P		
Southern toad	*Bufo terrestris*	P	P	P
Oak toad	*Bufo quericus*	P	P	P
Florida box turtle	*Terrepene carolina bauri*	P	P	
Gopher tortoise	*Gopherus polyphemus*	P	P	P
American alligator[a]	*Alligator mississippiensis*	O		
Green anole	*Anolis carolinensis*	O		P
Southern fence lizard	*Sceloperus undulatus undulatus*	P		P
Ground skink	*Scincella laterale*	P		P
Southeastern five-lined skink	*Eumeces inexpectatus*	P		P
Peninsula mole skink	*Eumeces egregins onocrepis*		P	P
Six-line race runner	*Cnemidophorus sexlineatus*		P	P
Eastern glass lizard	*Ophisaurus ventralis*	P	P	
Island glass lizard	*Ophisaurus compressus*		P	P
Slender glass lizard	*Ophisaurus attenuatus*		P	
Worm lizard	*Rhineura floridana*		P	P
Florida green water snake	*Nerodia cyclopian floridana*	P		
Brown water snake	*Nerodia taxispilota*	P		
Florida water snake	*Nerodia sipedon pictiventris*	P		
Florida brown snake	*Storeria dekayi victa*	P		P
Eastern garter snake	*Thamnophis sirtalis*	P		
Peninsula ribbon snake	*Thamnophis sauritus*	P		
Pine woods snake	*Rhadinaea flavilata*	P		
Florida red-bellied snake	*Storeria occipitomaculata*	P	P	
Eastern hognose snake	*Heterodon platyrhinos*		P	P
Southern hognose snake	*Heterodon simus*		P	P
Southern ringneck snake	*Diadophis punctatus*	P		
Rough green snake	*Opheodrys aestivus*	P		
Southern black racer	*Colaber constrictor priapus*	P	P	P
Barking treefrog	*Hyla gratiosa*	P		

Table 2.3.6-8. Terrestrial Reptiles and Amphibians Observed or Which Potentially Occur in the Vicinity of the HPS Site (Page 2 of 2)

Common Name	Scientific Name	Mesic Hardwoods	Open Pine-Pasture	Upland Oak-Palmetto
Green treefrog	*Hyla cinerea*	O		
Squirrel treefrog	*Hyla squirella*	P		
Pine woods treefrog	*Hyla femoralis*	P		
Florida chorus frog	*Psuedracris negrita verrucosa*	P		
Bullfrog	*Rana catesbeiana*	O		
Pig frog	*Rana grylio*	P		
Southern leopard frog	*Rana sphenocephala*	O		
Florida gopher frog	*Rana areolat aesopus*	P		

Note: O = observed on the site.
P = potentially occurring on the site.

[a] Listed species. See Table 2.3.6-10.

Source: TPS/SECI, 1989.

Table 2.3.6-9. Threatened and Endangered Plant Species Potentially Occurring on or Near the Hardee Unit 3 Site

Scientific Name	Common Name	Status[a] USFWS	Status[a] FDA	General Habitat Association	Probability of Occurrence[b]
Habenaria repens	Water spider orchid		T	Wetlands	M
Hartwrightia floridana	Hartwrightia	C2	T	Marsh grassland or boggy swales Blooms Sept-Nov	L
Phlebodium aureum	Golden polypody		T	Epiphytic in hammocks	M
Pteroglossapsis ecristata	Wild coco	C2	T	Dry sandy pinelands Blooms in Fall	L
Tillandsia setacea	Red needle-leaf air plant		T	Epiphytic in hammocks	M
Vittaria lineata	Shoestring fern		T	Epiphytic in hammocks	M
Osmunda cinnamomum	Cinnamon fern		CE	Moist, shady forests	P
Thelypteris hispidula	Hairy maiden fern		T	Moist, shady forests	P
Thelypteris interrupta	Spreading tri-vein fern		T	Moist, shady forests	P

Note: FDA = Florida Department of Agriculture and Consumer Services.
USFWS = U.S. Fish and Wildlife Service.

[a] Status: C2 = under review for listing by USFWS, but substantial evidence of biological vulnerability and/or threat is lacking.
CE = commercially exploited.
T = threatened.

[b] Probability of occurrence onsite:
L = low probability of presence.
M = moderate probability of presence.
P = present on site.

Source: KBN, 1994.

Table 2.3.6-10. Federal and State Listed Animal Species Occurring or Potentially Occurring On or Near the Hardee Unit 3 Site

Scientific Name Common Name	Status[a] USFWS	FGFWFC	General Habitat Association	Probability of Occurrence[b]
Bird				
Aimophila aestivalis Bachman's sparrow	C2		Upland	L
Aramus guarauna limpkin		SSC	Wetland	M
Athene cunicularia floridana burrowing owl		SSC	Upland	L
Egretta caerulea little blue heron	C2	SSC	Wetland	M
Egretta thula snowy egret		SSC	Wetland	M
Egretta tricolor tricolored heron		SSC	Wetland	M
Falco peregrinus peregrine falcon	T	E	Upland Wetland Freshwater	L
Falco sparverius paulus Southeastern American kestrel	C2	T	Upland Wetland	L
Grus canadensis pratensis Florida sandhill crane		T	Upland Wetland	L
Haliaeetus leucocephalus bald eagle	E	T	Upland Wetland Freshwater	L
Mycteria americana wood stork	E	E	Wetland	M
Polyborus plancus Audubon's crested caracara	T	T	Upland Wetland	L
Mammal				
Mustela frenata peninsulae Florida long-tailed weasel	C2		Upland Wetland	L
Neofiber alleni round-tailed muskrat	C2		Wetland	L
Reptile				
Drymarchon corais couperi Eastern Indigo snake	T	T	Upland Wetland	L
Alligator mississippiensis American alligator	TSA	SSC	Wetland Freshwater	H

Note: FGFWFC = Florida Game and Fresh Water Fish Commission.
USFWS = U.S. Fish and Wildlife Service.

[a] Status:
C2 = under review.
E = endangered.
SSC = species of special concern.
T = threatened.
TSA = threatened due to similarity of appearance.

[b] Probability of Occurrence:
H = high probability.
L = low probability.
M = moderate probability.

Source: KBN, 1994.

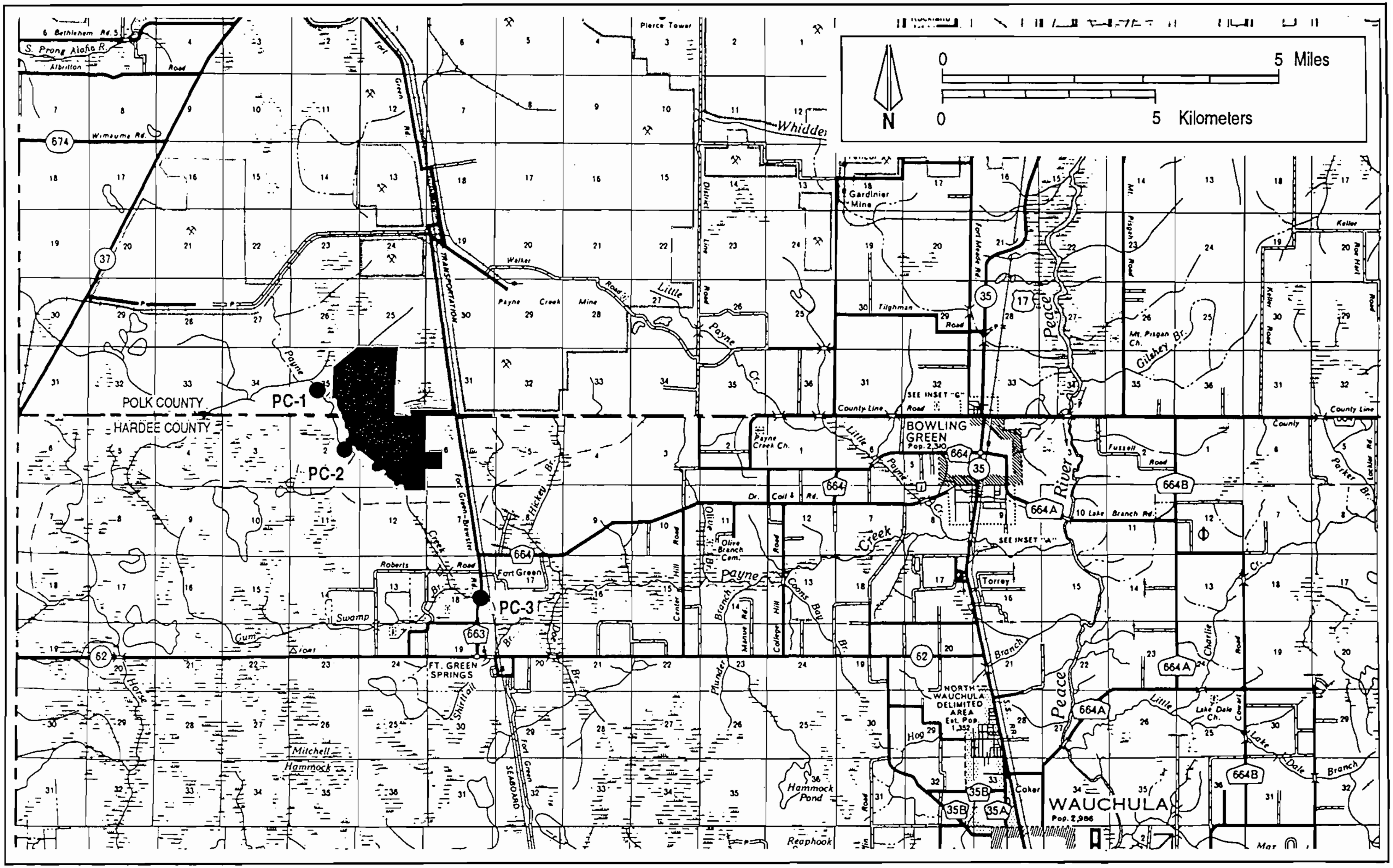

Figure 2.3.6-1
Aquatic Ecology Sampling Station Locations

Source: TPS/SECI, 1989.

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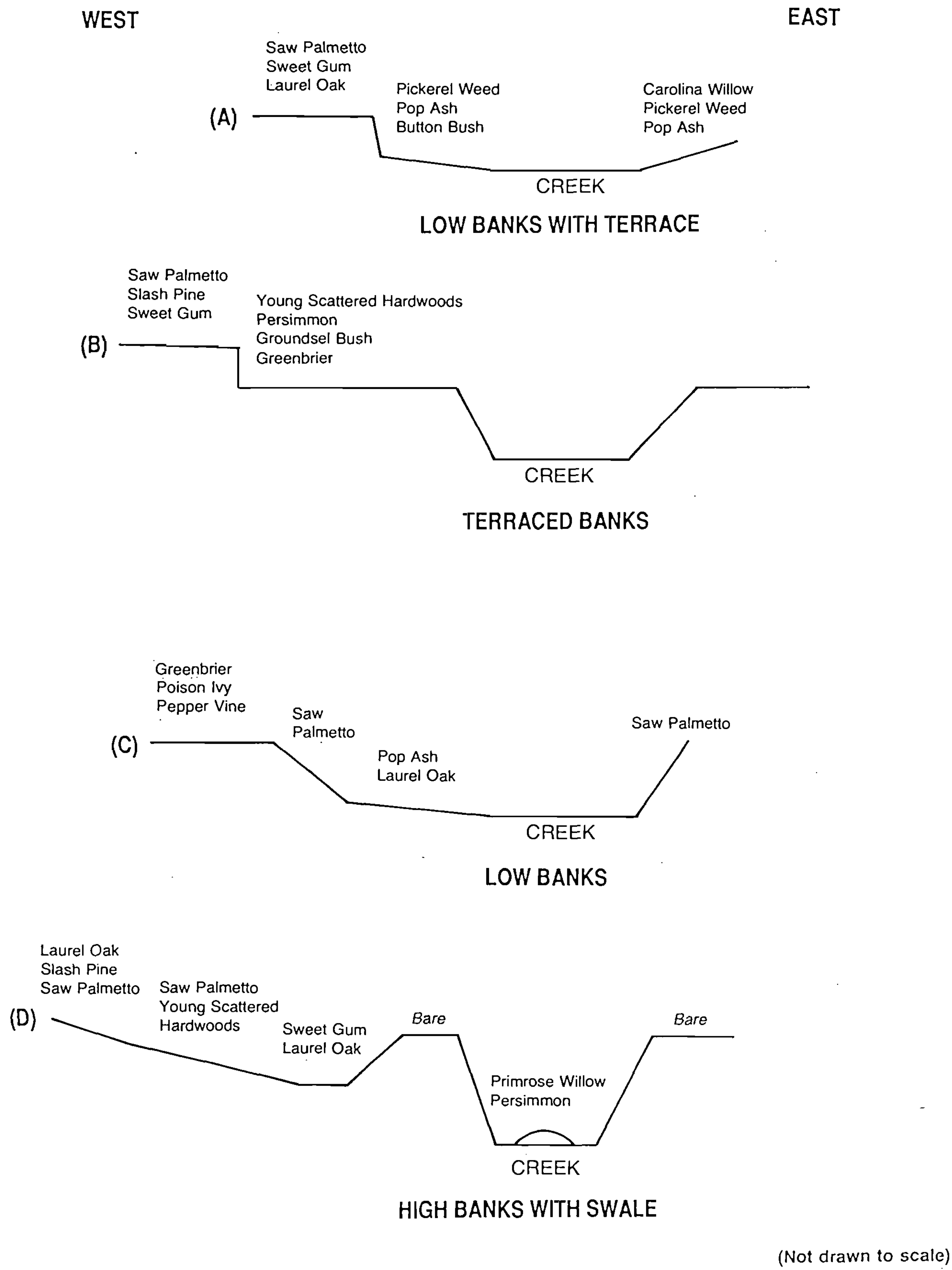

Figure 2.3.6-2
Generalized Relationship of Plant Species to Payne Creek Floodplain Configurations

Source: TPS/SECI, 1989.

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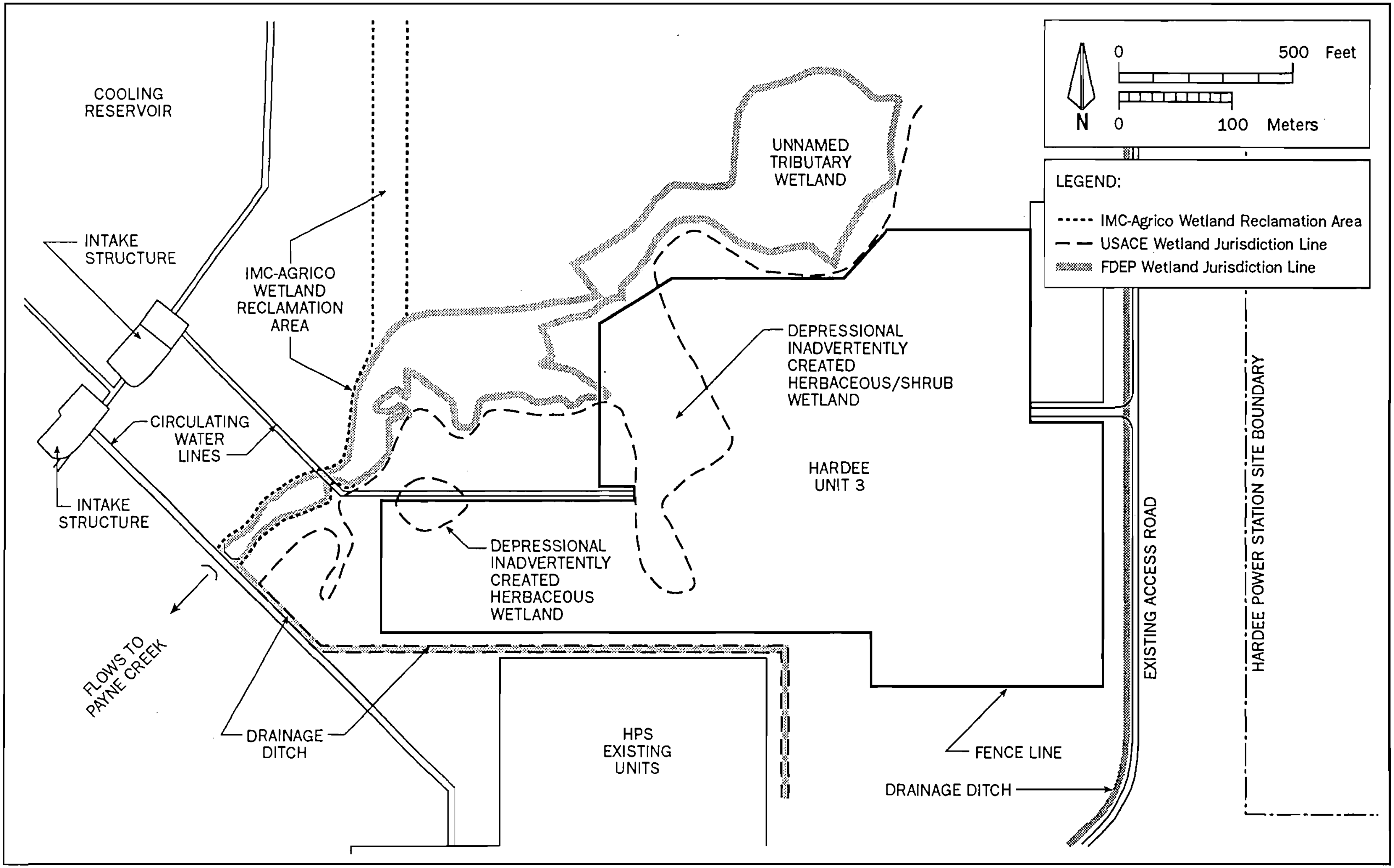

Figure 2.3.6-3
Location of Jurisdictional Wetlands

Source: KBN, 1994.

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2.3.7 METEOROLOGY AND AMBIENT AIR QUALITY

2.3.7.1 METEOROLOGY

The meteorological data collected at existing monitoring stations were used to describe the local and regional climatology in the vicinity of the proposed Hardee Unit 3 Project. The closest existing meteorological station to the HPS site with complete meteorological data is the primary National Weather Service (NWS) station located at the Tampa International Airport situated approximately 67 km (42 miles) to the west-northwest of the proposed plant site. NWS has recorded weather observations for more than 40 years at this site, and these data are the most complete for and representative of the region surrounding the proposed project. FDEP has approved the use of these meteorological data in previous air permit applications for this area and recommended that these data be used for this project.

2.3.7.1.1 Temperature

The climate in the Tampa area, including the project site, is subtropical with a marine influence from the Gulf of Mexico. Temperature means and extremes for Tampa are presented in Table 2.3.7-1. The mean annual temperature is approximately 22°C (72°F) with monthly temperatures varying from a maximum of 32.2°C (90.0°F) to a minimum of 10.7°C (51.3°F). Record extreme temperatures range from a low of -7.8°C (18°F) to a record high of 37°C (99°F). Although the sun's elevation is nearly zenith during the summertime, temperatures do not exceed 38°C (100°F). The reason can be attributed to the high relative humidities with subsequent cloud cover formation and the abundant convective-type precipitation.

2.3.7.1.2 Relative Humidity and Precipitation

Relative humidities, which indicate the amount of moisture in the air at a given temperature, are presented in Table 2.3.7-2 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 are also presented in Table 2.3.7-2. Approximately 69 percent of the annual precipitation falls during the 6 warmest months, May through October. The mean annual precipitation is approximately 122 cm (48 inches), but this has varied from as little as

74 cm (29 inches) to over 193 cm (76 inches) in the past 46 years. The majority of rain is in the form of short-lived convection showers.

2.3.7.1.3 Wind Patterns

The Tampa area lies entirely within the trade wind belt (i.e., below 30°N latitude), resulting in predominant winds from the east. However, because of the location of the Gulf of Mexico, moderate to strong late afternoon sea breezes occur on days with strong land heating producing local onshore winds (i.e., wind with a westerly component). Annual and seasonal windroses for the 5-year period from 1982 through 1986 are given in Figures 2.3.7-1 and 2.3.7-2. A summary of the average wind speeds for each season and throughout the year, including calm conditions, is presented in Table 2.3.7-3.

2.3.7.1.4 Atmospheric Stability

Atmospheric stability is a measure of the atmosphere's capability to disperse pollutants. During the daytime with strong insolation, the atmosphere can disperse pollutants very quickly for a relatively short period of time. This condition is considered as very unstable and generally occurs infrequently during the year. During the nighttime under clear skies and light wind speeds, the atmosphere is considered stable with minimal potential to disperse pollutants. Under moderate to high wind speeds, pollutants are dispersed at moderate rates under neutral conditions, which are generally more prevalent throughout the year and can occur any time throughout the day.

The seasonal and annual average occurrences of atmospheric stability classes are shown in Table 2.3.7-4.

During the summer months, unstable stability occurs nearly 40 percent of the time due to strong insolation, whereas unstable stability occurs only 16 percent of the time in the winter months. Neutral stability occurs most frequently during the winter months due to the higher wind speeds in this season. The occurrence of stable stability is nearly uniform throughout the year, with a maximum occurrence of approximately 47 percent in the fall.

2.3.7.1.5 Mixing Height

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 depths for Tampa determined using the Holzworth method are listed in Table 2.3.7-5. The highest afternoon mixing depths occur in the spring and the lowest morning depths occur in mid-winter.

2.3.7.1.6 Severe Storms

Thunderstorms are the most frequent of severe storms, occurring an average of 87 days per year. These storms occur throughout the year, but about 88 percent occur from May through October.

In the 80-km (50-mile) coastal strip from above Pinellas County to Tampa Bay, there is less than a 10 percent chance that a tropical storm will pass over the Bay area during any given year. For storms of hurricane strength [i.e., wind speeds exceeding 117 km/hr (73 mph)], the chance decreases to 1 in 16 (i.e., 6.2 percent) with a 1 percent chance that the winds will be greater than 200 km/hr (124 mph) (i.e., wind speeds of a great hurricane).

Statistics compiled by the Severe Local Storms (SELS) branch of the National Severe Storms Forecast Center (Pautz, 1969) show that 42 tornadoes were spotted within the 1° latitude by 1° longitude square centered just south of the Tampa area from 1955 to 1967. This averages approximately two tornadoes per year. The tornado recurrence interval for any specific point location within the 1° square was estimated by the methodology of Thom (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

2.3.7.2.1 Ambient Standards

The existing applicable national and Florida ambient air quality standards (AAQS) are presented in Table 2.3.7-6. Primary national AAQS were promulgated to protect the public health, and secondary national AAQS were promulgated to protect the public welfare from any known or anticipated adverse effects associated with the presence of pollutants in the ambient air. Areas of the country in violation of AAQS are designated as nonattainment areas, and new sources to be located in or near these areas may be subject to more stringent air permitting requirements.

Hardee County is classified as an attainment area for all criteria pollutants. Adjacent counties, such as Polk County, are also classified as attainment areas for all criteria pollutants. The nearest nonattainment areas to the project site are Hillsborough and Pinellas counties, which are classified as nonattainment for ozone, and a portion of Pinellas County, which is classified as nonattainment for lead.

Prevention of significant deterioration (PSD) review is used to determine whether significant air quality deterioration will result from the new or modified source located in attainment areas. Under federal PSD review requirements, all major new or modified sources of air pollutants regulated under the Clean Air Act (CAA) must be reviewed and approved by EPA or an agency delegated with PSD review authority. In Florida, FDEP has been delegated PSD review authority by EPA.

In promulgating the 1977 CAA Amendments, Congress specified that certain increases above an air quality *baseline concentration* level of sulfur dioxide (SO_2) and particulate matter (PM) concentrations 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 have an impact. Three classifications were designated based on criteria established in the CAA Amendments. Initially, Congress promulgated areas as either Class I [international parks, national wilderness areas, and memorial parks larger than 2,024 ha (5,000 acres), and national parks larger than 2,428 ha (6,000 acres)] or as Class II (all areas not designated as Class I). No Class III areas, which would be allowed greater deterioration than Class II areas, were designated. EPA then promulgated as regulations the requirements for classifications and area designations.

On October 17, 1988, EPA promulgated regulations to prevent significant deterioration due to NO_x emissions and established PSD increments for NO_2 concentrations. The EPA class designations and allowable PSD increments are presented in Table 2.3.7-7. Florida has adopted the EPA allowable increments for PM, SO_2, and NO_2. On June 3, 1993, EPA promulgated regulations to establish PSD increments for PM with an aerodynamic diameter of 10 micrometers (μm) or less (PM10). These regulations become effective 1 year from the promulgation date or earlier if adopted by Florida; Florida has not yet adopted these regulations.

The term *baseline concentration* evolves from federal and state PSD regulations and denotes a fictitious concentration level corresponding to specified baseline data and certain additional baseline sources. By definition in the PSD regulations, as amended August 7, 1980, 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 SO_2 and PM emissions of major stationary sources which commenced construction before January 6, 1975 and NO_x emissions before February 8, 1988 but were not in operation by the applicable baseline date.

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

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

Baseline date means the earliest date after August 7, 1977 for SO_2, total suspended particulate (TSP), and PM10 concentrations and February 8, 1988 for NO_2 concentrations, on which the first complete application under 40 CFR 52.21 is submitted by a major stationary source or major modification subject to the requirements of 40 CFR 52.21.

2.3.7.2.2 Ambient Air Quality Data

FDEP has approved an exemption from PSD ambient air quality monitoring for this project. The request was made in the Environmental Licensing Plan of Study (KBN, 1993) and FDEP approved the monitoring exemption in October 1993 (FDEP, 1993). The exemption is appropriate because:

1. The facility's impacts of applicable pollutants are expected to be below the *de minimis* impact levels for certain pollutants (e.g. CO, NO_2). For those pollutants, an exemption from monitoring is available under FDEP rules [17-2.500(3)(e) F.A.C.] for impacts less than *de minimis* impact levels;

2. For those pollutants above the *de minimis* impact levels (i.e., SO_2 and PM10), existing ambient data collected by FDEP, Tampa Electric Company, and FPC are representative of air quality at the project site; and
3. The air dispersion modeling and monitoring analyses for the HPS, proposed to operate at a 660-MW capacity (currently permitted for 295 MW), was exempt from performing preconstruction monitoring. For that project, ambient data collected by FDEP were used to satisfy the preconstruction monitoring requirements. Since the proposed project will have lower emissions and impacts than those considered for HPS, preconstruction monitoring is not warranted since baseline conditions have essentially remained the same since the HPS was originally permitted.

FDEP operates a statewide ambient air monitoring network with monitoring stations nearest to the project site located in Polk County. The network in Polk County consists of several monitoring stations that measure SO_2 and O_3 concentrations. Ambient SO_2 concentrations are measured at monitoring stations located in Mulberry, approximately 28 km (17 miles) from the project site, and in Nichols, located approximately 24 km (15 miles) from the project site. Ambient O_3 concentrations are measured at two monitoring stations, both located in Lakeland, approximately 33 km (21 miles) and 43 km (27 miles) from the project site.

Over the last several years, ambient data have been collected in the vicinity of the site by Tampa Electric Company and FPC. A 1-year program was conducted by Tampa Electric Company at two sites located approximately 10 km (6 miles) to the north of the project site. Ambient SO_2, PM10, and O_3 concentrations were measured from April 1991 through March 1992. A 1-year program was conducted by FPC at one site located approximately 23 km (14 miles) to the northeast of the project site. Ambient SO_2, PM10, and O_3 concentrations were measured from October 1991 through October 1992.

Summaries of observed SO_2, PM10, and O_3 concentrations measured at these stations from 1990 through 1992 are given in Tables 2.3.7-8 through 2.3.7-10.

The SO_2, PM10, and O_3 concentrations observed at these stations are within national and state AAQS. Because these monitors are located in more developed areas and/or in proximity [i.e., within 10 km (6.2 miles)] of major sources, the observed concentrations are considered to be higher than those expected to occur at the proposed facility site.

Given the rural nature of the site, existing concentrations of other criteria pollutants, i.e., carbon monoxide (CO), NO_2, and lead (Pb), which are usually associated with an urban environment, should be well below the AAQS.

2.3.7.2.3 Existing Air Pollutant Sources

The proposed plant location is in a rural area with minimal number of air pollution sources. The major source near the site is the HPS existing units located adjacent to the proposed site. The HPS existing units consist of a combined cycle unit (two CTs, associated HRSG, and steam turbine) and simple cycle unit (one CT) with a maximum permitted capacity of 295 MW. Other major air pollution sources are located within 15 km (9 miles) from the site in Polk County. These sources are mainly phosphate rock mining and beneficiation plants. Air pollutant emissions from these sources, in the form of fugitive dusts, are not significant.

Major sources that are proposed for the area include the Tampa Electric Company's Polk Power Station, located approximately 10 kilometers (km) (6 miles) to the north, and Florida Power Corporation's Polk County site, located approximately 19 km (12 miles) to the northeast of the site. The Tampa Electric Company's facility will consist of an integrated coal gasification combined cycle project with maximum electrical generating capacity of 260 MW. The FPC facility will initially consist of four combined cycle generating units with an electrical generating capacity of 470 MW. Both of these proposed facilities have undergone review in the SCA process; the SCAs were approved in January 1994 by the Site Certification Board, which consists of the Governor and State Cabinet.

Because SO_2 and PM concentrations were determined to be significant due to emissions from Hardee Unit 3 (see Section 5.6), a detailed review was conducted to determine SO_2 and PM emission sources located within 55 km (34 miles) of the proposed source. Based on emission data developed by FDEP from previous air permit applications, the major facilities located within 55 km (34 miles) of the site that have SO_2 or PM emissions greater than 20 tons per year (TPY) are presented in Tables 2.3.7-11 and 2.3.7-12, respectively.

Additional major emission sources located more than 55 km (34 miles) from the proposed source were also identified and considered in the air quality modeling analyses.

2.3.7.2.4 Background Concentrations

Background concentrations are air quality concentrations due to air pollutant sources not explicitly accounted for in the air modeling analysis. Because the site is located near very few major sources of SO_2 or PM emissions, background concentrations are expected to be low. As a result, existing monitoring data are used to estimate background concentrations. The ambient data are collected in areas that are more industrialized and have higher emission densities than the proposed site. Therefore, the estimated background concentrations are considered to be conservative (i.e., higher concentrations than actually exist at the proposed plant site).

For SO_2 concentrations, data collected in 1992 by FDEP during the periods that TECO and FPC conducted their monitoring programs were reviewed and used in estimating background concentrations. During these monitoring programs, the highest 3-hour, 24-hour, and annual average concentrations were 256, 50, and 11 $\mu g/m^3$, respectively (see Table 2.3.7-8). These concentrations were assumed to represent background concentrations.

Similar to the SO_2 concentrations, the PM10 background concentrations were derived from data collected in 1992 by FDEP during the periods that TECO and FPC conducted their monitoring programs. Based on the data review, the highest 24-hour and annual average concentrations of 70 and 20 $\mu g/m^3$ were assumed to represent background concentrations.

2.3.7.3 MEASUREMENT PROGRAMS

Since the proposed Hardee Unit 3 was exempted by FDEP from ambient air quality monitoring, all information (i.e., meteorology and air quality data) were compiled from offsite monitoring stations maintained and operated by cooperating governmental agencies or from FDEP-approved PSD monitoring programs operated by other air permit applicants. Ambient air quality data were obtained from FDEP which operates ambient air monitoring stations in Polk County. No significant changes in these programs are anticipated after Hardee Unit 3 goes into commercial operation.

Meteorological data were obtained from the NWS surface stations in Tampa and upper-air station in Ruskin. These data were obtained for a 5-year period from 1982 through 1986 from which the joint frequency of wind direction, wind speed, and atmospheric stability and a 5-year average of mixing heights were developed. Since 1965, the wind sensors have been located 6.7 m (22 ft) above grade. Regular surface observations are taken just before each hour, 7 days per week. Upper-air soundings are conducted twice per day at 0700 and 1900 Eastern Standard Time.

Table 2.3.7-1. Temperature Means and Extremes (°F) Measured at Tampa International Airport

Month	Daily Temperatures[a]			Extremes[b]	
	Mean	Maximum	Minimum	Maximum	Minimum
January	60.8	70.2	51.3	86	21
February	62.2	71.7	52.7	88	24
March	66.7	76.2	57.2	91	29
April	71.4	81.1	61.7	93	40
May	77.0	86.4	67.5	98	49
June	80.8	89.2	72.4	99	53
July	82.0	89.8	74.1	97	63
August	82.1	90.0	74.1	98	67
September	80.6	88.6	72.6	96	57
October	74.7	83.3	66.0	94	40
November	67.3	76.7	57.9	90	23
December	62.0	71.5	52.6	86	18
Annual	72.3	81.2	63.4	99	18

Note: °C = 5/9 (°F-32)

[a] 30-year period of record, 1963 to 1992.
[b] 46-year period of record, 1947 to 1992.

Source: NOAA, 1992.

Table 2.3.7-2. Precipitation and Diurnal Relative Humidity Measured at Tampa International Airport

Month	Precipitation (inches)			Humidity[c] (%) hour (LT)			
	Mean[a]	Maximum[b]	Minimum[b]	0100	0700	1300	1900
January	2.21	8.02	T	85	86	59	73
February	2.77	7.95	0.21	83	86	56	69
March	3.02	12.64	0.06	83	87	55	67
April	2.00	6.59	T	82	87	51	62
May	3.05	17.64	0.10	82	86	52	62
June	6.79	13.75	1.86	84	87	60	69
July	7.67	20.59	1.65	86	88	63	73
August	7.95	18.59	2.35	87	90	64	76
September	6.48	13.98	1.28	87	91	62	75
October	2.60	7.36	0.09	86	89	57	72
November	1.65	6.12	T	86	88	57	74
December	2.02	6.66	0.07	85	87	59	74
Annual	48.20	76.57	28.89	85	88	58	71

Note: LT = local time.
T = trace amount.

inches x 2.540 = cm.

[a] 30-year period of record, 1963 to 1992.
[b] 46-year period of record, 1947 to 1992.
[c] 29-year period of record, 1964 to 1992.

Source: NOAA, 1992.

Table 2.3.7-3. Wind Direction and Wind Speed Measured at Tampa International Airport[a]

Season	Average Wind Speed (mph)	Calm (%)	Prevailing Wind Direction	Prevailing Wind Average Wind Speed (mph)
Winter	7.9	6.7	East-northeast, East	7.6 7.9
Spring	8.3	6.4	East	8.4
Summer	6.4	10.2	East	6.4
Fall	7.2	7.0	East-northeast	7.7
Annual	7.5	7.6	East	7.6

Note: mph x 1.6093 = km/hr.

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

Source: NOAA, 1986.

Table 2.3.7-4. Occurrences of Atmospheric Stability Classes Determined at Tampa International Airport[a]

Season	Occurrence (%) of Stability Class					
	Very Unstable	Moderately Unstable	Slightly Unstable	Neutral	Slightly Stable	Moderately Stable
Winter	0.0	3.8	12.2	42.6	16.7	24.6
Spring	0.8	10.7	17.3	29.6	15.8	25.7
Summer	3.5	17.2	17.4	17.9	15.8	28.2
Fall	0.6	9.3	16.1	26.6	18.3	29.0
Annual	1.2	10.3	15.8	29.1	16.7	26.9

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

Source: NOAA, 1986.

Table 2.3.7-5. Morning and Afternoon Mixing Heights Determined at Tampa International Airport[a]

Season	Mixing Height (m)	
	Morning	Afternoon
Winter	464	1,041
Spring	562	1,500
Summer	760	1,428
Fall	565	1,305
Annual	588	1,320

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

Source: NOAA, 1986.

Table 2.3.7-6. National and State of Florida Ambient Air Quality Standards (AAQS)

Pollutant	Averaging Time	AAQS ($\mu g/m^3$) National Primary Standard	AAQS ($\mu g/m^3$) National Secondary Standard	AAQS ($\mu g/m^3$) 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	NA	10,000
	1-Hour Maximum[b]	40,000	NA	40,000
Nitrogen Dioxide	Annual Arithmetic Mean	100	100	100
Ozone	1-Hour Maximum[a]	235	235	235
Lead	Calendar Quarter	1.5	1.5	1.5

Note: NA = not applicable.
PM10 = particulate matter with an aerodynamic diameter ≤ 10 μm.
$\mu g/m^3$ = micrograms per cubic meter.

[a] Maximum concentration not to be exceeded more than an average of 1 calendar day per year.
[b] Maximum concentration not to be exceeded more than once per year.

Sources: 40 CFR, Parts 50 and 52.
Florida Administrative Code (F.A.C.), Chapter 17-2.

Table 2.3.7-7. Federal and State of Florida PSD Allowable Increments

Pollutant/Averaging Time	Allowable Increment ($\mu g/m^3$) 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)[c]			
Annual Arithmetic Mean	4	17	34
24-Hour Maximum[a]	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[b]			
Annual Arithmetic Mean	2.5	25	50

Note: PM10 = particulate matter with an aerodynamic diameter less than or equal to 10 μm.
TSP = total suspended particulate.

[a] Maximum concentration not to be exceeded more than once per year.
[b] Not yet adopted by the State of Florida.
[c] Final regulations were promulgated in Federal Register, 58 FR 31622, June 3, 1993; become effective one year after promulgation date or earlier if adopted by State of Florida.

Source: 40 CFR Part 52, Section 52.21.
Florida Administrative Code, Chapter 17-2.

Table 2.3.7-8. Ambient SO_2 Concentrations for Air Monitoring Stations Located Within 55 km of the Hardee Unit 3 Project--1990 to 1992

Location		Site	UTM Coordinates (km)[a]		Period		Number of	Concentration ($\mu g/m^3$)				
								3-Hour		24-Hour		
City	County	Number	East	North	Year	Months	Observations	1st	2nd	1st	2nd	Annual
Mulberry	Polk	2860-006-F02	405.5	3086.0	1992	January-December	8,655	256	151	39	38	10
			(1°; 28.3 km)		1991	February-December	7,118	203	176	42	40	12
Nichols	Polk	3680-010-F02	399.5	3081.3	1992	January-December	8,205	213	183	50	48	11
			(347°; 24.2 km)		1991	January-December	8,542	179	167	67	58	10
					1990	January-December	8,612	341	252	66	62	9
Lakeland	Polk	2160-004-F02	412.75	3108.5	1991	January-January	252	31	16	7	5	3
			(9°; 51.4 km)		1990	January-December	8,683	122	122	42	27	5
Homeland[b]	Polk	3680-037-J02	418.7	3076.35	1992	January-October	6,040	170	161	42	42	7
			(36°; 23.1 km)		1991	October-December	1,657	72	49	31	29	6
Nichols[c]	Polk	3680-036-J01	400.1	3066.2	1992	January-March	1,920	199	—	42	—	10
			(330°; 9.8 km)		1991	April-December	5,694	202	136	42	40	8

[a] Relative location to proposed Hardee Unit 3 east and north UTM coordinates (km) of 405.0 and 3057.7, respectively, given in parentheses.
[b] Monitoring station from Florida Power Corporation's Polk County site.
[c] Monitoring station from Tampa Electric Company's Polk Power Station site.

Sources: FDEP, 1990, 1991, 1992. KBN, 1994.

Table 2.3.7-9. Ambient PM10 Concentrations for Air Monitoring Stations Located Within 55 km of the Hardee Unit 3 Project--1991 to 1992

Location		Site Number	UTM Coordinates (km)[a]		Period		Number of Observations	Concentration ($\mu g/m^3$)		
								24-Hour		
City	County		East	North	Year	Months		1st	2nd	Annual
Homeland[b]	Polk	3680-037-J02	418.7	3076.35	1992	January-October	46	70	44	20
			(36°; 23.1 km)		1991	October-December	13	38	24	17
Homeland[b]	Polk	3680-037-J09	418.7	3076.35	1992	January-October	42	60	42	20
			(36°; 23.1 km)							
Nichols[c]	Polk	3680-035-J01	401.1	3067.4	1992	January-March	16	28	20	14
			(338°; 10.5 km)		1991	March-December	26	43	34	18
Nichols[c]	Polk	3680-036-J01	400.1	3066.2	1992	January-March	16	30	26	14
			(330°; 9.8 km)		1991	March-December	30	48	45	19

[a] Relative location to proposed Hardee Unit 3 east and north UTM coordinates (km) of 405.0 and 3057.7, respectively, given in parentheses.
[b] Monitoring station from Florida Power Corporation's Polk County site.
[c] Monitoring station from Tampa Electric Company's Polk Power Station site.

Sources: FDEP, 1990, 1991, 1992. KBN, 1994.

Table 2.3.7-10. Ambient O_3 Concentrations for Air Monitoring Stations Located Within 55 km of the Hardee Unit 3 Project--1991 to 1992

Location		Site Number	UTM Coordinates (km)[a]		Period		Number of Observations	Concentration [ppm (μg/m³)] 1-Hour	
City	County		East	North	Year	Months		1st	2nd
Lakeland	Polk	2160-005-G01	401.588	3090.755	1992	June-December	4,678	0.098 (192)	0.082 (161)
			(354°; 33.2 km)						
Lakeland	Polk	2160-006-G01	404.435	3100.652	1992	June-December	4,360	0.108 (212)	0.107 (210)
			(359°; 43.0 km)						
Homeland[b]	Polk	3680-037-J02	418.7	3076.35	1992	January-October	6,525	0.095 (186)	0.095 (186)
			(36°; 23.1 km)		1991	October-December	1,845	0.076 (149)	0.076 (149)
Nichols[c]	Polk	3680-036-J01	400.1	3066.2	1992	January-March	1,911	0.075 (147)	—
			(330°; 9.8 km)		1991	April-December	5,911	0.098 (192)	0.096 (188)

[a] Relative location to proposed Hardee Unit 3 east and north UTM coordinates (km) of 405.0 and 3057.7, respectively, given in parentheses.
[b] Monitoring station from Florida Power Corporation's Polk County site.
[c] Monitoring station from Tampa Electric Company's Polk Power Station site.

Sources: FDEP, 1990, 1991, 1992. KBN, 1994.

Table 2.3.7-11. SO_2 Emission Sources (>20 TPY) Within 55 km of the Hardee Unit 3 Project (Page 1 of 2)

			Coordinates Relative to Hardee Unit 3[a]				
	UTM Coordinates (km)		Cartesian (km)		Polar		Maximum Allowable Emissions[b]
Facility Name	East	North	X	Y	Distance (km)	Direction (degrees)	(TPY)
TPS Hardee Power Station (295 MW)[c]	404.8	3057.3	-0.2	-0.4	0.4	207	2,412
TECO - Polk Power Station[c]	402.5	3067.4	-2.5	9.7	10.0	345	2,010
Imperial Phosphate (Brewer)[c]	404.8	3069.5	-0.2	11.8	11.8	359	275
Gardinier Fort Meade	415.3	3063.3	10.3	5.6	11.7	61	1,173
IMC-Agrico Chem - S. Pierce[c]	407.5	3071.3	2.5	13.6	13.8	10	4,377
Mobil Mining - Big Four Mine[c]	394.8	3067.7	-10.2	10.0	14.3	314	589
U.S. Agri-Chemicals Ft. Meade[c]	416.0	3069.0	11.0	11.3	15.8	46	3,438
Central Florida Power	416.2	3069.2	11.2	11.5	16.1	46	38
City of Wauchula	418.4	3047.0	13.4	-10.7	17.1	129	180
FPC - Polk[c]	414.3	3073.9	9.3	16.2	18.7	30	859
Farmland Industries Green Bay[c]	409.5	3079.5	4.5	21.8	22.3	12	4,087
IMC Agrico Chem- New Wales[c]	396.6	3078.9	-8.4	21.2	22.8	338	13,921
Mulberry Cogeneration[c]	413.6	3080.6	8.6	22.9	24.5	21	464
IMC Agrico Chem - Noralyn Mine	414.7	3080.3	9.7	22.6	24.6	23	505
CF Industries Bartow - Bonnie Mine Road[c]	408.4	3082.4	3.4	24.7	24.9	8	4,982
Kaplan Industries	418.3	3079.3	13.3	21.6	25.4	32	398
American Orange Corp.	429.8	3047.3	24.8	-10.4	26.9	113	198
IMC Agrico/Conserve Nichols[c]	398.4	3084.2	-6.6	26.5	27.3	346	1,593
Mulberry Phosphates (Royster)[c]	406.8	3085.1	1.8	27.4	27.6	4	2,013
Geologic Recovery	401.8	3085.8	-3.2	28.1	28.3	354	98
Mobil Mining -Nichols[c]	398.4	3085.3	-6.6	27.6	28.4	347	2,304
Cargill/Seminole Fertilizer Bartow[c]	409.8	3087.0	4.8	29.3	29.7	9	5,000
IMC Fertilizer - Prairie	402.9	3087.0	-2.1	29.3	29.4	356	109
Orange Co.	418.7	3083.6	13.7	25.9	29.3	28	26
Imperial/Pavex Corp - W Bartow	413.0	3086.2	8.0	28.5	29.6	16	75
FPL - Manatee	367.2	3054.1	-37.8	-3.6	38.0	265	83,351
Laidlaw Env. Services	424.7	3091.9	19.7	34.2	39.5	30	240
Consolidated Minerals Plant City	393.8	3096.3	-11.2	38.6	40.2	344	809
Citrus Hill	447.9	3068.3	42.9	10.6	44.2	76	411
Cargill Citro-America	447.9	3068.3	42.9	10.6	44.2	76	223
Ridge Cogeneration[c]	416.7	3100.4	11.7	42.7	44.3	15	480
Lakeland City Power Larsen[c]	409.2	3102.8	4.2	45.1	45.2	5	5,024
TECO - Big Bend[c]	361.9	3075.0	-43.1	17.3	46.4	292	237,854
FPL-Avon Park	451.4	3050.5	46.4	-7.2	47.0	99	67
Macasphalt Winter Haven	423.1	3101.5	18.1	43.8	47.4	22	48

Table 2.3.7-11. SO_2 Emission Sources (>20 TPY) Within 55 km of the Hardee Unit 3 Project (Page 2 of 2)

			Coordinates Relative to Hardee Unit 3[a]				
	UTM Coordinates (km)		Cartesian (km)		Polar		Maximum Allowable Emissions[b]
Facility Name	East	North	X	Y	Distance (km)	Direction (degrees)	(TPY)
Cargill/Gardinier Riverview[c]	363.4	3082.4	-41.6	24.7	48.4	301	5,872
Lakeland City Power McIntosh[c]	408.5	3105.8	3.5	48.1	48.2	4	30,567
Auburndale Cogen[c]	420.8	3103.3	15.8	45.6	48.3	19	222
Owens-Brockway	423.4	3102.8	18.4	45.1	48.7	22	120
Coca Cola Auburndale	421.6	3103.7	16.6	46.0	48.9	20	709
Adams Packing Auburndale	421.1	3104.2	16.1	46.5	49.2	19	94
SFE Processing	421.7	3104.2	16.7	46.5	49.4	20	188
Hillsborough RRF[c]	368.2	3092.7	-36.8	35.0	50.8	314	771
CLM/Pacific Chloride	361.8	3088.3	-43.2	30.6	52.9	305	702
TECO - Gannon	360.0	3087.5	-45.0	29.8	54.0	304	93,265
Gulf Coast Lead	364.0	3093.5	-41.0	35.8	54.4	311	1,498
Alcoma Packing	451.6	3085.5	46.6	27.8	54.3	59	327
Additional Sources Outside 55 km Considered in Modeling Analysis							
Lafarge Corp.	357.7	3090.6	-47.3	32.9	57.6	305	20,293
TECO - Hookers Point	358.0	3091.0	-47.0	33.3	57.6	305	13,524
FPC - Bartow	342.4	3082.6	-62.6	24.9	67.4	292	62,618
FPC - Higgins	336.5	3098.4	-68.5	40.7	79.7	301	19,619
FPC - Intercession City[c]	446.3	3126.0	41.3	68.3	79.8	31	17,667

Note: Screening area of 55 km for the proposed unit is based on the project's estimated significant impact distance of 5 km plus 50 km.

[a] Proposed Hardee Unit 3 east and north UTM coordinates (km): 405.0 and 3057.7.
[b] Generally based on the facility's maximum hourly emission rate for entire year.
[c] A PSD increment-consuming source is located at this facility.

Source: KBN, 1994.

Table 2.3.7-12. Particulate Matter (PM) Emission Sources Within 55 km of the Hardee Unit 3 Project (Page 1 of 4)

			Coordinates Relative to Hardee Unit 3[a]				
					Polar		Maximum Allowable Emissions[b]
	UTM Coordinates (km)		Cartesian (km)		Distance	Direction	
Facility Name	East	North	X	Y	(km)	(degrees)	(TPY)
TPS Hardee Power Station (295 MW)[c]	404.8	3057.3	-0.2	-0.4	0.4	207	33
TECO Polk	402.5	3067.4	-2.5	9.7	10.0	346	438
Gardinier Fort Meade	415.3	3063.3	10.3	5.6	11.7	61	132
Imperial Phosphate (Brewer)[c]	404.8	3069.5	-0.2	11.8	11.8	359	162
IMC-Agrico Chemical South Pierce[c]	407.5	3071.3	2.5	13.6	13.8	10	858
Mobil Big Four Mine	394.8	3067.7	-10.2	10.0	14.3	314	68
US Agri-Chemicals Fort Meade[c]	416.0	3069.0	11.0	11.3	15.8	46	1,066
Central Florida Power	416.2	3069.2	11.2	11.5	16.1	46	47
Florida Privitization Inc	418.3	3048.0	13.3	-9.7	16.5	126	281
City of Wachula	418.4	3047.0	13.4	-10.7	17.1	129	21
Estech/Swift	411.5	3074.2	6.5	16.5	17.7	22	311
FPC-POLK[c]	414.3	3073.9	9.3	16.2	18.7	30	149
Estech-Duette Phosphate Mine	388.9	3047.2	-16.1	-10.5	19.2	237	751
IMC Kingsford	398.2	3075.7	-6.8	18.0	19.2	339	417
IMC-Agrico Chemical Co Pierce[c]	403.7	3079.0	-1.3	21.3	21.3	357	841
C & M Products Co	405.5	3079.1	0.5	21.4	21.4	1	162
Farmland Industries Green Bay Plant[c]	409.5	3079.5	4.5	21.8	22.3	12	503
IMC-Agrico New Wales	396.6	3078.9	-8.4	21.2	22.8	338	1,427
Ewell Ind Bonnie Mine Rd	407.7	3080.9	2.7	23.2	23.4	7	96
Mulberry Cogeneration[c]	413.6	3080.6	8.6	22.9	24.5	21	70
IMC-Agrico Noralyn Mine	414.7	3080.3	9.7	22.6	24.6	23	1,690
Ridge Pallets Inc	419.1	3078.1	14.1	20.4	24.8	35	96
CF Industries Bartow Bonnie Mine Road[c]	408.4	3082.4	3.4	24.7	24.9	8	1,748
Bio-Medical Service Corp of GA	413.9	3081.3	8.9	23.6	25.2	21	46
IMC/Uranium Recovery CF Industries[c]	408.4	3082.8	3.4	25.1	25.3	8	1,212
Kaplan Industries	418.3	3079.3	13.3	21.6	25.4	32	53
American Orange Corp	429.8	3047.3	24.8	-10.4	26.9	113	181
Orange Cogen[c]	414.8	3083.0	9.8	25.3	27.1	21	44
IMC-Agrico/Conserve Nichols[c]	398.4	3085.2	-6.6	26.5	27.3	346	1,598
Mulberry Phosphates (Royster)	406.8	3085.1	1.8	27.4	27.6	4	1,394
Kaiser Aluminum	408.3	3085.5	3.3	27.8	28.0	7	106
Mobil Mining & Minerals Nichols	398.4	3085.3	-6.6	27.6	28.4	347	991
Orange Co of Florida	418.7	3083.6	13.7	25.9	29.3	28	119
IMC Fertilizer Prairie	402.9	3087.0	-2.1	29.3	29.4	356	288
Purina Mills	402.0	3087.0	-3.0	29.3	29.5	354	88
Pavex	413.0	3086.2	8.0	28.5	29.6	16	44

Table 2.3.7-12. Particulate Matter (PM) Emission Sources Within 55 km of the Hardee Unit 3 Project (Page 2 of 4)

Facility Name	UTM Coordinates (km) East	UTM Coordinates (km) North	Coordinates Relative to Hardee Unit 3[a] Cartesian (km) X	Cartesian (km) Y	Polar Distance (km)	Polar Direction (degrees)	Maximum Allowable Emissions[b] (TPY)
Cargill/Seminole Fertilizer[c]	409.8	3087.0	4.8	29.3	29.7	9	544
Ridge Pallets Inc.	418.6	3084.1	13.6	26.4	29.7	27	165
US Agri-Chemicals Bartow[c]	413.2	3086.3	8.2	28.6	29.8	16	444
Florida Rock Industries	416.8	3085.8	11.8	28.1	30.5	23	57
Ewell Ind S Florida Ave	406.3	3092.9	1.3	35.2	35.2	2	348
All Sun Products	413.5	3093.8	8.5	36.1	37.1	13	318
FPL - Manatee	367.2	3054.1	-37.8	-3.6	38.0	265	40,765
Manatee Scrap Processing	366.9	3053.8	-38.1	-3.9	38.3	264	108
Sun Pac Foods	422.7	3092.6	17.7	34.9	39.1	27	62
Lykes Pasco Packing	412.4	3096.5	7.4	38.8	39.5	11	48
Consolidated Minerals Inc Plant City	393.8	3096.3	-11.2	38.6	40.2	344	749
Pavers Incorporated	414.0	3098.2	9.0	40.5	41.5	13	479
Schering Berlin Polymers	410.7	3098.9	5.7	41.2	41.6	8	30
Rinker Cencon Corp	412.4	3099.0	7.4	41.3	42.0	10	159
Quikrete of Florida	412.8	3099.0	7.8	41.3	42.0	11	253
Zipperer S. Agape Mortuary Services	363.0	3064.7	-42.0	7.0	42.6	279	21
Florida M&M	362.2	3066.2	-42.8	8.5	43.6	281	21
Alumax Extrusions	385.6	3097.0	-19.4	39.3	43.8	334	172
Ero Industries	427.5	3095.6	22.5	37.9	44.1	31	33
Citrus Hill Mfg	447.9	3068.3	42.9	10.6	44.2	76	66
Florida Brick & Clay Co	384.9	3097.1	-20.1	39.4	44.2	333	26
Ridge Cogeneration[c]	416.7	3100.4	11.7	42.7	44.3	15	414
Union Camp Corp	402.0	3102.0	-3.0	44.3	44.4	356	47
Amcon Concrete	364.0	3075.0	-41.0	17.3	44.5	293	39
Erly Juice Inc	399.0	3101.8	-6.0	44.1	44.5	352	117
Florida Tile	405.4	3102.4	0.4	44.7	44.7	1	309
C-Cure of Florida	386.0	3098.7	-19.0	41.0	45.2	335	21
Lakeland City Power Larsen[c]	409.2	3102.8	4.2	45.1	45.3	5	107
Monier Roof Tile	414.0	3102.5	9.0	44.8	45.7	11	44
Driggers Concrete	360.0	3065.9	-45.0	8.2	45.7	280	21
Palm Harbor Homes	391.8	3101.5	-13.2	43.8	45.7	343	22
Vigoro Industries	427.9	3097.4	22.9	39.7	45.8	30	136
Westcon	375.3	3092.8	-29.7	35.1	46.0	320	21
TECO Big Bend[c]	361.9	3075.0	-43.1	17.3	46.4	292	6,014
Citrus World	441.0	3087.3	36.0	29.6	46.6	51	601

Table 2.3.7-12. Particulate Matter (PM) Emission Sources Within 55 km of the Hardee Unit 3 Project (Page 3 of 4)

Facility Name	UTM Coordinates (km) East	UTM Coordinates (km) North	Coordinates Relative to Hardee Unit 3[a]: Cartesian (km) X	Cartesian (km) Y	Polar Distance (km)	Polar Direction (degrees)	Maximum Allowable Emissions[b] (TPY)
IMC-Agrico Chemical Big Bend	362.1	3076.1	-42.9	18.4	46.7	293	195
Macasphalt	423.1	3101.5	18.1	43.8	47.4	22	70
Florida Rock Industry	365.8	3085.0	-39.2	27.3	47.8	305	21
Lakeland City Power McIntosh[c]	408.5	3105.8	3.5	48.1	48.2	4	15,151
Auburndale Cogeneration[c]	420.8	3103.3	15.8	45.6	48.3	19	161
Florida Mining & Materials Alabama Lane	420.8	3103.4	15.8	45.7	48.4	19	40
Cargill/Gardinier Fertilizer Riverview	363.4	3082.4	-41.6	24.7	48.4	301	880
Owens-Brockway Glass Container	423.4	3102.8	18.4	45.1	48.7	22	189
Packaging Corp of America	423.4	3102.8	18.4	45.1	48.7	22	38
Coca Cola	421.6	3103.7	16.6	46.0	48.9	20	387
Adams Packing Association	421.1	3104.2	16.1	46.5	49.2	19	144
Eger Concrete Lake Ida & 5th St	428.1	3102.0	23.1	44.3	50.0	28	49
S I Lime Co Division of Longview Lime	362.9	3084.7	-42.1	27.0	50.0	303	48
R C Martin Concrete Products	368.6	3092.1	-36.4	34.4	50.1	313	28
Graves Enterprises Riverview	363.1	3085.3	-41.9	27.6	50.2	303	350
The Florida Brewery	422.8	3104.7	17.8	47.0	50.3	21	121
Hillsborough Co Resource Recovery	368.2	3092.7	-36.8	35.0	50.8	314	172
John Carlos Florida	426.2	3104.1	21.2	46.4	51.0	25	29
Reed Minerals Division	362.2	3085.5	-42.8	27.8	51.0	303	70
Eastern Electric Apparatus Repair Cp	366.6	3092.0	-38.4	34.3	51.5	312	21
Southeastern Galvanizing Division	368.5	3094.5	-36.5	36.8	51.8	315	21
City of Tampa Dept.	364.0	3089.5	-41.0	31.8	51.9	308	48
Kearney Development Company	368.7	3094.8	-36.3	37.1	51.9	316	21
Gaylord Container Corp	366.3	3092.3	-38.7	34.6	51.9	312	108
Southeastern Wire	368.3	3094.5	-36.7	36.8	52.0	315	21
GAF Building Materials Corp	362.2	3087.2	-42.8	29.5	52.0	305	57
Florida Rock Industries	428.0	3105.2	23.0	47.5	52.8	26	55
Leisey Shell Corp	352.7	3064.8	-52.3	7.1	52.8	278	20
Nitram	362.5	3089.0	-42.5	31.3	52.8	306	218
GNB Inc (PAC CHL)	361.8	3088.3	-43.2	30.6	52.9	305	25
Paktank Florida	360.8	3087.3	-44.2	29.6	53.2	304	178
Amcon Products	364.6	3092.8	-40.4	35.1	53.5	311	32
Florida Steel Corp	364.6	3092.8	-40.4	35.1	53.5	311	144
Bay Concrete	365.1	3093.8	-39.9	36.1	53.8	312	37
IMC Port Sutton Terminal	360.1	3087.5	-44.9	29.8	53.9	304	442

Table 2.3.7-12. Particulate Matter (PM) Emission Sources Within 55 km of the Hardee Unit 3 Project (Page 4 of 4)

			Coordinates Relative to Hardee Unit 3[a]				
	UTM Coordinates (km)		Cartesian (km)		Polar		Maximum Allowable Emissions[b]
Facility Name	East	North	X	Y	Distance (km)	Direction (degrees)	(TPY)
TECO Gannon	360.0	3087.5	-45.0	29.8	54.0	304	5,855
Florida Mega-Mix	364.5	3093.4	-40.5	35.7	54.0	311	22
CSX Transportation Inc	361.0	3089.0	-44.0	31.3	54.0	305	404
David J Joseph Co	364.0	3092.9	-41.0	35.2	54.0	311	123
The Gibson-Homans	365.5	3094.8	-39.5	37.1	54.2	313	21
Holman Inc	359.5	3087.3	-45.5	29.6	54.3	303	55
Holman Inc	359.3	3087.1	-45.7	29.4	54.3	303	54
Gulf Coast Lead	364.0	3093.5	-41.0	35.8	54.4	311	25
Eastern Association Terminal	360.2	3088.9	-44.8	31.2	54.6	305	534
Glen-Mar Concrete Products	363.2	3093.3	-41.8	35.6	54.9	310	22
Additional Sources Outside 55 km Considered in the Modeling Analysis							
TECO Hooker's Point	358.0	3091.0	-47.0	33.3	57.6	305	1,232
LaFarge Corp	357.7	3090.6	-47.3	32.9	57.6	305	1,207
CF Industries Zephyrhills	388.0	3116.0	-17.0	58.3	60.7	344	1,006
FPC - Bartow	342.4	3082.6	-62.6	24.9	67.4	292	9,244
FPC - Higgins	336.5	3098.4	-68.5	40.7	79.7	301	1,082
FPC - Intercession City[c]	446.3	3126.0	41.3	68.3	79.8	31	809

Note: Screening area of 55 km for the proposed unit is based on the project's estimated significant impact distance of 5 km plus 50 km.

[a] Proposed Hardee Unit 3 east and north UTM coordinates (km): 405.0 and 3057.7.
[b] Generally based on the facility's maximum hourly emission rate for entire year.
[c] A PSD increment-consuming source is located at this facility.

Source: KBN, 1994.

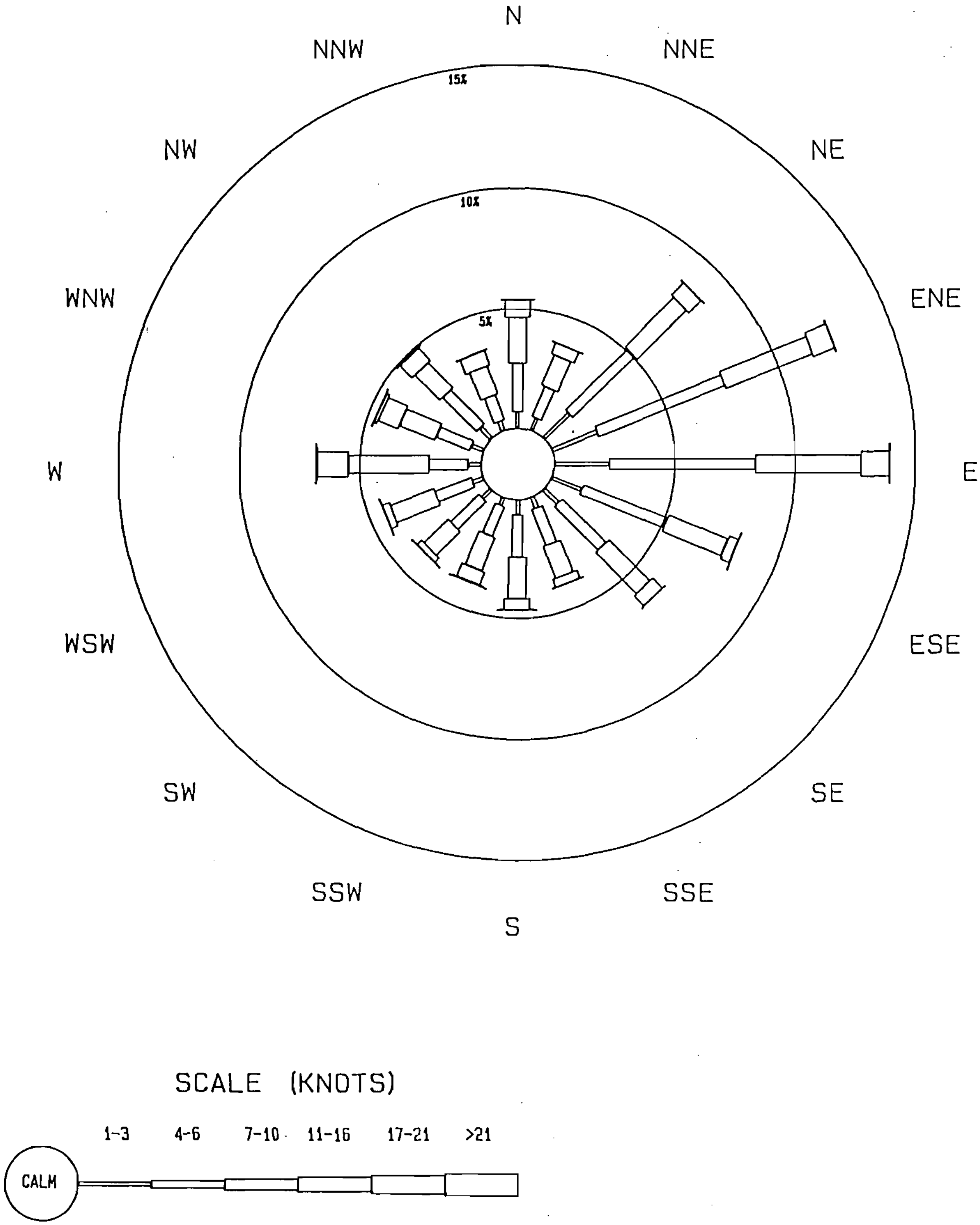

Figure 2.3.7-1
Annual Average Wind Frequency Distribution in Tampa, Florida, 1982–1986

Source: TPS/SECI, 1989.

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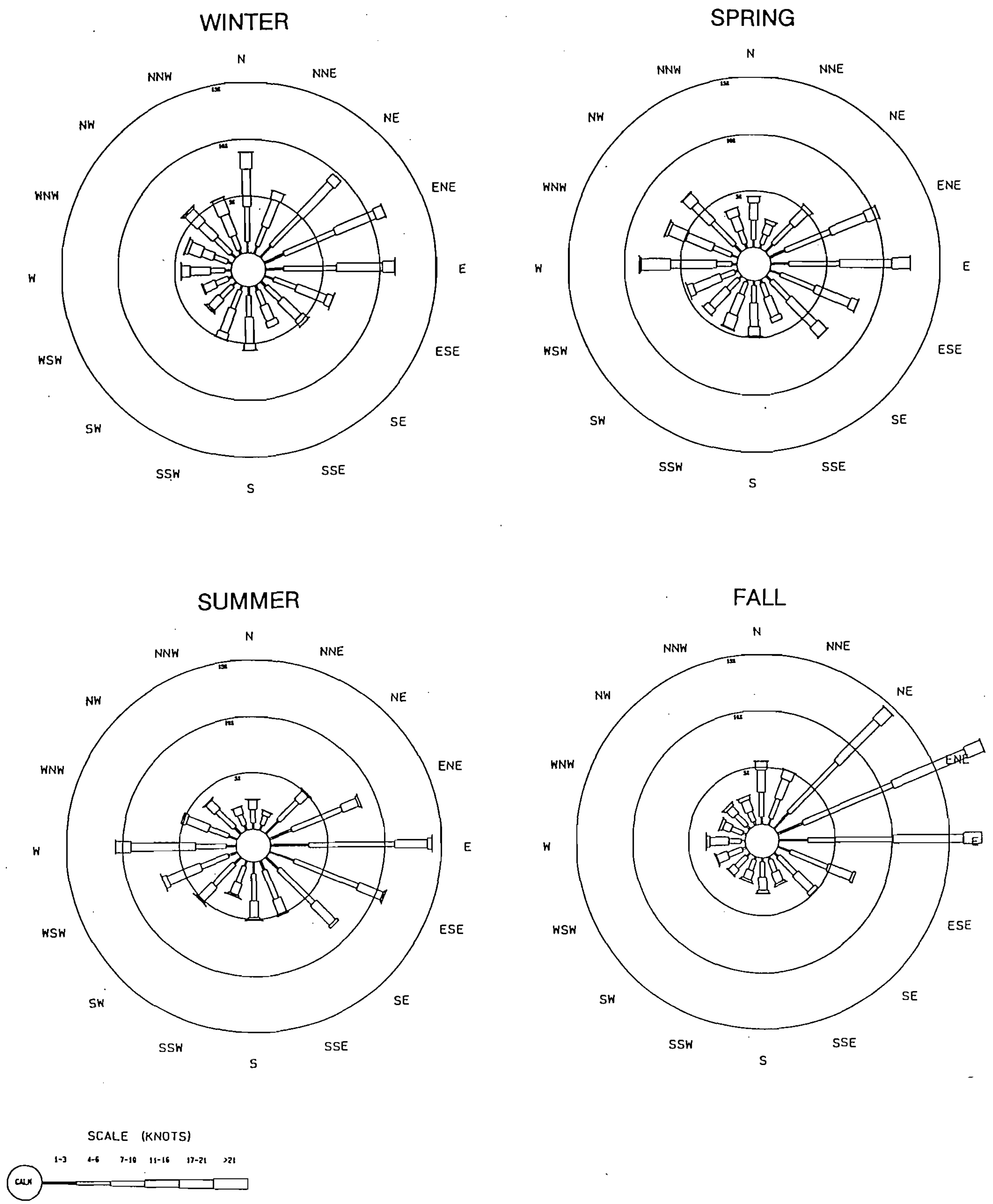

Figure 2.3.7-2
Seasonal Average Wind Frequency Distribution in Tampa, Florida, 1982–1986

Source: TPS/SECI, 1989.

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2.3.8 NOISE

2.3.8.1 BACKGROUND

The proposed facility is located in an isolated, undeveloped area (with the exception of the HPS existing units) of open-pit phosphate mining directly south of the Polk-Hardee County line. The unmined topography of woodland/grassland area is predominantly flat with the exception of overburden spoil mounds that range in length from a few meters to hundreds of meters. Directly west of the proposed site is the cooling water reservoir constructed as part of the HPS existing units. Most of the phosphate mining area is undeveloped with the closest residential receptor a little more than 1.6 km (1 mile) south of the proposed facility. Polk County has no adopted noise ordinances or standards, and the Hardee County noise performance standards to not apply to the receiving agriculturally zoned lands surrounding the HPS site.

2.3.8.2 NOISE MEASUREMENT PROCEDURES

An ambient noise monitoring program was performed using the slow response mode to obtain integrated, A-weighted sound pressure levels. A windscreen was used because all measurements were taken outside. The microphone was positioned so that a random incidence response, as specified by the American National Standard Institute (ANSI), was achieved. A continuous record of the sound level meter output data was made on the strip chart during all monitoring. This not only produced a continuous hard copy output of the Model 2230, but also provided a quality control check of the sound level meter operation during monitoring. Integrated sound pressure level (SPL) data consisting of three noise parameters were collected at each location.

- L_{eq} — The sound pressure level averaged over the measurement period; this parameter is the continuous steady sound pressure level that would have the same total acoustic energy as the real fluctuating noise over the same time period.
- Max — The maximum sound pressure level for the sampling period.
- Min — The minimum sound pressure level for the sampling period.

Monitoring was conducted using the sound level meter mounted on a tripod at a height of 1.2 m (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 time marks and comments could be recorded without disturbing or influencing the sound level measurement process. Local wind speed and temperature were measured by a handheld anemometer and thermometer during the monitoring period. Field notes were recorded during monitoring and included the local meteorological parameters and major noise sources.

A comprehensive baseline noise analysis survey to assess the existing ambient noise levels in the area of the proposed facility was conducted on the October 27 and 28, 1993. SPL data were collected at five different locations (Figure 2.3.8-1) using ANSI measurement techniques. The noise monitoring equipment used during the survey included:

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. Sound Level Meter Calibration Unit
   B&K Type 4230 Sound Level Calibrator, 94 decibels (Db) @ 1,000 hertz (Hz).

The B&K Type 2230 sound level meter complies with Type I--Precision requirements set forth by ANSI S1.4 for sound level meters. The specifications for this equipment are presented in Appendix 10.5.1.

The five monitoring locations represent sites that are:

1. At the four sides of the proposed Hardee Unit 3 site (Sites 1, 2, 3, and 4), and
2. Near the center of the proposed facility (Site 5).

Site 1 is located at the eastern boundary of the proposed facility, directly west of the access road to the HPS existing units. Site 2 is immediately south of the Polk-Hardee County line in Section 1, Range 24 East, Township 33 South. Site 3 is along the southeast corner of the HPS cooling reservoir. Site 4 is located approximately 244 m (800 ft) south of the general services building in between the proposed power block. This site is the closest monitoring site to a commercial receptor, the HPS existing units. Site 5 is situated approximately 122 m (400 ft) northeast of the general services building of Hardee Unit 3. The homes on Roberts Road are the closest non-commercial (residential) receptors to the plant site and are more than 1.6 km (1 mile) from the proposed facility.

Ambient SPLs were measured at various times during the day and night time for a minimum of 30 consecutive minutes at each of the five sites. The L_{eq} (equivalent sound pressure level averaged for the sampling period) as well as the maximum and minimum SPLs during each monitoring episode were recorded and are presented in Table 2.3.8-1. The average minimum, maximum, and L_{eq} SPLs for each site were calculated. The SPL averages were calculated using the following formula:

$$\text{Average SPL} = 10 \text{ Log } \frac{\sum_{i=1}^{N} 10^{(SPL_i/10)}}{N}$$

where: N = number of observations.

SPL_i = individual sound pressure level in data set.

Also included in Table 2.3.8-1 are the wind speed, wind direction, and microphone orientation as well as comments on events and observations occurring during the monitoring program. The SPL data were analyzed and reported in A-weighted decibels (DBA). The higher the decibel value, the louder the sound.

2.3.8.3 EXISTING AMBIENT SOUND PRESSURE LEVEL CONDITIONS

The baseline ambient L_{eq} SPLs in the area of the proposed facility ranged from a low of 39.4 DBA at Site 3 to a high of 54.9 DBA at Site 1. The minimum ambient values varied from 34.0 to 52.9 DBA at Sites 3 and 2, respectively. Sound sources in the proposed area included earthmoving equipment used in the reclamation of previously mined areas, aircraft traffic and vehicular traffic into HPS, as well as various types of songbirds and insects. The intensity of these various noise sources can vary significantly both spatially and temporally.

The HPS existing units were not in operation during the baseline noise study. The only noise emanating from the HPS existing facility was produced from auxiliary equipment (i.e., pumps and motors) and onsite vehicular traffic. However, subsequent baseline noise monitoring was performed when the existing units were in operation.

Table 2.3.8-1. Ambient Sound Pressure Level Data for the Hardee Unit 3 Site

Site No.	Date/Time	Wind Speed (mph)	Wind Direction (degrees)	Microphone Angle (degrees)	Sound Pressure Levels Min	Max	L_{eq}	Comments
1	10/27/93-1600	3-5	045	090	38.0	58.2	44.6	Cars (2)
	10/27/93-2150	0	—	090	50.8	69.4	54.9	Insect noises
	10/28/93-1040	2-4	270	090	36.6	72.9	44.4	Birds and airplanes
	11/30/93-1840	3-5	050	090	44.4	64.8	47.2	HPS existing unit[a]
				Average	46.0	69.0	50.2	
2	10/27/93-1810	2-4	000	180	39.3	61.7	44.0	Birds, heavy equipment
	10/27/93-2240	3-6	090	180	52.9	65.5	54.5	Diesel pump operating
	10/28/93-1010	3-6	270	180	42.5	53.6	45.7	Heavy equipment
	11/30/93-1907	3-8	225	000	47.8	63.0	50.0	HPS existing unit[a]
				Average	48.5	62.6	50.5	
3	10/27/93-1730	2-4	000	180	34.0	57.1	39.4	Red-wing blackbirds
	10/27/93-2210	3-6	090	180	50.1	70.0	52.2	Insect noises
	10/28/93-1150	3-6	270	180	34.8	64.9	45.8	Jets (4) and birds
	11/30/93-1935	3-8	225	270	39.6	57.1	47.0	HPS existing unit[a]
				Average	44.7	65.5	47.6	
4	10/27/93-1650	3-5	045	000	38.4	61.6	43.3	Airplane
	10/27/93-2310	3-6	090	000	47.0	72.1	51.0	Auxiliary equipment at plant
	10/28/93-0930	1-3	—	000	42.0	72.5	46.8	Birds and airplane
	11/30/93-1745	3-10	248	180	43.1	63.4	45.3	HPS existing unit[a]
				Average	43.7	69.7	47.3	
5	10/27/93-1520	3-5	045	180	40.1	52.1	44.0	Airplane
	10/27/93-2115	0	—	180	47.7	52.5	49.8	Insect noises
	10/28/93-0850	1-2	—	180	39.4	53.8	46.3	Birds and heavy equipment
	11/30/93-1813	2-7	248	180	45.8	54.0	48.7	HPS existing unit[a]
				Average	44.6	53.2	47.7	

[a] HPS existing units (two combustion turbines and the steam turbine) operating during monitoring.

Source: KBN, 1994.

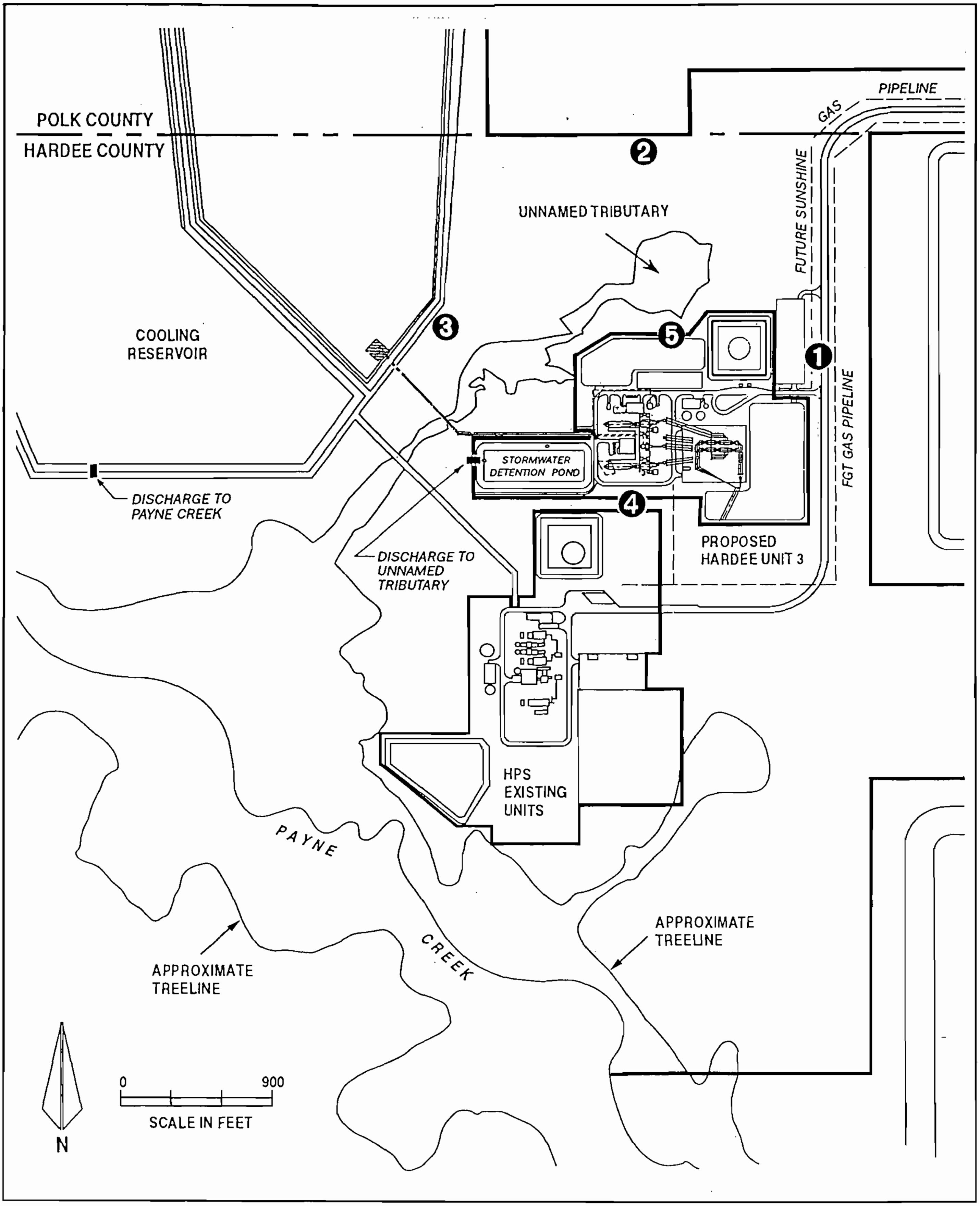

Figure 2.3.8-1
Baseline Noise Monitoring Locations

Source: KBN, 1994.

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2.3.9 OTHER ENVIRONMENTAL FEATURES

The previous sections describe the environmental features of the Hardee Unit 3 site.

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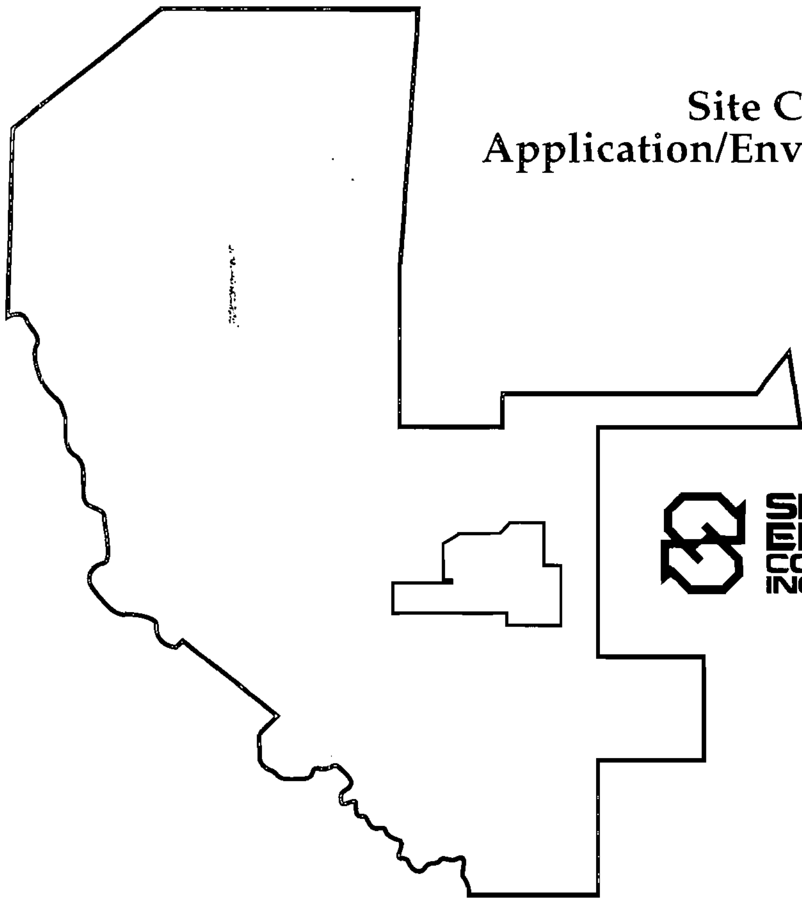
HARDEE UNIT 3

Site Certification Application/Environmental Analysis



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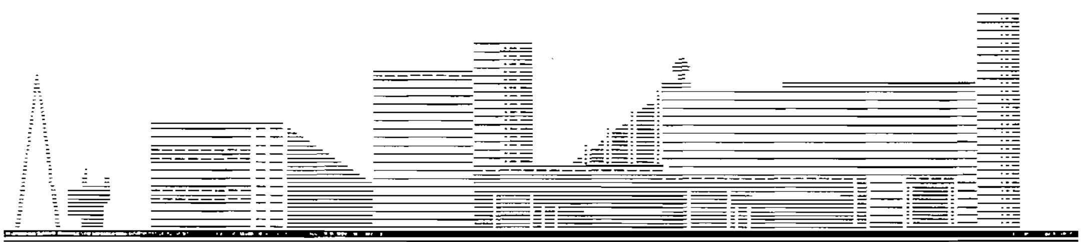


Chapter 3.0

3.0 THE PLANT AND DIRECTLY ASSOCIATED FACILITIES

TABLE OF CONTENTS
(Page 1 of 3)

TABLE OF CONTENTS
(Page 2 of 3)

TABLE OF CONTENTS
(Page 3 of 3)

LIST OF TABLES

LIST OF FIGURES

3.1 BACKGROUND

This chapter provides a description of the proposed Hardee Unit 3 Project, including the overall site layout, key components of the facility and their operation, and proposed controls for air emissions and water discharges. Fuel specifications are provided for both natural gas and distillate fuel oil. Estimates of the expected character, quality, and quantity of discharges and emissions from the proposed facility are provided, based on the current available engineering and design information.

In 1990, the Hardee Power Station (HPS) was certified for 660 megawatts (MW) of generation in a phased construction schedule as follows:

1. TECO Power Services--295 MW (1993) (Phase 1A).
2. TECO Power Services--145 MW (future unit) (Phase 1B).
3. SECI--220 MW (date unspecified) (Phase 2).

This new certification does not change Phases 1A and 1B above but will increase the Seminole Electric Cooperative Incorporated (SECI) certified generation (Phase 2) from 220 MW to 440 MW, with a now-established inservice date of January 1999.

Location of the Hardee Unit 3 facility at the HPS site and selection of the combined cycle technology will maximize the beneficial use of the HPS site while minimizing environmental, land use, and cost impacts otherwise associated with development of a 440-MW power plant. The proposed project will utilize but not alter a number of the HPS existing facilities, including the cooling reservoir and transmission lines, and will increase the ultimate generating capacity without increasing the overall size of the HPS site.

The Hardee Unit 3 Project consists of a 440-MW combined cycle power plant and directly associated facilities. The project will consist of two 150-MW Westinghouse Model 501F advanced combustion turbines (CTs), with dry low nitrogen oxide (NO_x) combustors with a combined generating capacity of 300 MW (net). Each CT will be connected to a heat recovery steam generator (HRSG) which will utilize the waste heat from the CT to produce steam to be utilized in a single 140-MW (net) steam turbine. The proposed facility (Figure 3.1.0-1) will have a total nominal generating capacity of 440 MW (net). No duct burners are proposed for the

Hardee Unit 3 Project. By utilizing the otherwise wasted heat from the CT, the Hardee Unit 3 combined cycle facility will be more efficient than either simple cycle CTs or traditional steam cycle power plants. The dry low-NO_x combustor designed for the Model 501F CT consists of two premixed fuel zones plus a standard diffusion flame pilot burner. Low NO_x levels are achieved by introducing fuel primarily to the premix zones and reducing the amount of fuel being combusted from the pilot nozzle. Steam injection is used to increase the power output from the unit when firing natural gas. This is commonly referred to as "steam for power augmentation." This is different than using steam injection in the combustion zone for standard combustors, which is used for NO_x control. When natural gas is combusted at ambient temperatures of 27 degrees Celsius (°C) [80 degrees Fahrenheit (°F)] or higher, the turbines are not capable of generating sufficient electrical power to meet the required nominal generating capacity of 150 MW. Therefore, power output will be increased through use of steam for power augmentation when firing natural gas to achieve near full load requirements when ambient temperatures are 27°C (80°F) or higher.

The CTs are capable of both combined cycle and simple cycle operation; the latter is possible by using bypass stacks which bypass the HRSG. The CTs will use natural gas as the primary fuel and distillate fuel oil with a 0.05 percent sulfur content as the backup fuel. Use of distillate fuel oil will be equivalent to 1,500 hours per year at full load. Gas will be transported to the site via pipeline, and oil will be trucked to the site. The Hardee Unit 3 facility will connect with an onsite natural gas supply from either the existing Florida Gas Transmission (FGT) system or the proposed SunShine Natural Gas Pipeline. Fuel oil will be stored onsite in a new 16.6-million-liter (L) (4.4-million-gallon) aboveground storage tank.

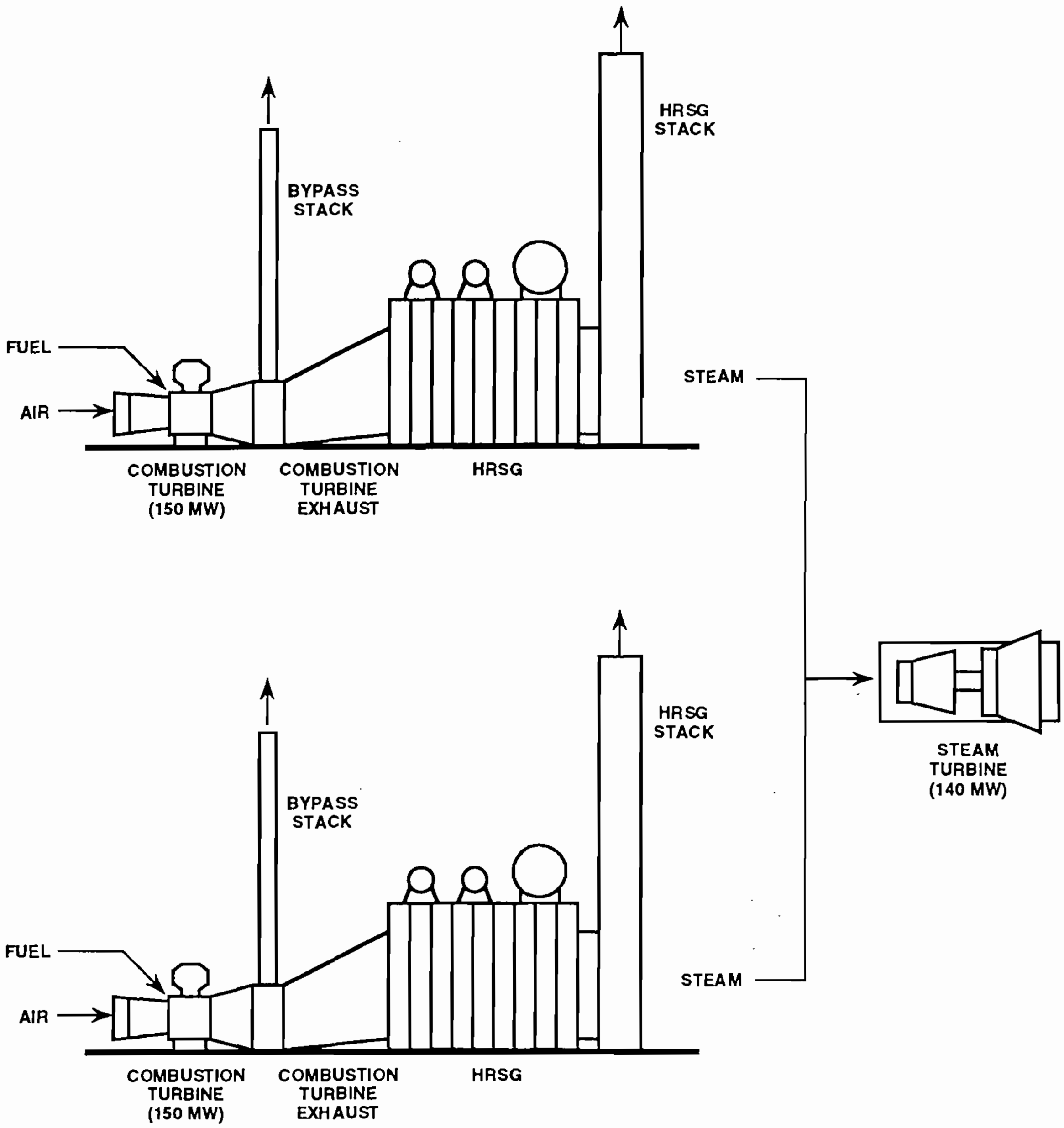
Other onsite facilities to be constructed as part of the proposed project include the switchyard, water treatment building, general services building, distillate fuel oil unloading and storage facilities, water circulating pipes, and warehouse/service buildings.

Primary water uses for the proposed project will be for condenser cooling, air emission control during oil firing, and process water. The existing 230-hectare (ha) (570-acre) cooling reservoir will be used for condenser cooling, with process water and makeup water being obtained from the lower Floridan aquifer through onsite wells under current water-use authorization.

Air emissions control will consist of state-of-the-art dry low-NO_x combustors in the CTs when firing natural gas. Water injection will be used for NO_x control when firing distillate fuel oil. SO_2 air emissions will be controlled by the use of low-sulfur fuels. These design alternatives maximize control of air emissions while minimizing economic, environmental, and energy impacts [see Section 3.4 for the analysis of best available control technology (BACT)].

The Hardee Unit 3 facility has been designed to minimize direct discharge to surface waters. Non-contact stormwater runoff will be collected and routed to a stormwater detention pond which has been designed to meet Southwest Florida Water Management District (SWFWMD) requirements (see Section 3.8 and Appendix 10.11.1). All wastewaters, including process water pretreatment backwash, sanitary treatment system wastewater, plant and equipment drains, and neutralization unit effluent, will be treated as appropriate and recycled to the existing cooling reservoir. The existing cooling reservoir will not be structurally altered, with the exception of the addition of new condenser cooling water intake and discharge structures for the proposed project. The previously certified discharge structure from the cooling reservoir to Payne Creek will not be structurally modified.

Hardee Unit 3 will connect to the Florida electric power grid within the existing HPS site; no new offsite transmission lines will be constructed.



NOTE: HRSG = Heat Recovery Steam Generator

Figure 3.1.0-1
Schematic Flow Diagram of Hardee Unit 3 Facility

Source: KBN, 1994.

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3.2 SITE LAYOUT

The Hardee Unit 3 Project will be located on the 526-ha (1,300-acre) HPS site (see Figure 3.2.0-1). The proposed facility will be located adjacent to the HPS existing units and will occupy approximately 20 ha (50 acres) of the HPS site. The Hardee Unit 3 facilities and their approximate areas are:

Base Plant and Buildings	2.7 ha (6.7 acres)
Fuel Oil Storage/Handling	1.7 ha (4.2 acres)
Switchyard	1.3 ha (3.3 acres)
Switchyard Interconnect	0.3 ha (0.7 acres)
Water/Wastewater Treatment	0.4 ha (1.1 acres)
Site Runoff Detention Pond	3.0 ha (7.4 acres)
Construction Laydown	5.7 ha (14.1 acres)
Miscellaneous (e.g., site roads)	5.0 ha (12.5 acres)
Total Land Area Requirements	20 ha (50 acres)

A profile of the Hardee Unit 3 facilities is shown in Figure 3.2.0-2, with preliminary dimensions presented in Table 3.2.0-1.

Site non-contact stormwater runoff will be released to surface waters, i.e., the unnamed tributary to Payne Creek, from the site runoff detention pond (see Figure 3.2.0-3). Discharges from the cooling reservoir will be through the previously certified, existing discharge structure to Payne Creek; however, such discharges will still be infrequent (i.e., only during storm events greater than the 10-year, 24-hour storm). No additional point source water discharges will be associated with the Hardee Unit 3 facility.

Exhaust gases will be emitted from either a stack associated with each HRSG unit or each CT bypass stack (see Figure 3.2.0-4). The bypass stacks would be operated only when the HRSG and associated steam cycle are not in operation or when simple cycle operation is necessary.

Table 3.2.0-1. Dimensions of Major Plant Facilities for the Hardee Unit 3 Facility

Facility	Elevation[a] (ft)	Length (ft)	Width (ft)
CT Enclosure	30	110	35
Bypass Stack	75	—	23[b]
Inlet Air Filter	60	40	40
HRSG Stack	90	—	19[b]
HRSG	70	122	39
Steam Turbine	53	90	40
Service/Fire Water Tank	45	—	53[b]
Demineralizer Tank	45	—	57[b]
Fuel Oil Storage Tank	53	—	125[b]
Service Building	36	90	90
Warehouse	20	40	80
Covered Laydown	25	25	60
Machine Shop	20	80	60
Water Treatment Building	20	75	40
Circulating Water Chemical Feed	16	50	25
Water Pump Building	16	60	20
Substation Control Building	16	30	15

Note: feet (ft) x 0.3 = meters (m).

[a] Above ground surface.
[b] Diameter.

Source: Black & Veatch, 1994.

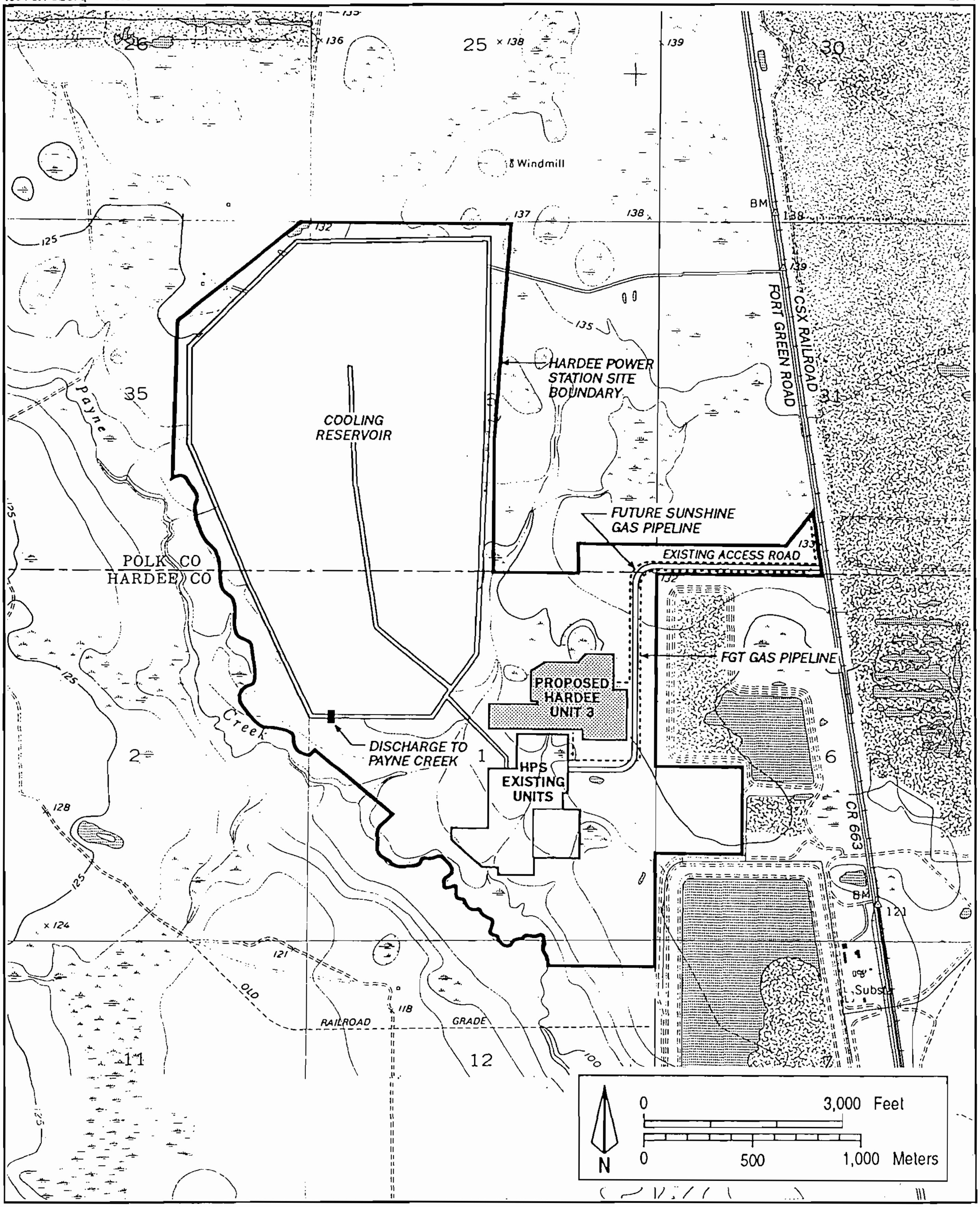

Figure 3.2.0-1
Hardee Unit 3 Site

Sources: USGS, 1987; KBN, 1994.

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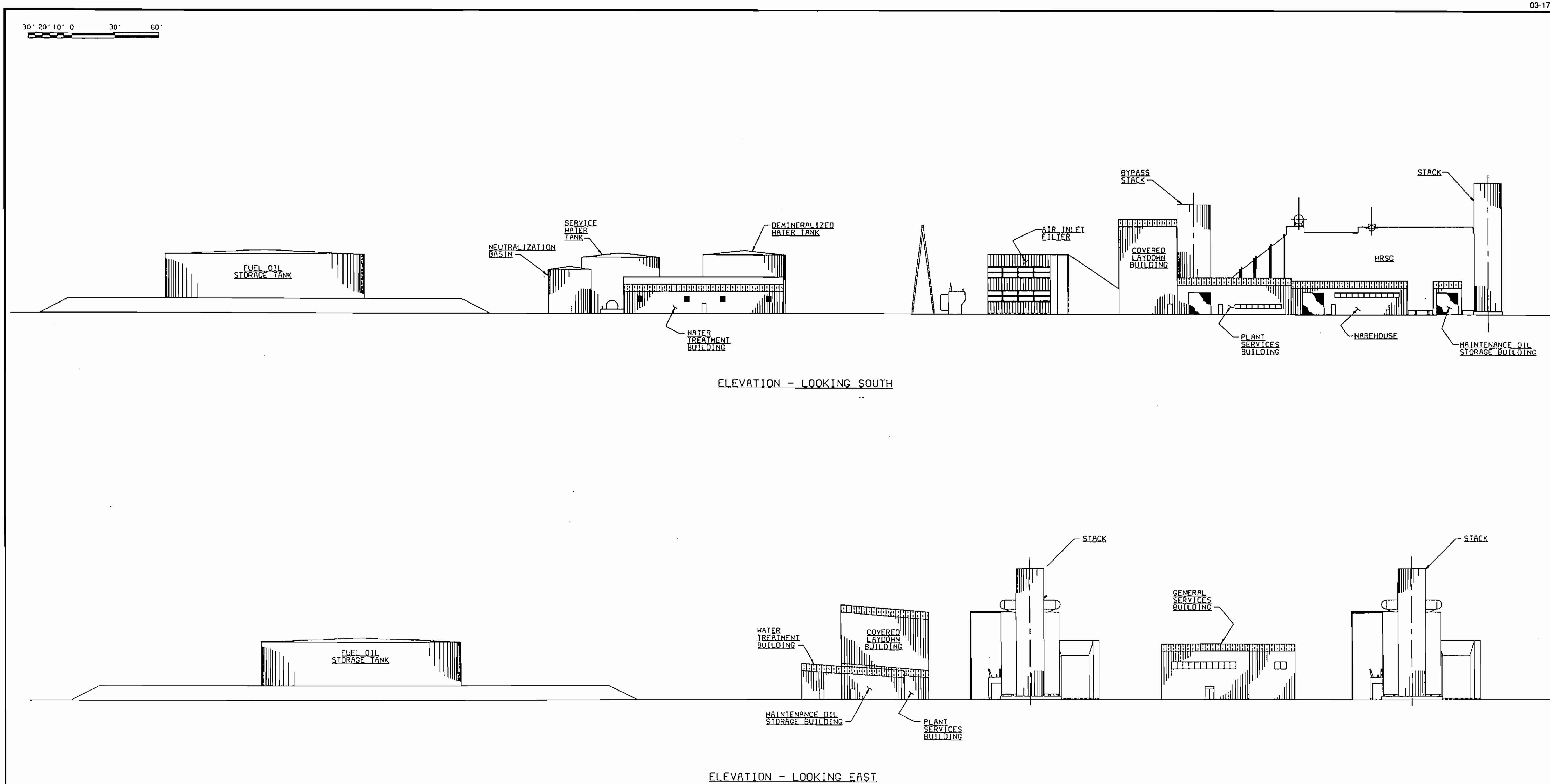

Figure 3.2.0-2
Hardee Unit 3 Profile

Source: Black & Veatch, 1994.

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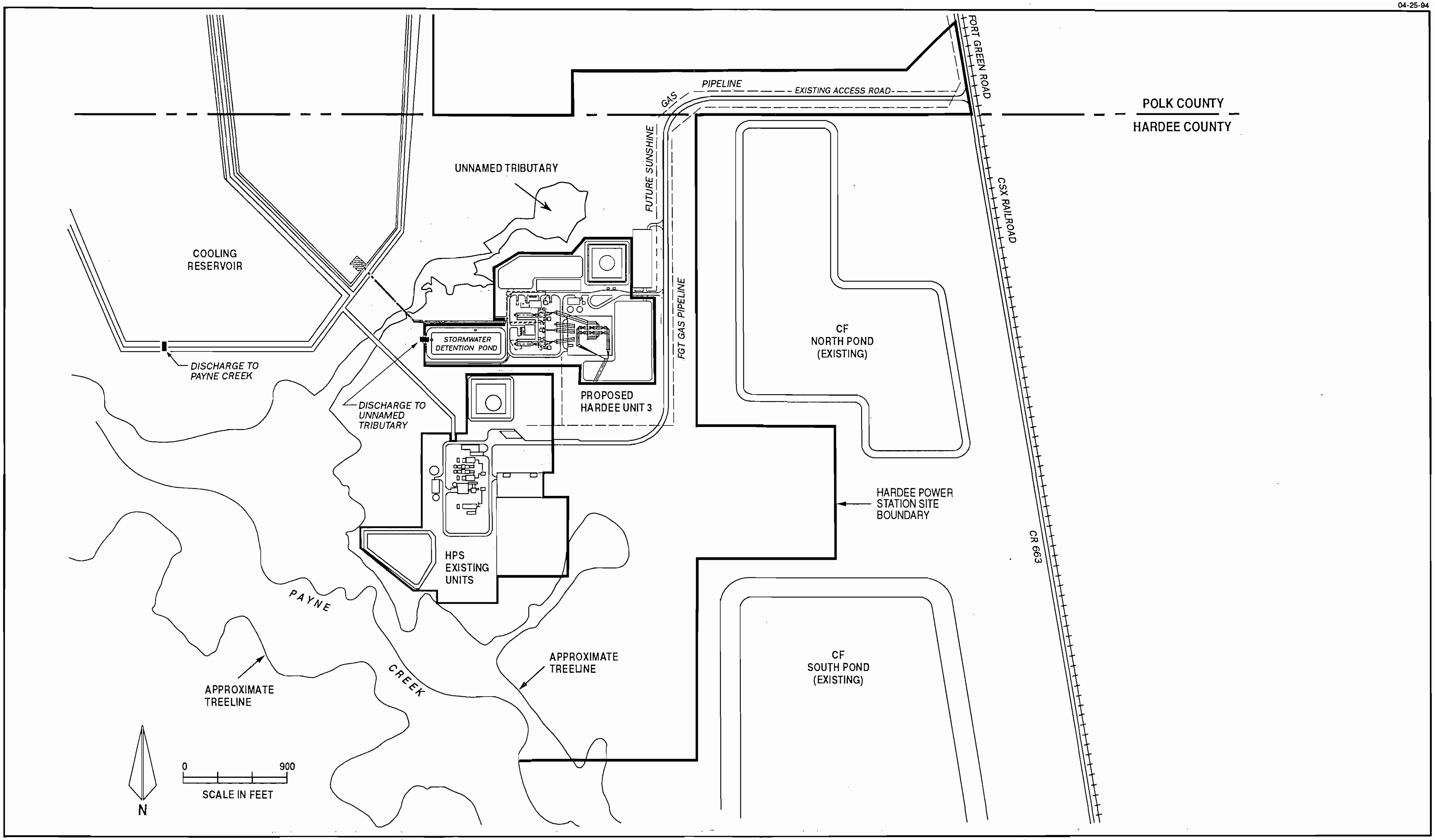

Figure 3.2.0-3
Hardee Unit 3 Proposed Site Layout

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BUILDING AND FACILITIES LEGEND	
NO	DESCRIPTION
1	COMBUSTION TURBINE
2	STEAM TURBINE
3	HEAT RECOVERY STEAM GENERATOR
4	STEPUP TRANSFORMER
5	COMBUSTION TURBINE EXHAUST STACK
6	HRSG EXHAUST STACK
7	SUBSTATION
8	GENERAL SERVICES BUILDING
9	WATER TREATMENT BUILDING
10	ACCESS ROAD
11	PARKING
12	NEUTRALIZATION BASIN
13	DEMINERALIZED WATER TANK
14	SERVICE WATER TANK
15	FUEL OIL STORAGE WITH CONTAINMENT BERMS
16	SEWAGE TREATMENT PLANT
17	OIL WATER SEPARATOR/WASTEWATER COLLECTION SUMP
18	BUS EXTENSION CORRIDOR
19	FUEL OIL UNLOADING AREA
20	FUEL OIL UNLOADING PUMPS
21	FUEL OIL FORWARDING PUMPS
22	MAINTENANCE OIL STORAGE BUILDING
23	BRIDGE CRANE RAIL
24	12' AGGREGATE ACCESS ROAD
25	SUBSTATION CONTROL BUILDING
26	NOT USED
27	PLANT SERVICES BUILDING
28	WAREHOUSE
29	STORM WATER DETENTION POND
30	CONSTRUCTION LAYDOWN AREA
31	CONSTRUCTION PARKING
32	CONSTRUCTION OFFICE TRAILER AREA
33	MOTOR OPERATED SLIDE GATE
34	PROJECT DIRECTIONAL SIGN
35	200' SETBACK LINE FROM WELL
36	CIRCULATING WATER LINES
38	DETENTION POND DISCHARGE STRUCTURE
39	WASTEWATER LINE
40	TRUCK TURN AROUND
41	EQUIPMENT LAYDOWN SPACE
42	CIRCULATING WATER DISCHARGE STRUCTURE
43	OVERHEAD PIPE RACK
44	AGGREGATE LAYDOWN AREA
45	FUTURE SUNSHINE PIPELINE CONNECTION

LEGEND	
(symbol)	EXISTING TREES
(symbol)	TRANSMISSION LINE EASEMENT
(symbol)	WETLANDS LIMITS

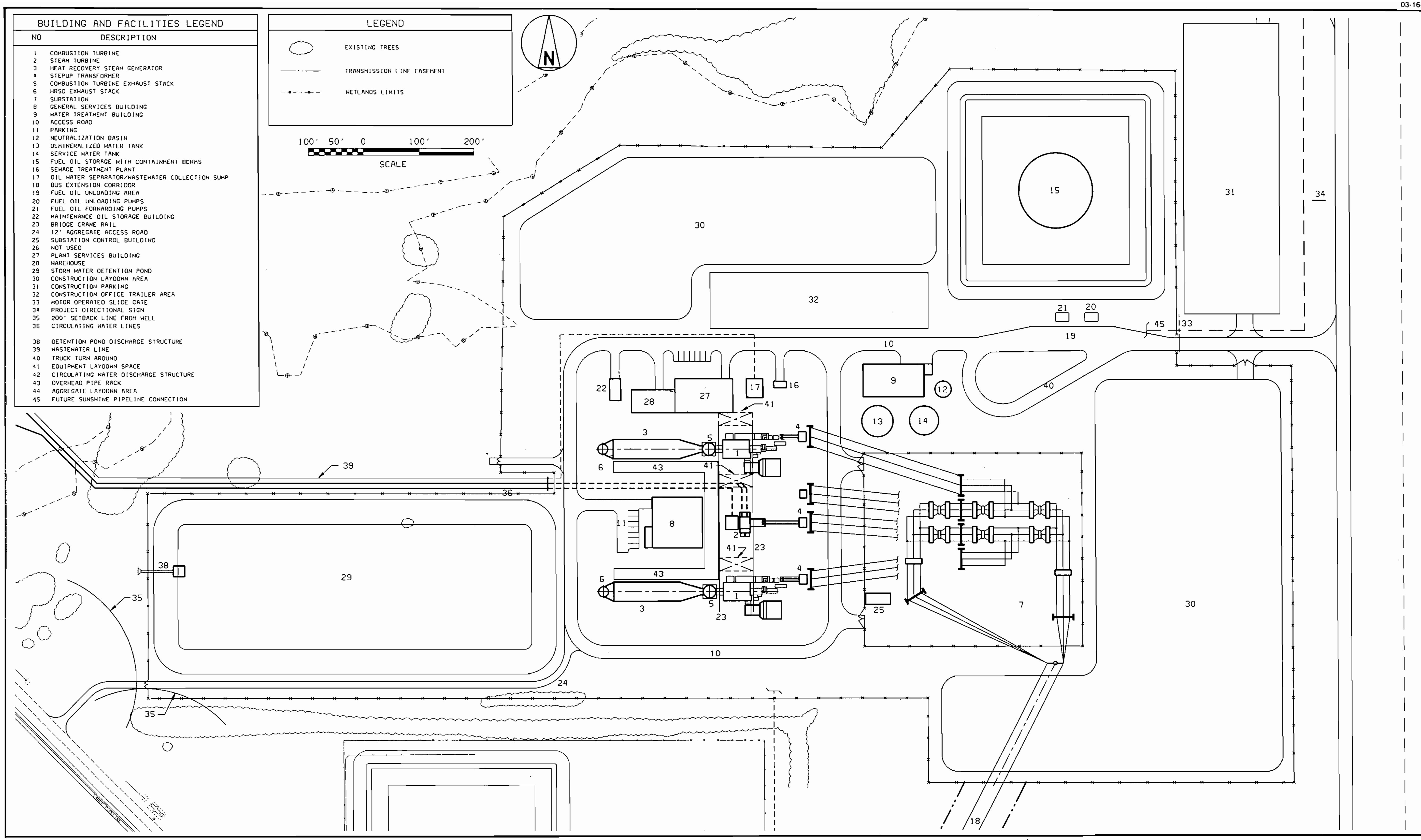

Figure 3.2.0-4
Hardee Unit 3 Plot Plan

Source: Black & Veatch, 1994.

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3.3 FUEL

The primary fuel used by the ~~CTs will be~~ natural gas, delivered to the plant by pipeline. Typical properties of pipeline-grade natural gas are shown in Table 3.3.0-1. The heat content is typically 48,548 Joules per gram (J/g) [20,890 British thermal units per pound (Btu/lb)] [low heating value (LHV)] with a maximum sulfur content of 1 grain per 100 standard cubic feet (gr/100 scf) of gas. The secondary fuel will be low sulfur distillate fuel oil. Typical properties of the fuel oil are shown in Table 3.3.0-2. The fuel oil will have a heat content of between 43,147 J/g (18,566 Btu/lb) (LHV) and 45,736 J/g (19,680 Btu/lb) [high heating value (HHV)] with a maximum sulfur content of 0.05 percent by weight.

No onsite storage will be provided for natural gas. Fuel oil will be stored onsite in a new 16.6-million-liter (4.4-million-gallon) aboveground steel storage tank. As part of the oil storage and delivery system, berms and special drainage will be provided. Oily wastewater will be routed to oil separation equipment for treatment and subsequent routing to the cooling reservoir. A preliminary Spill Prevention, Control, and Countermeasure (SPCC) Plan for Hardee Unit 3 is presented in Appendix 10.1.8.

The CTs will also be capable of burning synthetic gas derived from coal gasification. The plant site could accommodate the possible future addition of coal gasification facilities, which would include a gasifier, gas cleanup equipment, and coal handling and storage systems. Although a coal gasification facility is not being proposed for certification as part of the Hardee Unit 3 Project, a discussion of potential coal gasification alternatives and the site's capability to accommodate such facilities is presented in Section 8.3.

The generating capacity of a combined cycle plant is affected by ambient temperature, with increased temperature resulting in less efficient electric production. Greater overall fuel consumption will occur at lower ambient temperatures. For the purpose of calculating maximum hourly fuel use quantities, the following operating conditions for the CTs were used:

1. 0°C (32°F) dry-bulb ambient temperature,
2. 30 percent relative humidity,
3. 38 meters above mean sea level (m-msl) [125 feet above mean sea level (ft-msl)] elevation,

4. 53,847 J/g (23,170 Btu/lb) heating value (HHV) of natural gas, and
5. 45,736 J/g (19,680 Btu/lb) heating value (HHV) of distillate fuel oil.

At these conditions, the maximum heat input for the nominal 440-MW facility is 3,795 x 10^9 J/hr and 4,160 x 10^9 J/hr [3,598 and 3,944 x 10^6 Btu/hr] (HHV) when firing natural gas and distillate fuel oil, respectively [100 percent capacity, 0°C (32°F)]. The corresponding maximum fuel usage is 19,567 grams per second (g/s) [155,290 pounds per hour (lb/hr) or 3,600,000 cubic feet per hour (cf/hr)] for natural gas and 25,252 g/s (200,410 lb/hr) for fuel oil. Annual fuel usage at 15°C (59°F) ambient temperature is expected to be 575,210,000 kilograms per year (kg/yr) [1,268,100,000 pounds per year (lb/yr) or 2.94 x 10^{10} cubic feet per year (cf/yr)] for natural gas and 127,100,000 kg/yr (280,200,000 lb/yr) for fuel oil (assuming an equivalent of 1,500 hours per year of at full load). Hardee Unit 3 will connect onsite with either an existing 46-cm (18-inch) FGT natural gas lateral already constructed to the HPS site or the proposed SunShine Pipeline Company's natural gas pipeline.

Table 3.3.0-1. Expected Natural Gas Analysis

<u>Constituents, Percent by Volume</u>	
Hydrogen (H_2)	—
Methane (CH_4)	83.40%
Ethylene (C_2H_4)	—
Ethane (C_2H_6)	15.80%
Carbon Monoxide (CO)	—
Carbon Dioxide (CO_2), max	2.0%
Nitrogen (N_2)	0.80%
Oxygen (O_2), max	0.40%
Hydrogen Sulfide (H_2S), max	1 grain/100 scf
Sulfur (S), max.	1 grain/100 scf
Water (H_20) Vapor, max.	4 lb/10^6 scf
Synthetic Lubricants (Phosphate-Ester Based)	Trace
Specific Gravity (relative to air)	0.636
<u>Ultimate, Percent by Weight</u>	
Hydrogen (H_2)	23.53%
Carbon (C)	75.25%
Nitrogen (N_2)	1.22%
Oxygen (O_2)	—
Btu/ft^3 @60°F and 30 inches HgA (HHV)	950 (min)-1129
Heating Value Btu/lb	23,170 (HHV) 20,890 (LHV)

Sources: TPS/SECI, 1989.
KBN, 1994.

Table 3.3.0-2. Expected Fuel Oil Analysis[a]

Specific gravity, 60°F (16°C)	0.82-0.86
Viscosity, cST, 100°F (38°C), min	0.5
Pour point, max	
°F	0
°C	17.8
Heating value, LHV	
Btu/lb	18,566
J/g	43,147
Heating value, HHV	
Btu/lb	19,680
J/g	45,736
Filterable dirt, mg/100 ml	4
Carbon residue (10% Bottoms), %, max.	0.25
Carbon residue (100% Sample), %, max.	1.0
Sulfur, % wgt., maximum	0.05
Nitrogen, % wgt.	<0.015 - 0.03
Hydrogen, % wgt.	12.2 - 13.2
Ash (fuel as delivered), ppm wgt, max.	50
Trace metal contaminants (untreated)	
Sodium plus potassium, ppm, max.	1
Vanadium, ppm, max.	0.5
Lead, ppm, max.	1
Calcium, ppm, max.	2

[a] Specification is typical of American Society of Testing and Materials (ASTM) Grade distillate fuel oil (ASTM D-398).

Sources: TPS/SECI, 1989.
KBN, 1994.

3.4 AIR EMISSIONS CONTROLS

3.4.1 AIR EMISSIONS TYPES AND SOURCES

The Hardee Unit 3 Project consists of a 440-MW combined cycle power plant and directly associated facilities. The project will consist of two 150-MW Westinghouse Model 501F advanced combustion turbines, with dry low-NO_x burners, with a combined generating capacity of 300 MW (net). Each combustion turbine will be connected to a HRSG which will use the waste heat to produce steam to be used in a single 140-MW (net) steam turbine. The facility will have a nominal generating capacity of 440 MW (net). No duct burners are proposed for the Hardee Unit 3 Project.

The dry low-NO_x combustor designed for the 501F combustion turbine consists of two premixed fuel zones plus a standard diffusion flame pilot burner. Low NO_x levels are achieved by introducing fuel primarily to the premix zones and reducing the amount of fuel being combusted from the pilot nozzle. Steam injection is used to increase the power output from the unit when firing natural gas. This is commonly referred to as "steam for power augmentation." This is different than using steam injection in the combustion zone for standard combustors, which is used for NO_x control. When natural gas is combusted at ambient temperatures of 27°C (80°F) or higher, the turbines are not capable of generating sufficient electrical power to meet the required nominal generating capacity of 440 MW. As a result, power output will be increased through use of steam for power augmentation when firing natural gas to achieve near full load requirements when ambient temperatures are 27°C (80°F) or higher. Steam for power augmentation is expected to be required for a maximum of 2,000 hours per year based on ambient temperatures and unit demand.

Power augmentation with dry low-NO_x combustors increases dynamic pressure activity in the overall combustion process. To minimize this activity, the pilot flame percentage is increased from its normal "low NO_x" level to a slightly higher percentage. As the pilot flame increases, there is a resulting increase in NO_x and carbon monoxide (CO) levels.

Air pollutant emissions will be emitted from the CTs when firing either natural gas or fuel oil. Emissions will emanate from either the bypass or HRSG stacks depending upon the mode of operation.

Air emissions result from either the combustion process itself or impurities in the fuel. Table 3.4.1-1 presents the maximum estimated emission rates for regulated pollutants. The maximum estimated emission rates were determined using the manufacturer's information for the equipment proposed for the project. The design parameters were provided for operating loads of 100 percent (base load), 75 percent, and 50 percent capacity and for ambient temperatures of 0°C (32°F), 15°C (59°F), 22°C (72°F), and 36°C (95°F). Annual emissions were based on emissions expected for base load and ambient temperatures of 15°C (59°F). The prevention of significant deterioration (PSD) application (see Appendix 10.1.5) presents the basis for the emission rates and maximum annual emissions of regulated and nonregulated pollutants.

During combustion, two types of NO_x are formed: fuel NO_x and thermal NO_x. Fuel NO_x emissions are formed through the oxidation of a portion of the nitrogen contained in the fuel. Thermal NO_x emissions are generated through the oxidation of a portion of the nitrogen contained in the combustion air. NO_x formation can be limited by lowering combustion temperatures (through water or steam injection) and/or staging combustion (a reducing atmosphere followed by an oxidizing atmosphere, known as dry NO_x control).

Carbon monoxide is formed by incomplete combustion of fuel. High combustion temperatures, adequate excess air, and good fuel/air mixing during combustion will minimize CO formation. Carbon monoxide formation is limited by ensuring complete efficient combustion of the fuel in the turbines. Recent improvements in CT combustor technology allow for both reduced NO_x emissions and low CO emissions.

Emissions of NO_x for the Hardee Unit 3 facility are proposed at concentrations of 15 parts per million (ppm) and 42 ppm, corrected to ISO conditions and 15 percent oxygen (O_2) dry conditions (ppmvd) for natural gas and distillate fuel oil firing, respectively. When firing natural gas during power augmentation, the NO_x emissions are proposed at 25 ppmvd corrected to ISO conditions and 15 percent O_2. Maximum estimated NO_x emissions for distillate fuel oil firing are 42 ppm at ISO conditions based on a maximum concentration of fuel-bound nitrogen of 0.015 percent; higher fuel-bound nitrogen concentrations would also increase NO_x emissions. At a fuel-bound nitrogen concentration of 0.03 percent, NO_x would increase by about 12 ppm (corrected conditions) in accordance with the NSPS adjustment found in 40 Code of Federal Regulations (CFR) 60, Subpart GG, Section 60.332(a)(3).

Emission rates for CO were established by the level of NO_x control, since dry low NO_x combustors will be used. Maximum CO emission rates for the project would be 20 part per million by volume dry (ppmvd) and 25 ppmvd at base load operation for natural gas and distillate fuel oil, respectively. When firing natural gas during power augmentation, the CO emissions would be 50 ppmvd.

Maximum SO_2 emission rates are dictated by the amount of sulfur in the fuels.

Table 3.4.1-1. Summary of the Maximum Potential Annual Emissions for the Proposed CTs for Combined Cycle Operations at the Hardee Unit 3 Facility

	Emissions (TPY)			
Pollutant	Fuel Oil	Natural Gas	Natural Gas-Steam for Power Augmentation	Total
Potential Emissions (Without Power Augmentation)[a]				
SO_2	140.1	34.8	NA	174.9
PM/PM10	94.1	50.4	NA	144.5
NO_x	466.2	673.2	NA	1,139.4
CO	127.9	486.1	NA	614.0
VOC	29.2	69.5	NA	98.7
Lead	0.16	NA	NA	0.16
Arsenic	0.014	NA	NA	0.014
Beryllium	0.0069	NA	NA	0.0069
Fluoride	0.090	NA	NA	0.090
Mercury	0.024	0.0003	NA	0.025
Sulfuric Acid Mist	31.1	6.86	NA	38.0
Potential Emissions (With Power Augmentation)[b]				
SO_2	140.1	25.2	9.32	174.6
PM/PM10	94.1	36.5	14.4	145.1
NO_x	466.2	487.7	251.5	1,205.4
CO	127.9	352.2	313.4	793.5
VOC	29.2	50.3	17.9	97.5
Lead	0.16	NA	NA	0.16
Arsenic	0.014	NA	NA	0.014
Beryllium	0.0069	NA	NA	0.0069
Fluoride	0.090	NA	NA	0.090
Mercury	0.024	0.0002	0.00009	0.025
Sulfuric Acid Mist	31.1	4.97	1.84	37.9

Note: NA = not applicable.

[a] Emission rates are based on two CTs firing fuel oil for 1,500 hours and natural gas for 7,260 hours at ambient temperature of 59°F (without power augmentation) and relative humidity of 60 percent.

[b] Emission rates are based on two CTs firing fuel oil for 1,500 hours and natural gas for 7,260 hours at ambient temperature of 59°F and relative humidity of 60 percent. Natural gas combustion includes 2,000 hours of steam for power augmentation at ambient temperature of 80°F and relative humidity of 80 percent.

Source: KBN, 1994.

3.4.2 AIR EMISSION CONTROLS

The use of clean fuels, i.e. natural gas and low-sulfur distillate fuel oil, and combustion controls will minimize air emissions and enable compliance with applicable emission-limiting standards. Using clean fuels will minimize emissions of sulfur dioxide (SO_2), particulate matter (PM)/particulate matter with an aerodynamic diameter of 10 micrometers or less (PM10), and other fuel-bound contaminants. Combustion controls will minimize the formation of NO_x (by water injection for fuel oil firing) and the formation of CO and volatile organic compounds (VOCs) by combustor design. These techniques are proposed as BACT for this project based on an evaluation of economic, energy, and environmental impacts. The following subsection presents a summary of the BACT analysis which is presented in full in the PSD permit application in Appendix 10.1.5.

3.4.3 BEST AVAILABLE CONTROL TECHNOLOGY (BACT)

BACT review is required under the State of Florida and U.S. Environmental Protection Agency (EPA) regulations pertaining to PSD. Federal regulations are codified in 40 CFR Part 52.21, and the State of Florida has adopted PSD regulations essentially the same as the federal rules (Rule 17-212.400 F.A.C.). The BACT review (Rule 17-212.410, F.A.C.) is part of the evaluation of control technology under PSD rules. BACT is applicable to all pollutants for which PSD review is required and is pollutant-specific. It is an emission limitation that is based on the maximum degree of reduction for each regulated pollutant which is determined to be appropriate after taking into account energy, environmental, and economic impacts and other costs. BACT cannot be any less stringent than the federal New Source Performance Standards (NSPS) applicable to the source under evaluation.

The State of Florida and EPA have established a policy for BACT review in which the most stringent control alternatives are evaluated first. The alternatives are either rejected based on technological, environmental, energy, or economic reasons or are proposed as BACT. This procedure is referred as the "top-down" approach. For the Hardee Unit 3 Project, BACT is applicable for emissions of nitrogen oxides, carbon monoxide, sulfur dioxide, volatile organic compounds, PM and PM10, and trace contaminants.

The applicable NSPS for the Hardee Unit 3 Project is that promulgated by EPA for stationary gas turbines. These NSPS (40 CFR Part 60, Subpart GG) establish emission-limiting standards for NO_x and SO_2. The applicable NSPS are:

> NO_x--75 ppmvd corrected to 15 percent oxygen and heat rate plus adjustment to fuel-bound nitrogen
>
> SO_2--no more than 0.8 percent sulfur in the fuel

Appendix 10.1.5 of this Site Certification Application/Environmental Assessment (SCA/EA) contains a complete PSD application. Section 4.0 of that application contains the BACT evaluation for this project and addresses those pollutants for which BACT is applicable, i.e., nitrogen oxides, carbon monoxide, sulfur dioxide, particulates, beryllium, sulfuric acid mist, and inorganic arsenic. It includes a discussion of the environmental, economic, and energy aspects of alternative control techniques and methods. The remainder of this section briefly describes those control technologies that were considered in the analysis and the conclusions reached. For details, refer to Section 4.0 and Attachment B in the PSD application, Appendix 10.1.5.

3.4.3.1 NITROGEN OXIDES

Dry low-NO_x combustor technology has recently been offered and installed by CT manufacturers to reduce NO_x emissions by inhibiting thermal NO_x formation through premixing fuel and air prior to combustion and providing staged combustion to reduce flame temperatures. NO_x emissions of 15 ppmvd (corrected to 15 percent O_2) have been offered by manufacturers for advanced CTs. Advanced in this context is the larger (over 150 MW) and more efficient (higher initial firing temperatures and lower heat rate) CTs. This technology truly represents pollution prevention since NO_x emissions are inhibited from forming.

Selective catalytic reduction (SCR) is a post-combustion process where NO_x in the gas stream is reacted with ammonia in the presence of a catalyst to form nitrogen and water. The reaction occurs typically between 316 and 399°C (600 and 750°F) which limits SCR application to combined cycle units where such temperatures occur in the HRSG. Exhausts from simple cycle operation are in the range of 538°C (1,000°F), thus limiting SCR application for this mode of operation. SCR has been installed and operated on combined cycle facilities generally achieving 9 ppmvd (corrected to 15 percent O_2) while burning natural gas. Applications with oil firing are limited. Where oil firing has been attempted, catalyst poisoning and ammonium salt formation have occurred. Ammonium salts (ammonium sulfate and ammonium bisulfate) are formed by the reaction of sulfur oxides in the gas stream and ammonia. These salts are highly acidic, and special precautions in materials and ammonia injection rates must be implemented to minimize their formation. Ammonia injected in the SCR system that does not react with NO_x is emitted directly and referred to as ammonia slip. In general, SCR manufacturers guarantee ammonia slip to be no more than 10 ppmvd; however, permitted limits in some applications have exceeded 25 ppmvd. While SCR is technically capable of reducing NO_x emissions to 9 ppmvd at 15 percent O_2 when firing natural gas and 15 ppmvd at 15 percent O_2 when firing fuel oil, SCR has not been applied to an advanced CT of the size proposed for this project or to the amount of oil firing that may occur with Hardee Unit 3.

The recent permitting trend for advanced CTs is the use of dry low-NO_x combustors. Indeed, all of the recent combined cycle projects using advanced CTs have been permitted with this technology including three projects in Florida (FPL Martin Units 3 and 4, FPC Polk Power Park, and Central Florida Cogeneration Project) and one in Maryland [Baltimore Gas and Electric Company (BG&E) Perryman Project].

Based on an analysis of the economic, environmental, and energy impacts, dry low-NO_x combustion technology was selected as the proposed BACT for NO_x.

The total capital and annual costs for SCR are estimated to be $8,647,400 and $4,462,200, respectively. The cost effectiveness was estimated to be $6,802 per ton of NO_x removed from 15 ppm to 9 ppm (natural gas). This cost effectiveness is above that considered reasonable for this technology in recent Florida Department of Environmental Protection (FDEP) permitting actions. In addition, this cost effectiveness accounts for only the reduction of NO_x with SCR use and not the potential increased emissions of ammonia or other criteria pollutants (particulate, SO_2, CO, and VOC) that may result. The net removal cost effectiveness ($/ton) will be much higher. Indeed, it could be over $15,000 per ton [$4,462,200 divided by the net reduction of 276 tons per year (TPY)]. Although NO_x emissions will decrease with SCR, the ammonia and other criteria pollutants will increase due to the electrical energy required to run the SCR system and the backpressure from the turbines will reduce the electrical power output from the project. This power, which would otherwise be available to the electrical system, will have to be replaced by other less efficient units.

The cost effectiveness of $6,802 per ton of NO_x removed is estimated by assuming that the proposed project would run at full load all year at the maximum emission rates for natural gas and fuel oil. Such conditions are generally unrealistic but provide a conservative basis for calculating cost effectiveness. In reality, the actual capacity factor will be lower than 100 percent, and fuel oil would only be used as a backup supply. The actual cost effectiveness would likely be in the range of $9,000 to $13,000 per ton of NO_x removed. Presented below is the calculated cost effectiveness for a range of Hardee Unit 3 operating scenarios (i.e., capacity factor and fuel oil usage).

Cost Effectiveness (per ton NO_x removed)	Total Capacity Factor (%)	Fuel Operation (hours per year)
$9,108	100	500 oil; 2,000 gas with power augmentation; 6,260 gas
$9,732	70	1,000 oil; 1,600 gas with power augmentation; 3,532 gas
$12,906	70	350 oil; 1,400 gas with power augmentation; 4,382 gas

Although NO_x emissions would be reduced by about 656 TPY with SCR as compared to dry low-NO_x combustors alone, the net emissions reduction would not be as great. There are three additional factors that must be considered. First, ammonia slip would occur which may be as high as 193 TPY. Second, additional particulate matter may be formed through the reaction of ammonia and sulfur oxides forming ammonium salts. As much as 51 TPY additional particulate matter may be formed. Third, SCR would require energy for system operation and reduce the efficiency of the CT. This lost energy would have to be replaced since the proposed project would be an efficient plant while operating. Any power plants replacing this lost energy would be lower on the dispatch list and inevitably more polluting. Conservatively, this lost energy would result in the emissions of an additional 135 TPY of criteria pollutants. Additional emissions of carbon dioxide would also result.

Energy impacts with SCR would also not be insignificant. The energy penalty from SCR equipment and backpressure on the turbine would result in lost energy of about 15 x 10^{-6} kWh per year. This amount of energy is sufficient to provide the annual electrical needs of 1,250 residential customers.

As noted from this analysis, the application of SCR is economically unreasonable and should be rejected as BACT.

3.4.3.2 CARBON MONOXIDE

The proposed BACT emission rates for CO are 20 ppmvd and 25 ppmvd at base load operation for natural gas and distillate fuel oil, respectively. When firing natural gas during power augmentation, the CO emission rate would be 50 ppmvd. The CTs would utilize advanced combustion technology and are consistent with those established as BACT by FDEP.

The only other feasible control measure available to reduce CO emissions from the combined cycle 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. The temperature range for this process is approximately 316 to 649°C (600 to 1,200°F), with the highest removal efficiencies occurring in the upper temperature range.

An oxidation catalyst will experience the same operating problems as those discussed for the SCR catalyst especially when using fuel oil. The cost of removal of CO by oxidation catalyst will be significant and is estimated to be approximately $4,000 per ton.

Combustion controls were selected as the proposed BACT control technology for CO based on economic, environmental, and energy considerations.

3.4.3.3 SULFUR OXIDES (SO_2 AND H_2SO_4 MIST)

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, i.e., natural gas and distillate fuel oil with a maximum sulfur content of 0.05 percent. Additionally, sulfuric acid mist production will be limited by fuel selection as previously described.

3.4.3.4 PARTICULATE MATTER AND OTHER REGULATED POLLUTANTS

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 PM emissions are minimal (i.e., these emissions are already lower than most baghouses emit). Clean-burning fuels that have low PM and trace contaminant contents are being proposed as BACT.

Emissions of other pollutants are expected to be minimal and require no additional control technology. Concentrations of beryllium 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. Although 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 DESIGN DATA FOR CONTROL EQUIPMENT

Fuel properties have been presented in Section 3.3. Flue gas data are presented in the PSD application for natural gas and for fuel oil firing. These data are estimates based on the most recent information available.

The control equipment for minimizing air pollutant emissions from the Hardee Unit 3 Project are integral to the design of the combustors associated with each Westinghouse 501F CT. When firing natural gas, emissions are controlled with the application of dry low-NO_x combustors which consist of two premixed fuel zones and a standard diffusion pilot flame. Low NO_x levels, and corresponding low levels of CO, particulate matter, and VOCs, are achieved by introducing a majority of the fuel into the premix zones that allow the combustion air to mix with the fuel prior to combustion. This reduces the flame temperatures and the NO_x formed in the combustion process. The NO_x emissions will be limited to no more than 15 ppmvd corrected to 15 percent oxygen at ISO conditions. This is equivalent to about 0.06 lb NO_x/MMBtu heat input.

When firing fuel oil, water will be injected into the combustion zone to reduce flame temperatures and NO_x formation. The amount of water injected will depend on the ambient temperature and will range from 883 Lpm at 0°C to 708 Lpm at 35°C (220 gpm at 32°F to 187 gpm at 95°F). The amount of water is controlled as a function of ambient temperature to ensure that NO_x emissions are limited to 42 ppmvd corrected to 15 percent oxygen at ISO conditions as well as limit the formation of CO and VOCs at base load to 25 ppmvd and 10 ppmvd, respectively.

The power augmentation mode will only be used when firing natural gas and at ambient temperatures of 27°C (80°F) or above. Power augmentation will involve injection of steam which will vary from 14,610 kg/hr at 27°C to 25,442 kg/hr at 35°C (32,210 lb/hr at 80°F to 56,090 lb/hr at 95°F). Dry low-NO_x combustors will still limit NO_x emissions, but the emissions will be slightly higher than under normal gas firing mode, i.e., 25 ppmvd corrected to 15 percent oxygen at ISO conditions. NO_x emissions are slightly higher during power augmentation due to an increase in pilot flame fuel which is required to limit combustion instability.

The design parameters when firing natural gas and fuel oil and under power augmentation are presented in Appendix 10.1.5, Prevention of Significant Deterioration (Attachment A). These data provide detailed design information, including fuel usage, water and steam injection, exhaust parameters, and emission calculations.

3.4.5 DESIGN PHILOSOPHY

The design philosophy for the Hardee Unit 3 Project minimizes air pollutant emissions by using the most efficient and pollutant-preventing generating technology. Initially, this concept has been incorporated with the selection of a combined cycle process utilizing advanced 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 25 percent. Thus, by maximizing the megawatt output per unit of fuel consumed, the air pollutant emissions per megawatt output are minimized. The selection of the most efficient CTs (the advanced type) also minimizes emissions with respect to power output. Pollution prevention is incorporated in the design by the use of clean fuels and combustion technology. Natural gas and very low sulfur content distillate oil will be used. Moreover, advanced dry low-NO_x combustion technology will be used to minimize NO_x emissions while ensuring that CO and VOC emissions are within accepted limits. Taken together, the design of Hardee Unit 3 will incorporate features that will make the project one of the most efficient and pollution-free power plants in the State of Florida.

3.5 PLANT WATER USE

The water demands and uses at the Hardee Unit 3 facility include condenser cooling, potable water, general plant service water, emergency (fire control) water, NO_x injection water (when firing distillate fuel oil for up to 1,500 hours per year), water for power augmentation, evaporative cooler makeup water, and steam cycle makeup water.

Condenser cooling demands for the Hardee Unit 3 Project will be satisfied by the existing cooling reservoir. Other water demands will be satisfied through direct withdrawal and use of lower Floridan aquifer water from onsite wells. All water demands for the Hardee Unit 3 Project will be met through the previously certified consumptive use allocation for the original HPS; no additional groundwater withdrawals will be requested for the Hardee Unit 3 Project.

Overall water balances for the entire 880-MW HPS (TPS 440-MW Units 1A and 1B and SECI 440-MW Hardee Unit 3) for average annual and maximum daily makeup conditions are presented in Figures 3.5.0-1 and 3.5.0-2.. These figures show the overall groundwater withdrawal rate from the lower Floridan aquifer and the overall water budget for the cooling reservoir and the individual service water systems. These rates are within the existing allocation for the HPS site. Individual components of the water budgets for the average annual and maximum conditions are shown in Tables 3.5.0-1 and 3.5.0-2; methodologies used to calculate the water budgets are presented in the Water Alternatives Study (see Appendix 10.10).

Detailed plant water balances for Hardee Unit 3 alone for the average annual makeup, maximum daily makeup, and maximum daily discharge conditions for the Hardee Unit 3 Project are presented in Figures 3.5.0-3, 3.5.0-4, and 3.5.0-5, respectively. Average annual makeup is based on average annual climatological data and average annual operating conditions which are defined:

- 70 percent plant load
- Power augmentation (steam injection) for 12 hours/day between June and October, when ambient temperature exceeds 27°C (80°F)
- Relative humidity of 80 percent
- 95 percent natural gas firing and 5 percent distillate fuel oil firing, and
- No oil firing during peak unit loading.

Maximum daily makeup was based on the worst-case monthly climatological data and the following operational conditions:

- 100 percent plant load
- -1.1°C (30°F) ambient temperature
- 50 percent relative humidity
- Fuel oil firing of the CTs
- NO_x injection water

The various components of the Hardee Unit 3 water balances (i.e., Figures 3.5.0-3 through 3.5.0-5) are discussed in Sections 3.5.2 through 3.5.4. Section 3.5.5 presents a discussion of plant size and water use; e.g., a 440-MW configuration.

The makeup water requirements for the cooling reservoir with the proposed 880-MW configuration and existing supply sources (i.e., Floridan aquifer wells, rainfall, surface water runoff, and recycled treated wastewater from the plant) were estimated using a water balance methodology. This water balance approach considers all the water inflows to and outflows from the cooling reservoir in order to calculate monthly water makeup and discharge requirements.

The water balance of the cooling reservoir can be summarized as the following:

$$\Delta Q = Q_P + Q_R + Q_{SA} + Q_D + Q_{DW} - Q_E - Q_L - Q_{BS} - Q_{SD}$$

where:

- ΔQ = gain or loss in reservoir volume over a specified unit of time
- Q_P = precipitation on the reservoir
- Q_R = upland runoff into reservoir
- Q_{SA} = surficial aquifer seepage into the reservoir
- Q_D = effluents discharged the reservoir
- Q_{DW} = deep-well makeup to the reservoir
- Q_E = evaporation
- Q_L = leakance
- Q_{BS} = berm seepage out of the reservoir
- Q_{SD} = surface discharge to Payne Creek

Given monthly variations in rainfall and runoff into the reservoir, monthly variations in reservoir levels are calculated. If the reservoir level exceeds the control elevation [37.8 m-msl (124 ft-msl)], the required discharge quantity is calculated and mathematically subtracted from the reservoir. If the reservoir level drops below the minimum allowable elevation [37.2 m-msl (122 ft-msl)], the required deep-well makeup quantity is calculated and mathematically added to the reservoir in order to maintain it at the minimum elevation. By tracking and maintaining this monthly balance in reservoir water levels, the long-term water makeup and discharge requirements are calculated for various operational (load) scenarios.

Based on this methodology, the reservoir makeup requirements are shown in Table 3.5.0-1 and Figure 3.5.0-1 for average conditions and in Table 3.5.0-2 and Figure 3.5.0-2 for maximum conditions. As seen in these tables, the average monthly makeup requirement is estimated to range from 12.0 million Lpd (3.17 mgd) under average load conditions to a monthly maximum water demand of 32.4 million Lpd (8.57 mgd) under maximum load conditions.

The estimated average monthly makeup requirement of 11.7 million Lpd (3.17 mgd) does not consider the variability of climatic conditions (e.g., a succession of dry or wet months) that will determine actual groundwater withdrawals. To estimate these types of scenarios, a probabilistic frequency analysis (i.e., Log-Pearson Type III) was conducted as follows:

1. Average annual monthly water requirements under average load conditions were computed for each of the 37 years modeled via the heat and water budget models;
2. The Log-Pearson Type III probability distribution was calculated for the 37 years of average annual monthly water requirements; and
3. Using the probability density function; water withdrawals for various recurrence intervals (e.g. once in 10 years) were computed.

The results of this frequency analysis are presented in Table 3.5.0-3. As seen in the table, the 10 percent (e.g., one month in 10 years) water withdrawal is approximately 14.4 million Lpd (3.8 mgd). This analysis shows that the groundwater withdrawal rate may slightly exceed the average annual monthly allocation a maximum of three times throughout the projected economic life of the Hardee Unit 3 facility. However, at no time will the groundwater withdrawal exceed the existing 32.7 million Lpd (8.64 mgd) maximum monthly allocation. Given the projected load scenarios for HPS, this value was selected as the design average makeup water requirement.

The average annual groundwater makeup for the entire 880-MW HPS (TPS 440-MW Units 1A and 1B, and SECI 440-MW Hardee Unit 3) is 3.8 mgd. The maximum daily makeup for the entire 880-MW HPS is 8.64 mgd. A detailed discussion of the derivation of the average annual and daily maximum makeup volumes is presented in the Water Alternatives Study (see Appendix 10.10).

Design water quality characteristics for the existing cooling reservoir, surface runoff, and lower Floridan aquifer are presented in Table 3.5.0-4. The existing cooling reservoir will continue to serve as the water source for condenser cooling, and the lower Floridan aquifer will be the source of plant service water and makeup to the cooling reservoir, when needed. Water from the lower Floridan aquifer will be obtained from onsite wells.

Table 3.5.0-1. Summary of Cooling Reservoir Water Balance for Annual Average Conditions for 880-MW Buildout

	Flow[a] (gpd)
Total Groundwater Withdrawal	
Reservoir Makeup	2,602,000
Units 1A and 1B Service Water	408,000
Unit 3 Service Water	164,000
TOTAL	3,174,000
Reservoir Water Inflows	
Direct Rainfall	2,224,900
Surface Runoff	311,500
Surficial Aquifer Seepage	0
Units 1A and 1B Water Discharge	86,300
Unit 3 Wastewater Discharge	93,700
Deep Well Makeup	2,602,000
Total Reservoir Inflow	5,318,400
Reservoir Water Outflows	
Leakance Losses	336,000
Dike Seepage Losses	920,000
Evaporation From Reservoir	4,062,400
Discharges to Payne Creek	0
Total Reservoir Outflow	5,318,400

[a] Assumes average load conditions.

Source: KBN, 1994.

Table 3.5.0-2. Summary of Cooling Reservoir Water Balance for Worst-Case Monthly Conditions for 880-MW Buildout

	Flow[a] (gpd)
Total Groundwater Withdrawal	
Reservoir Makeup	6,685,400
Units 1A and 1B Service Water	945,000
Unit 3 Service Water	937,000
TOTAL	8,567,400
Reservoir Water Inflows	
Direct Rainfall	2,034,600
Surface Runoff	0
Surficial Aquifer Seepage	0
Units 1A and 1B Water Discharge	200,000
Unit 3 Wastewater Discharge	285,000
Deep Well Makeup	6,685,400
Total Reservoir Inflow	9,205,000
Reservoir Water Outflows	
Leakance Losses	336,000
Dike Seepage Losses	920,000
Evaporation From Reservoir	7,949,000
Discharges to Payne Creek	0
Total Reservoir Outflow	9,205,000

[a] Assumes 100 percent load.

Source: KBN, 1994.

Table 3.5.0-3. Estimation of Monthly Average Water Demand Under Average Load Conditions Using the Log-Pearson Type III Distribution

Recurrence Interval (yrs)	Recurrence Percent	Flow (gpd)
1.01	99	1,905,023
2	50	3,208,315
5	20	3,619,754
10	10	3,807,750
25	4	3,984,341
50	2	4,085,172
100	1	4,166,616
200	0	4,233,623

Note: Results of the Log-Pearson Type III distribution based on average annual monthly water requirements under average load conditions (for 880 MW) computed for each of 37 years show that an average monthly water withdrawal rate of 3.8 mgd will be required once every 10 years. The withdrawal rate of 3.8 mgd is consistent with the currently existing groundwater allocation for HPS.

Data Statistics:

Average	3,173,000 gpd
Minimum	2,101,000 gpd
Maximum	4,131,000 gpd
Standard Deviation	487,600 gpd
Number of Observations	37 years[a]

[a] based on 444 months of historical data.

Source: KBN, 1994.

Table 3.5.0-4. Design and Existing Water Quality Characteristics for HPS (Page 1 of 2)

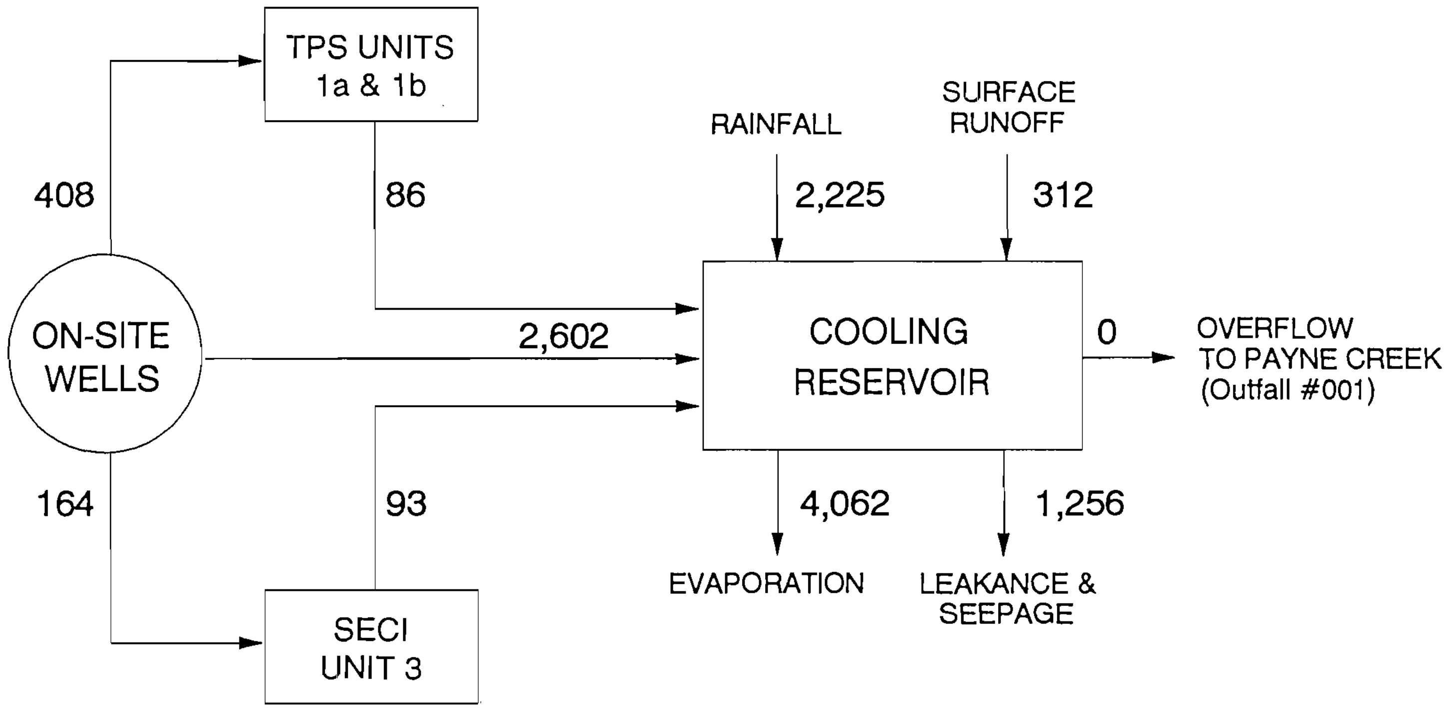
Parameter	Existing Cooling Reservoir	Design: Surface Runoff	Design: Lower Floridan Aquifer Makeup
Calcium, mg/L as $CaCO_3$	50.9	63	113
Magnesium, mg/L as $CaCO_3$	52.4	39	49
Sodium, mg/L as $CaCO_3$	108	17	37
Potassium, mg/L as $CaCO_3$	1.5	0	8
Total Hardness, mg/L as $CaCO_3$	101	102	162
Alkalinity, mg/L as $CaCO_3$	96	61	160
Sulfate, mg/L as $CaCO_3$	36.8	37	26
Chloride, mg/L	185	21	21
Silica, mg/L	<1	5.4	27
Fluoride, mg/L	1.81	1.0	2.0
Cyanide, mg/L	<0.005	<0.004	<0.005
MBAS, mg/L	NA	0.040	<0.180
Oil and Grease, mg/L	<5	<5	<5
Turbidity, NTU	10	1.7	14
pH, units	7.8	7	7.5
Total Dissolved Solids, mg/L	427	190	342
Specific Conductivity, μmho/cm	349	173	320
Total Kjeldahl Nitrogen, mg/L	1.57	0.74	0.39
Ammonia Nitrogen, mg/L	0.046	0.11	0.20
Organic Nitrogen, mg/L	NA	0.65	0.19
Nitrate+Nitrite-Nitrogen, mg/L	0.009	0.50	0.031

Table 3.5.0-4. Design and Existing Water Quality Characteristics for HPS (Page 2 of 2)

Parameter	Existing Cooling Reservoir	Design: Surface Runoff	Design: Lower Floridan Aquifer Makeup
Total Nitrogen, mg/L	1.58	1.24	0.421
Orthophosphorus, mg/L	0.347	0.41	0.20
Total Phosphorus, mg/L	0.816	0.44	0.20
Arsenic, μg/L	<5	<5	<10
Barium, μg/L	12	<10	75
Beryllium, μg/L	<0.1	<3	<0.1
Cadmium, μg/L	<5	<0.4	<0.7
Chromium, μg/L	<5	<10	13
Copper, μg/L	<10	7	7
Iron, μg/L	162	293	420
Lead, μg/L	<5	6.1	1
Manganese, μg/L	<5	7.9	28
Mercury, μg/L	<0.2	0.24	<0.2
Nickel, μg/L	<30	16	23
Selenium, μg/L	<5	<5	16
Silver, μg/L	<0.07	<0.08	<0.07
Strontium, μg/L	88	100	300
Zinc, μg/L	73	7.4	143
Alpha, Gross (pC/L)	12.5	1.7	8.4
Radium 226 (pC/L)	1.0	0.7	3.0

Note: NA = not analyzed.

Sources: TPS/SECI, 1989.
KBN, 1994.



NOTES:

1. FLOWS ARE EXPRESSED AS 1,000 GALLONS PER DAY
2. FLOWS ARE FOR 880 MW PLANT

Figure 3.5.0-1
Cooling Reservoir Water Balance — Annual Average Conditions for 880-MW Buildout

Source: KBN, 1994.

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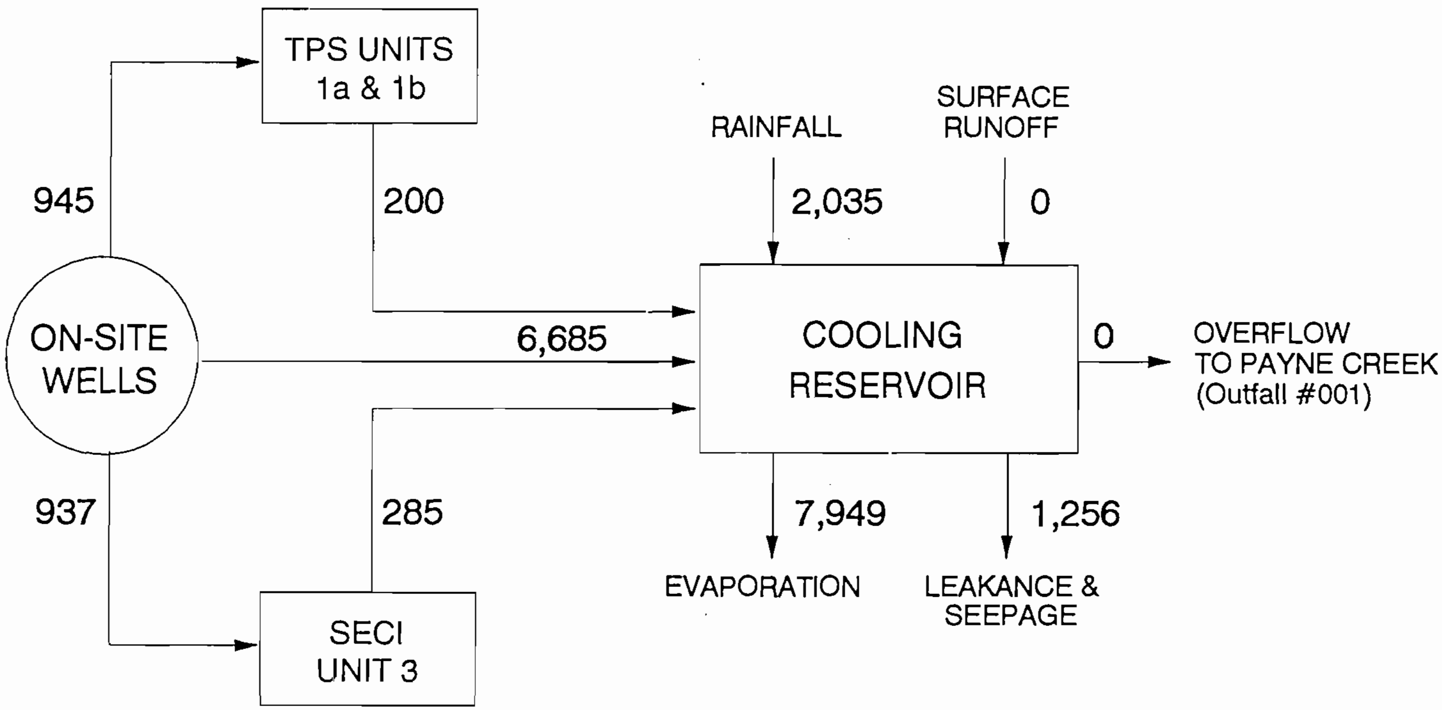

NOTES:

1. FLOWS ARE EXPRESSED AS 1,000 GALLONS PER DAY
2. FLOWS ARE FOR 880 MW PLANT

Figure 3.5.0-2
Cooling Reservoir Water Balance — Worst-Case Monthly Conditions for 880-MW Buildout

Source: KBN, 1994.

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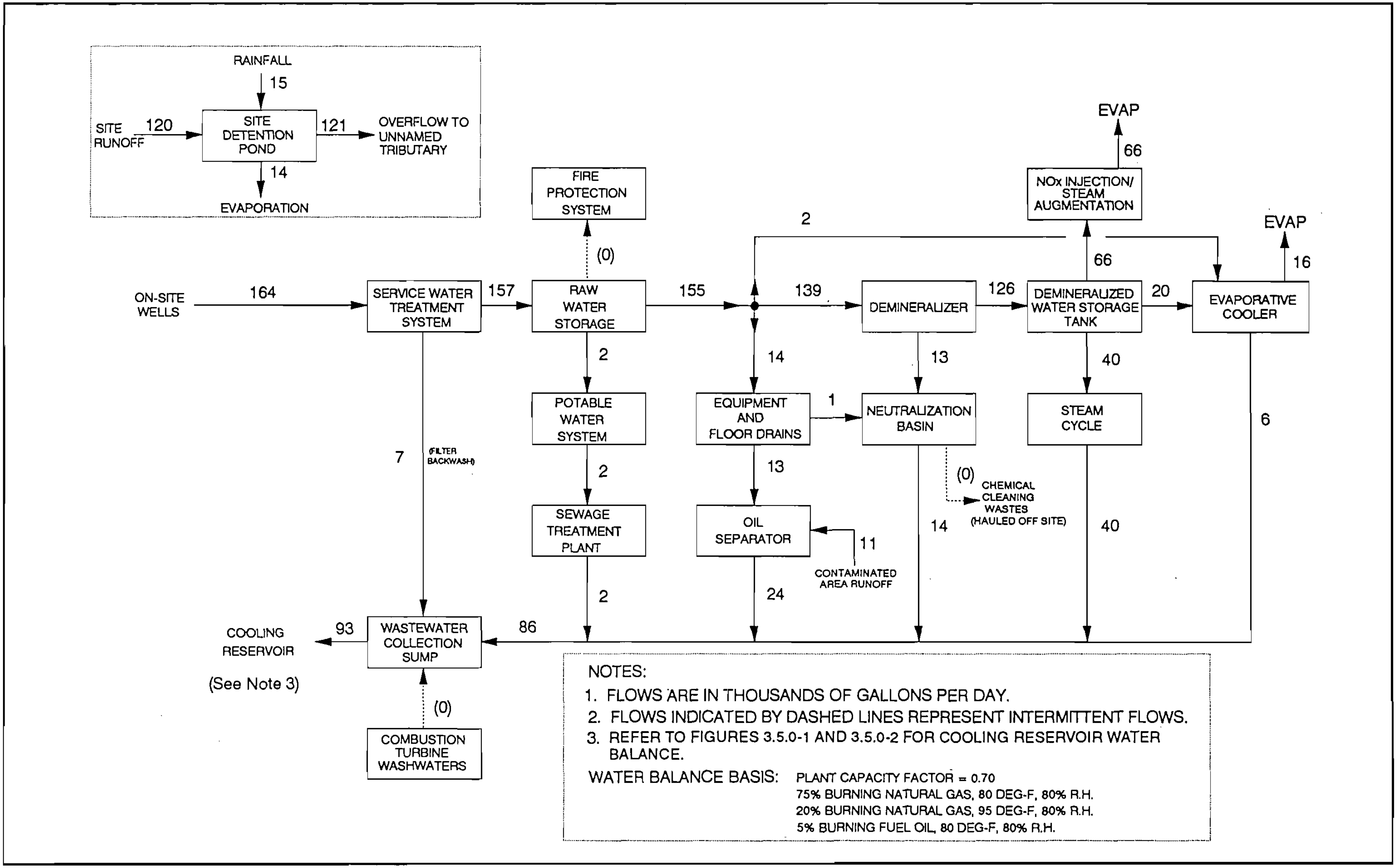

Figure 3.5.0-3
Plant Water Balance — Annual Average Makeup for the 440-MW Hardee Unit 3

Source: Black & Veatch, 1994.

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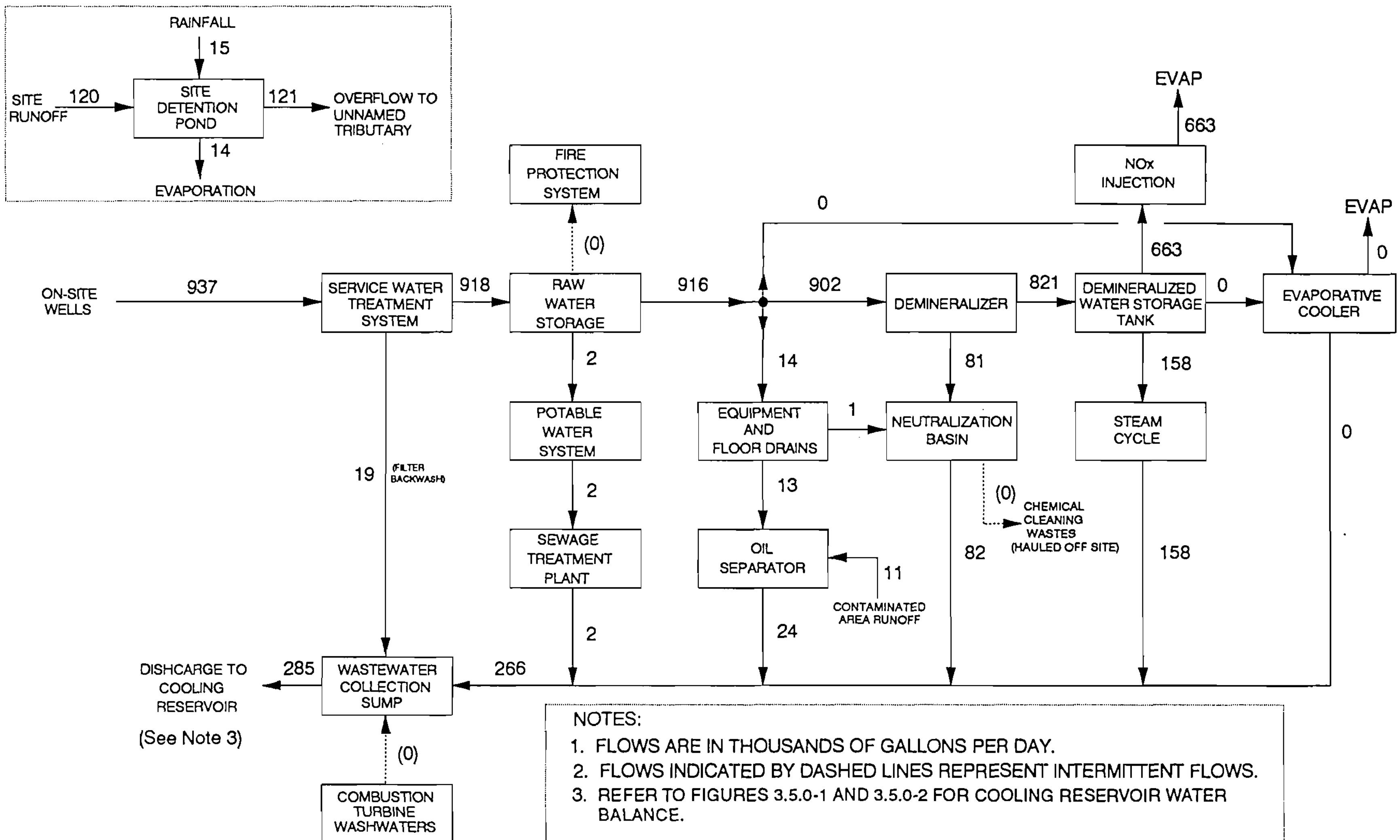

NOTES:
1. FLOWS ARE IN THOUSANDS OF GALLONS PER DAY.
2. FLOWS INDICATED BY DASHED LINES REPRESENT INTERMITTENT FLOWS.
3. REFER TO FIGURES 3.5.0-1 AND 3.5.0-2 FOR COOLING RESERVOIR WATER BALANCE.

WATER BALANCE BASIS: PLANT CAPACITY FACTOR = 1.0, UNIT LOAD FACTOR = 1.0
BURNING FUEL OIL, 30 DEG-F, 50% R.H.

Figure 3.5.0-4
Plant Water Balance — Maximum Daily Makeup for the 440-MW Hardee Unit 3

Source: Black & Veatch, 1994.

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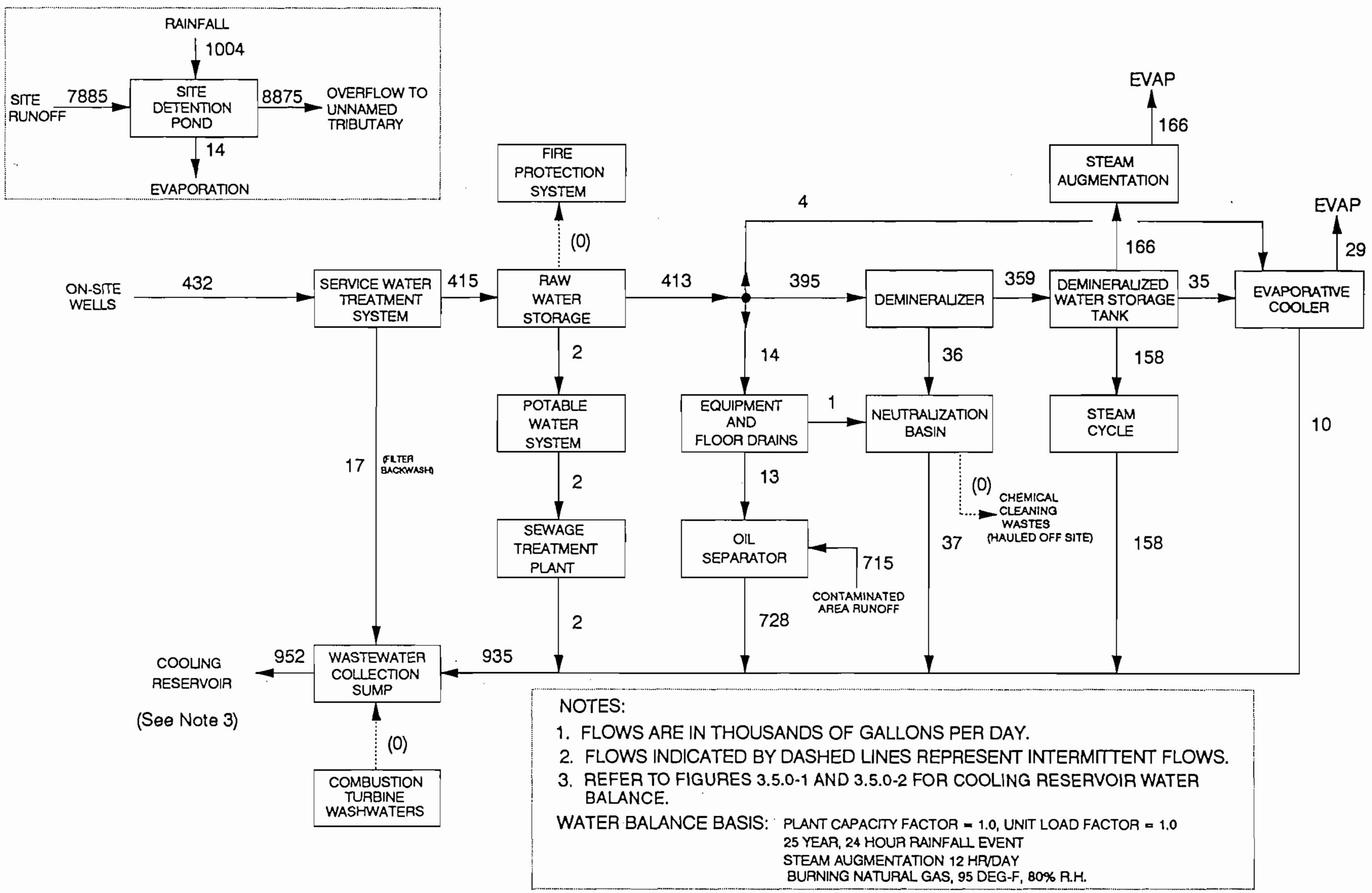

Figure 3.5.0-5
Plant Water Balance — Maximum Daily Discharge for the 440-MW Hardee Unit 3

Source: Black & Veatch, 1994.

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3.5.1 CIRCULATING WATER HEAT REJECTION SYSTEM

3.5.1.1 SYSTEM DESIGN

Based on the plant design for Hardee Unit 3, the following cooling system engineering design criteria were used:

1. The cooling system shall be capable of rejecting 1.24×10^{12} joules/hr (1.18×10^{9} Btu/hr) at 35°C (95°F) ambient temperature and 1.37×10^{12} joules/hr (1.30×10^{9} Btu/hr) at 0°C (32°F).
2. The cooling system shall be optimized for the expected ambient conditions and performance characteristics and requirements of the various heat rejection systems.
3. The cooling system shall be capable of supplying a daily average water temperature of 35°C (95°F) or cooler to the condenser under design ambient conditions and 100 percent load. Additionally, the condenser back-pressure shall not exceed 3.5 inches of mercury (in. Hg).
4. Cooling system water quality shall be maintained at satisfactory quality to allow continuous condenser cooling operation.

Condenser cooling will be achieved by once-through cooling using water from the existing cooling reservoir. Thermal modeling conducted as part of the Water Alternatives Study (see Section 5.1 and Appendix 10.10) indicated that the existing cooling reservoir has the capacity to accommodate the heat rejection requirements of the full 880-MW Hardee Power Station (440-MW Hardee Unit 3 Project and previously certified 295-MW Phase 1A and the future 145-MW Phase 1B).

The cooling reservoir will function as the fundamental component of the heat dissipation/rejection system. In this system, cooling water from the reservoir is pumped through the condenser to condense the turbine exhaust steam. This heated cooling water is returned to the cooling reservoir, where it is cooled through evaporative and radiant mechanisms.

The plant circulating water system consists of a single-pressure surface condenser, circulating water pumps, and supply and return circulating water piping to withdraw and return circulating water to the cooling reservoir. In addition to the surface condenser, an auxiliary cooling water system for equipment cooling will be installed. This system will consist of water-to-water heat exchangers and will receive cooling water from the circulating water system.

3.5.1.2 SOURCES OF COOLING WATER

As stated in the preceding section, the existing cooling reservoir will be used for condenser cooling for the Hardee Unit 3 Project. Currently, water makeup sources for the existing cooling reservoir include direct rainfall, runoff and seepage from the surrounding upland watershed, plant discharges to the reservoir, and, as necessary to maintain the reservoir water level, water from the lower Floridan aquifer. Proposed Hardee Unit 3 plant water inflows to the reservoir will include treated sanitary wastewater, plant and equipment drains, boiler blowdown, and demineralizer regeneration wastes; these will be treated as shown in the water mass balance (see Figures 3.5.0-3 through 3.5.0-5). The lower Floridan aquifer well water will not be treated before use as direct makeup to the cooling reservoir.

As part of the Water Alternatives Study conducted for Hardee Unit 3 (Appendix 10.10), refinements to the cooling reservoir water balance were developed. Based on these inputs and modeling results from the Water Alternatives Study, it was determined that the existing consumptive use allocation for the HPS is adequate to supply all water needs for the ultimate HPS generating capacity of 880 MW (440-MW Hardee Unit 3 Project and 440-MW Phase 1A and 1B previously certified) based on the 90 percent probability distribution of worst-case climatological data. Therefore, additional groundwater withdrawals will not be requested for the Hardee Unit 3 Project.

A maximum withdrawal rate of 32.7 million Lpd (8.64 mgd) is proposed for the 880-MW plant at the site with an average monthly withdrawal of 14.4 million Lpd (3.8 mgd). Small quantities of water will be used for drinking water, plant maintenance (cleaning) water, and miscellaneous water use at the plant.

The parameters listed in Table 3.5.1-1 were used to evaluate drawdown at the well and site boundary. These parameters were used with the modified Theis equation and the law of superposition to determine the drawdown at various distances from the pumping wells.

Figure 3.5.1-1 shows a worst-case groundwater withdrawal scenario of 58.3 million Lpd (15.4 mgd) (i.e., 1.8 times the permitted amount). Even when pumping at this unrealistically high rate for 120 days continuously, drawdown at the property boundary is estimated to be

<0.12 m (<0.4 ft.) Actual drawdowns will be considerably less given a pumping rate of 14.4 million Lpd (3.8 mgd).

Estimated long-term circulating water quality after 30 years of operation is shown in Table 3.5.1-2. These estimates are based on (1) existing water quality in the reservoir, (2) influent water quality from surface runoff and the lower Floridan aquifer, and (3) annual average climatological data and average load conditions for the entire 880-MW facility.

3.5.1.3 COOLING RESERVOIR WATER RELEASES

Water losses from the cooling reservoir include evaporation, seepage through the berm, leakance into the lower aquifers, and infrequent releases into Payne Creek (i.e., releases resulting from rainfalls greater than the 10-year, 24-hour storm).

Seepage from the cooling reservoir will serve as a continuous blowdown from the recirculating water system and will reduce the accumulation of adverse levels of dissolved solids within the reservoir.

To accommodate the infrequent releases which may occur during extreme (wet) meteorological conditions (>10-year, 24-hour rainfall event), a reservoir overflow to Payne Creek was certified and constructed as part of the original HPS certification (TPS/SECI, 1989). The cooling reservoir overflow/discharge is currently directed from the reservoir surface to the edge of the Payne Creek floodplain/wetlands by a large wide swale. At the upland edge of the Payne Creek floodplain/wetlands, the swale widens to an area of sheet flow prior to entering Payne Creek. No modifications to the existing discharge structure are proposed as part of the Hardee Unit 3 Project.

Table 3.5.1-1. Deep-Well Aquifer Characteristics for Hardee Unit 3

Parameter	Value
Aquifer	Floridan
Transmissivity	1,000,000 gpd/ft
Storativity	0.005
Depth to Static Water	85 ft

Source: Dames & Moore, 1979.

Table 3.5.1–2. Estimated Long–Term Cooling Reservoir Water Quality After 30 Years of Operation at Average Load Conditions

Parameter	Units	Concentration
Calcium	mg/L as CaCO3	310
Magnesium	mg/L as CaCO3	140
Sodium	mg/L as CaCO3	210
Potassium	mg/L as CaCO3	20
Total Hardness	mg/L as CaCO3	440
Alkalinity	mg/L as CaCO3	360
Sulfate	mg/L as CaCO3	250
Chloride	mg/L as CaCO3	60
Silica	mg/L	70
Fluoride	mg/L	5.4
Cyanide	mg/L	0.01
MBAS	mg/L	0.48
Oil and Grease	mg/L	5
Turbidity	mg/L	31
pH, units	std. units	7.5
Total Dissolved Solids	mg/L	1080
Specific Conductivity	μmho/cm	1240
Total Kjeldahl Nitrogen	mg/L	1.2
Ammonia Nitrogen	mg/L	0.5
Unionized Ammonia	mg/L	0.017
Organic Nitrogen	mg/L	0.7
Nitrate+Nitrite–Nitrogen	mg/L	0.2
Total Nitrogen	mg/L	1.4
Orthophosphorus	mg/L	0.6
Total Phosphorus	mg/L	0.6
Arsenic	μg/L	30
Barium	μg/L	200
Beryllium	μg/L	1.6
Cadmium	μg/L	1.00
Chromium	μg/L	40
Copper	μg/L	9.95
Iron	μg/L	990
Lead	μg/L	6.8
Manganese	μg/L	63
Mercury	μg/L	0.097
Nickel	μg/L	60
Selenium	μg/L	40
Silver	μg/L	0.14
Strontium	μg/L	800
Zinc	μg/L	370
Alpha, Gross	pC/L	22.2
Radium 226	pC/L	7.9

Source: KBN, 1994.

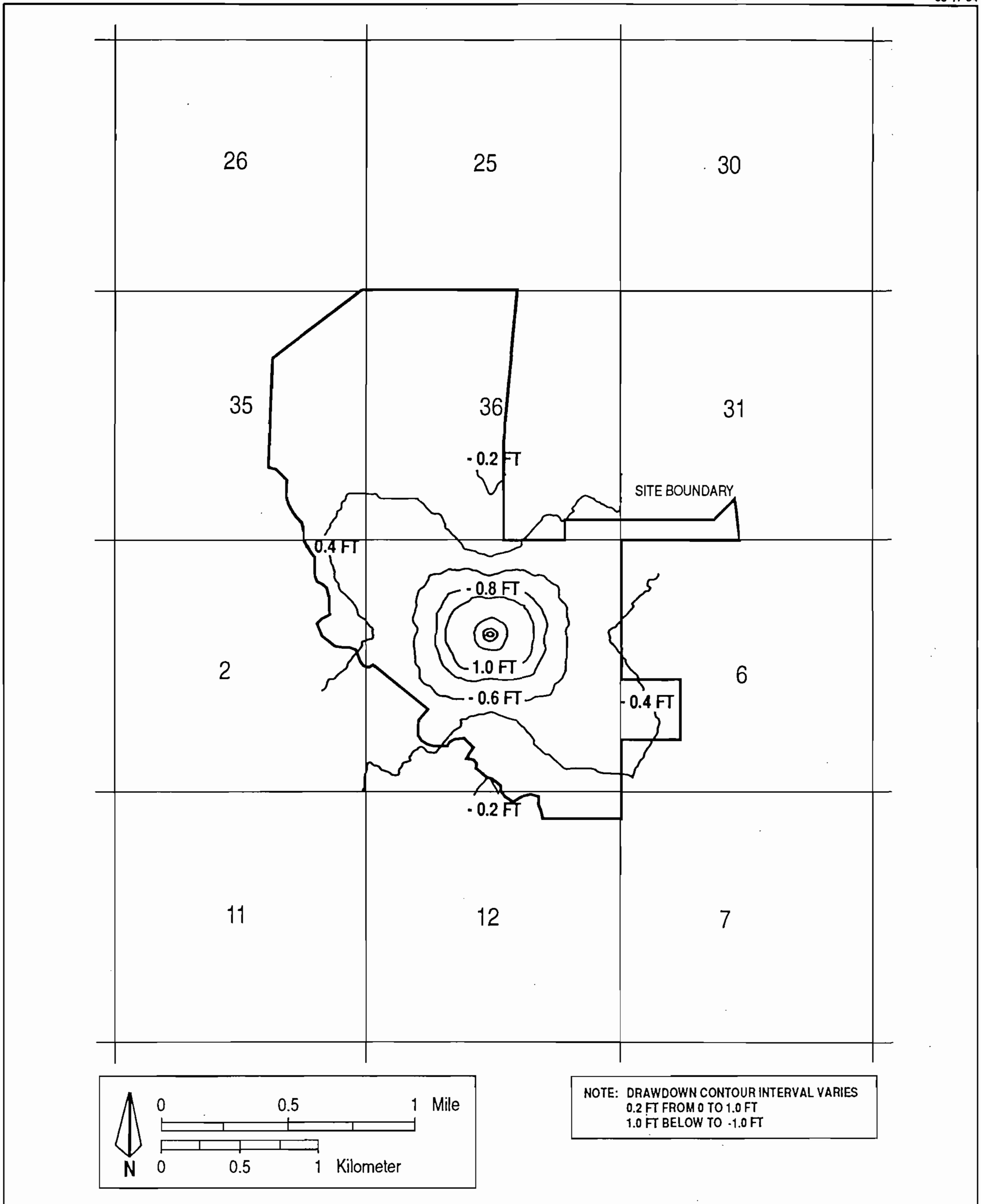

Figure 3.5.1-1
Predicted Worst-Case Groundwater
Drawdown Scenario

Source: TPS/SECI, 1989.

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3.5.2 DOMESTIC/SANITARY WASTEWATER

Domestic/sanitary wastewater generated within the Hardee Unit 3 plant will be treated in a new package sewage treatment plant. This plant will be constructed and operated in compliance with F.A.C. 17-600. Final design information will be submitted to FDEP pursuant to conditions of certification. Sanitary facilities using potable water will be sized for 40 administrative, maintenance, operating, and other personnel. Discharges from showers, wash basins, bathrooms, drinking fountains, and other facilities are expected to result in an estimated 2,000 gpd (50 gallons per person per day) of combined sanitary wastewater flow. The BOD of the sanitary wastewater influent is anticipated to be 160 mg/L, or 2.7 pounds per day BOD loading to the system. The sludge per pound of BOD ratio is 0.6, or 1.6 pounds per day of sludge.

The proposed sanitary waste treatment system will be an extended aeration type package unit capable of handling a daily load of at least 2,000 gallons. The sanitary wastewater treatment system will include a covered, vented lift station and an activated sludge package unit. The components of the package unit include equalization, biological treatment, clarification, sludge digestion, filtration, and disinfection units. Effluent from the sanitary wastewater treatment system will be routed to the wastewater collection sump and then routed to the cooling reservoir for reuse in the heat dissipation system. Periodically, sludge will be removed from the sludge digester by vacuum truck for offsite disposal in an appropriately licensed sanitary landfill. Approximately 1,022 L (270 gallons) of sewage sludge is expected to be produced each month, based on a maximum of 40 persons at full buildout and assuming a sludge concentration of 1.5 percent.

The treatment system will be designed to ensure compliance with the following effluent limitations: BOD, 20 mg/L; TSS, 20 mg/L; and pH between 6 and 8.5. Disinfection will be designed to result in not more than 200 fecal coliform values per 100 mL of effluent sample [Chapter 17-600.440(4), F.A.C.].

Figure 3.5.2-1 presents a flow diagram of the sanitary wastewater treatment system. Wastewater from the sanitary lift station will flow to an activated sludge package treatment unit. Aeration air will be supplied by blowers to provide oxygen and mixing to the activated sludge for biological metabolism of organic material. Activated sludge will flow by gravity from the aeration basin to the clarifier for solids separation. A portion of the settled solids will be recycled to the aeration basin to sustain the microorganism population. Excess activated sludge will be drawn off and sent to the sludge digester, providing the correct water-to-recycle ratio.

Effluent from the clarifier will flow by gravity to the chlorine contact chamber for disinfection. Effluent will be given at least 15 minutes contact time in the disinfectant chamber. A residual concentration of 0.5 mg/L total chlorine will be maintained in the effluent prior to discharge to the cooling reservoir.

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1994-3.1/SECI-SAN/TREATMENT

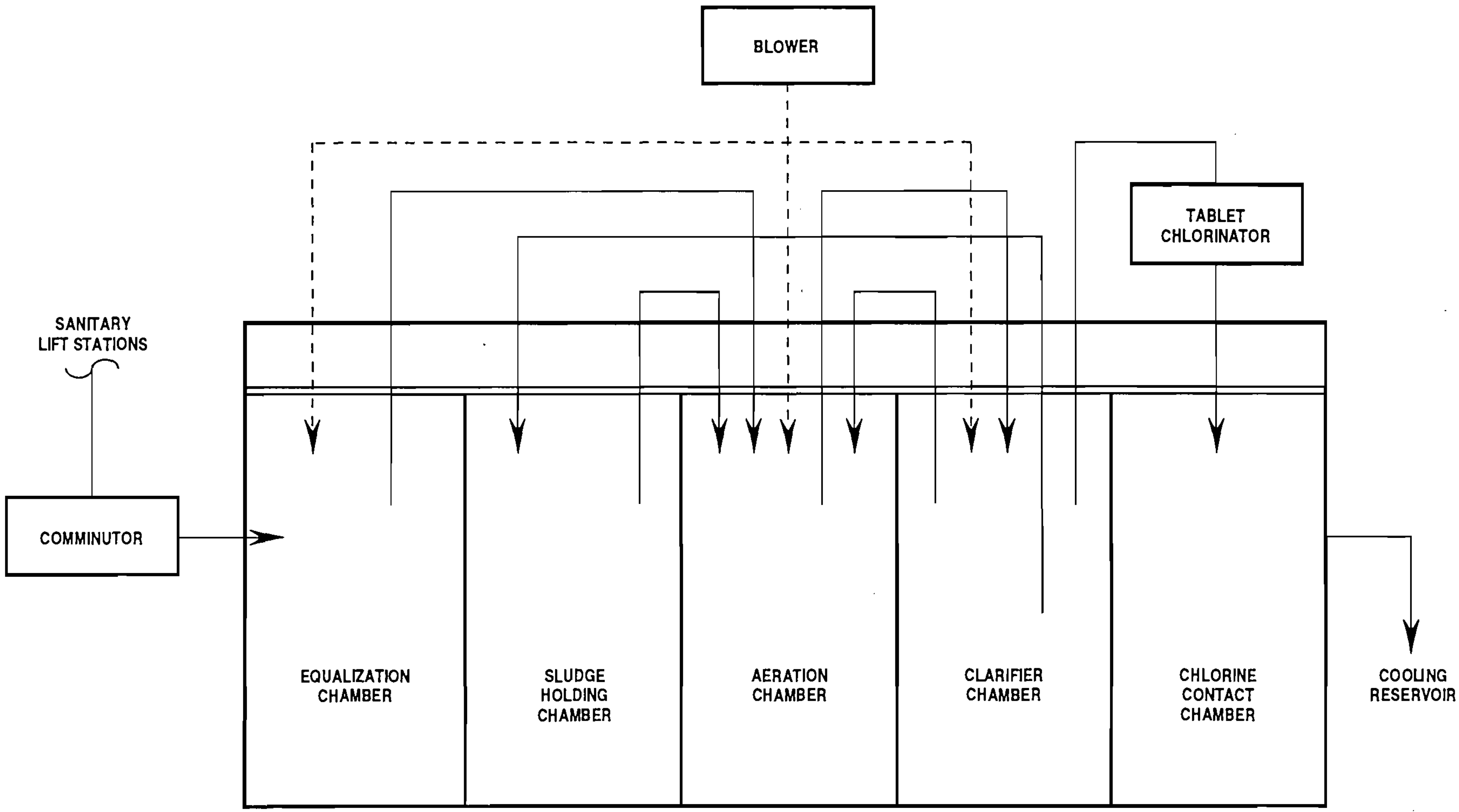

Figure 3.5.2-1
Sanitary Wastewater Treatment System

Source: Black & Veatch, 1994.

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3.5.3 POTABLE WATER

Potable water uses at the Hardee Unit 3 facility will include water for drinking, washing, and toilets. Potable water for the plant will be obtained from the service water system, which will be supplied by lower Floridan aquifer well water following treatment and chlorination by the service water treatment system. The average expected potable water usage is approximately 7,570 Lpd (2,000 gpd) based on 40 administrative, maintenance, operating, and other personnel.

The system will be classified as nontransient noncommunity water system and will be operated in accordance with Chapters 17-550 and 17-555, F.A.C., the Safe Drinking Water Act, the Florida State Drinking Water Act, and other relevant standards. Final design information will be submitted to FDEP pursuant to conditions of certification.

3.5.4 PROCESS WATER

3.5.4.1 DEMINERALIZED WATER

The second largest water use in the new facility will be for demineralized water. Demineralized water is required for:

1. Injection into the CTs to reduce NO_x emissions when firing distillate fuel oil;
2. Makeup to replace blowdown from the HRSG (necessary to maintain a low dissolved solids content in the HRSG);
3. Injection into CTs for power augmentation to meet load demand in summer months;
4. Makeup to replace miscellaneous steam losses in the heat recovery cycles; and
5. Makeup to replace losses in the evaporative cooler.

Service water (i.e., filtered lower Floridan aquifer well water) will be demineralized in the ion exchange demineralizer train. The demineralizer train will consist of primary and secondary cation and anion exchangers. A forced-draft type degasifier will be located between the primary and secondary exchange vessels for reduction of carbon dioxide (CO_2). The demineralizer ion exchange vessels will be regenerated with solutions of sulfuric acid and sodium hydroxide (NaOH). The resulting regenerant wastestreams will be collected in a neutralization unit and treated as described in Section 3.6.7. The treated regenerant wastewater will be collected in a wastewater collection sump and recycled to the existing cooling reservoir.

3.5.4.2 GENERAL SERVICE WATER

General usage water, including seal water, cleaning and flushing water, and emergency (fire control) water, will be provided by the service water system. Water requirements are expected to average 57 liters per minute (Lpm) [15 gallons per minute (gpm)] for the Hardee Unit 3 facility and will be supplied from the service water treatment system.

Service water will be lower Floridan aquifer water which has been filtered using pressure filters. The filter units will be used to remove suspended solids from the water supply stream. The filters will be backwashed periodically with an average of 26,500 L (7,000 gallons) of unfiltered water. The filter backwash will be routed to the wastewater collection sump and then directed to the cooling reservoir.

Following filtration, chlorine will be added to the water for disinfection. A residual chlorine concentration of 0.2 ppm will be maintained in the raw water storage tank.

3.5.5 WATER USE VARIATIONS

Maximum daily water requirements for Hardee Unit 3 discussed in the preceding sections are based on a 440-MW facility operating at 100 percent load and when ambient meteorological conditions would necessitate the greatest overall consumption of water. For the major plant water uses (i.e., demineralized water for NO_x injection water, power augmentation, evaporative cooler, and steam cycle makeup), water use is proportional to operating load. Thus, reduction in load would result in a proportional reduction in water demand. The balance of plant water uses (potable and general service uses) is less dependent on operating load.

Variations in ambient meteorological conditions will also result in variations in water demand for evaporative cooling and cooling reservoir makeup. Given that a large portion (approximately 50 percent) of the total cooling reservoir makeup comes from precipitation, an increase in precipitation will cause an equivalent decrease in cooling reservoir makeup from lower Floridan aquifer wells. Similarly, periods of low temperature and/or high humidity will cause the evaporation in the cooling reservoir to decrease, and will allow the cooling reservoir makeup from lower Floridan aquifer wells to decrease proportionally.

Given its size and volume, the cooling reservoir substantially dampens short-term variations in cooling water makeup. Whereas actual evaporative losses may vary significantly based on plant load or daily meteorological conditions, the relative fluctuation in reservoir level or reservoir volume is small. Cooling reservoir makeup is independent of the short-term variations in plant and meteorological conditions. The cooling reservoir functions as a surface water reservoir designed to manage all water inflows and outflows, thereby maximizing water reuse, minimizing water withdrawals, and minimizing water demand and use variations. Makeup to the cooling reservoir is untreated.

3.6 CHEMICAL AND BIOCIDE WASTE

The overall water/wastewater flow schemes for Hardee Unit 3 are shown in Figures 3.5.0-3 through 3.5.0-5. All wastewaters generated within the proposed facility will be recycled to the existing cooling reservoir, after appropriate treatment (as described below), for reuse as cooling reservoir makeup. A similar wastewater treatment and recycling scheme is currently in use at the existing HPS units. The principal water/wastewater discharges to the cooling reservoir include:

1. Circulating cooling water return flow,
2. Service water treatment system backwash water,
3. Sanitary treatment system wastewater,
4. Equipment and floor drains,
5. Neutralization unit effluent,
6. Contact stormwater plant runoff,
7. Steam cycle blowdown, and
8. Evaporative cooler blowdown.

The principal uses of chemicals and biocides at the Hardee Unit 3 facility will be for cooling reservoir circulating water quality control, steam cycle water quality control, sanitary wastewater treatment, makeup water demineralization, chemical cleaning of the boiler and preboiler piping systems, and miscellaneous chemical drains.

3.6.1 COOLING RESERVOIR CIRCULATING WATER CHEMICAL TREATMENT

Intermittent shock chlorination or other oxidizing or nonoxidizing biocides will be used to prevent biofouling of the circulating water system. A chlorine solution will be fed into the intake structure at the circulating water pump intake.

A scale inhibitor may be fed to the circulating water system to control the formation of calcium carbonate scales, which adhere to heat transfer surfaces and reduce cooling condenser performance.

3.6.2 STEAM CYCLE WATER TREATMENT

The steam-condensate-feedwater cycle will be chemically treated to prevent corrosion or scaling of the condensate piping and the HRSG preboiler piping and boiler drums. The steam cycle water will be treated with an oxygen scavenger, such as hydrazine, for dissolved oxygen control and with ammonia or an amine for pH control. Sodium phosphate will be fed to the boiler for control of pH and hardness. Residual phosphate in the boiler will react with hardness to form a nonadherent precipitate.

3.6.3 SANITARY WASTEWATER TREATMENT

Sanitary wastewater produced during normal plant operation will be routed to an extended aeration sewage treatment plant. The average expected flow of sanitary wastewater is 7,570 Lpd (2,000 gpd). The sanitary wastewater treatment plant will be operated in accordance with Chapters 17-600 and 17-601, F.A.C. Effluent from the sanitary wastewater treatment system will be routed to the wastewater collection sump and then recycled to the existing cooling reservoir.

During construction and prior to completion of the sewage treatment plant, construction-related sanitary wastes will be managed by the installation, use, and maintenance of portable chemical toilets. As necessary, sanitary wastes will be pumped from these individual toilets and disposed of offsite in an approved facility by a licensed contractor.

3.6.4 MAKEUP WATER DEMINERALIZATION

As discussed in Section 3.5.4, the makeup water to the steam cycle will be demineralized using an ion exchange type demineralizer train. The demineralization system will use sulfuric acid for cation resin regeneration and sodium hydroxide for anion resin regeneration. The sulfuric acid and sodium hydroxide will be stored in bulk storage tanks with secondary containment located in, or adjacent to, the water treatment building. The use of these chemicals will be on an intermittent and as-needed basis, dependent on duration of the demineralizer service run and regeneration requirements.

Cation resin regeneration will produce regenerant wastewater containing unreacted sulfuric acid and dissolved sulfate salts of the cations removed from the resins during regeneration. Anion resin regeneration will produce regenerant wastewater containing unreacted sodium hydroxide and dissolved sodium salts of the anions removed from the resins during regeneration.

The estimated regenerant wastewater flow will average approximately 49,000 Lpd (13,000 gpd) based on the average makeup requirement conditions. The regenerant wastewaters will be drained by gravity to the neutralization unit for pH adjustment prior to discharge to the wastewater collection sump and ultimately recycled to the cooling reservoir. The neutralization unit is described in Section 3.6.7.

3.6.5 CHEMICAL CLEANING

The HRSG boiler and preboiler piping will be chemically cleaned initially during commissioning and also periodically during the life of the plant. The chemicals used will not be permanently stored onsite but will be delivered to the site by a licensed contractor at the time of the scheduled periodic cleanings. The chemical cleaning solutions to be used for acid and alkaline cleaning of the HRSG will be dependent on the HRSG manufacturer selected. The actual cleaning solutions used must be consistent with the HRSG manufacturer's recommendations. Chemicals typically used in HRSG and feedwater pipe cleaning include the following:

1. Inhibited hydrochloric acid,
2. Ammonium bifluoride,
3. Hydroxyacetic acid,
4. Formic acid,
5. Disodium phosphate,
6. Trisodium phosphate,
7. Soda ash,
8. Nonfoaming wetting agents, and
9. Foam inhibitors.

Wastewaters will consist of the cleaning solutions and material removed during the cleaning process. The chemical cleaning contractor will dispose of the chemical cleaning wastes offsite.

Since chemical cleaning is an infrequent maintenance operation, it does not contribute to the liquid wastes produced by the normal operation of the plant.

3.6.6 MISCELLANEOUS CHEMICAL DRAINS

Chemical wastewater can result from draining a chemical storage tank or from cleaning and maintenance operations such as washdown of chemical storage areas. A dedicated chemical waste drainage system will be provided to route miscellaneous chemical wastes to the neutralization unit for treatment. Flows from the miscellaneous chemical drains will be intermittent and will not normally contribute to the wastewater flows.

3.6.7 NEUTRALIZATION UNIT

A neutralization unit will be provided for pH adjustment of chemical wastes on a batch basis. The unit will be of sufficient volume to accommodate the wastewaters produced during regeneration of the demineralizer system. The neutralization unit will be a reinforced concrete basin lined with a chemical-resistant membrane and acid-resistant brick and mortar. A chemical waste mixer will be provided to mix the acid and alkaline wastewaters to enhance their self-neutralizing tendencies. Sulfuric acid and sodium hydroxide, as required for neutralization, will be available from the demineralizer regeneration equipment. The pH-adjusted chemical wastewaters will be routed to the wastewater collection sump. The estimated discharge from the neutralization unit under maximum daily conditions is 140,045 Lpd (37,000 gpd). Table 3.6.7-1 presents the estimated water quality of the neutralization unit effluent.

Table 3.6.7-1. Estimated Characteristics of the Neutralization Unit Effluent for the Hardee Unit 3 Facility (Page 1 of 2)

Parameter	Concentration
Calcium, mg/L as $CaCO_3$	1,130
Magnesium, mg/L as $CaCO_3$	490
Sodium, mg/L as $CaCO_3$	3,050
Potassium, mg/L as $CaCO_3$	80
Total Hardness, mg/L as $CaCO_3$	1,620
Alkalinity, mg/L as $CaCO_3$	0
Sulfate, mg/L as $CaCO_3$	4,540
Chloride, mg/L as $CaCO_3$	210
Silica, mg/L	270
Fluoride, mg/L	20
Cyanide, mg/L	0.05
MBAS, mg/L	1.8
Oil and Grease, mg/L	0
Turbidity, NTU	10
pH, units	6-9
Total Dissolved Solids, mg/L	6,860
Specific Conductivity, umhos/cm	12,100
Total Kjeldahl Nitrogen, mg/L	3.9
Ammonia Nitrogen, mg/L	2.0
Organic Nitrogen, mg/L	1.9
Nitrate+Nitrite-Nitrogen, mg/L	0.3
Total Nitrogen, mg/L	4.2
Orthophosphorus, mg/L	2.0
Total Phosphorus, mg/L	2.0

Table 3.6.7-1. Estimated Characteristics of the Neutralization Unit Effluent for the Hardee Unit 3 Facility (Page 2 of 2)

Parameter	Concentration
Arsenic, μg/L	100
Barium, μg/L	750
Beryllium, μg/L	4.5
Cadmium, μg/L	3.5
Chromium, μg/L	130
Copper, μg/L	30
Iron, μg/L	0
Lead, μg/L	15
Manganese, μg/L	0
Mercury, μg/L	0.06
Nickel, μg/L	230
Selenium, μg/L	160
Silver, μg/L	0.35
Strontium, μg/L	3,000
Zinc, μg/L	1,400
Alpha, Gross (pC/L	84
Radium 226 (pC/L)	30

Source: Black & Veatch, 1994.

3.6.8 MISCELLANEOUS EQUIPMENT AND FLOOR DRAINS

Separate collection systems will be used to collect chemical drain wastewater and miscellaneous equipment and floor drain wastewater. Chemical drain wastewaters are addressed in Section 3.6.6. Miscellaneous equipment and floor drain wastewater can result from maintenance drains of equipment, seal water drains, and drains from general cleaning and maintenance, such as washdown of general plant (i.e., non-chemical) areas. Miscellaneous equipment and floor drains will be directed to an oil/water separator and then routed to the wastewater collection sump for recycling to the cooling reservoir. The estimated discharge from equipment and floor drains under maximum daily conditions is 49,210 Lpd (13,000 gpd).

3.7 SOLID AND HAZARDOUS WASTE

3.7.1 SOLID WASTE

Only small quantities of solid wastes will be generated by the Hardee Unit 3 Project since there will be no ash or flue gas desulfurization (FGD) waste generated. Solid wastes will be limited to municipal solid waste, sanitary waste treatment sludge, and infrequent replacement of demineralizer resins. The sanitary waste sludge will be disposed of by a licensed contractor who will remove sludge from the sludge-holding compartment once or twice per year. The sanitary waste sludge will be hauled offsite for disposal by a licensed contractor. All municipal solid wastes will be disposed of in an offsite sanitary landfill by a trash disposal contractor. Spent demineralizer resins will be removed from the site by a vendor and taken to an approved offsite disposal facility.

3.7.2 HAZARDOUS WASTE

Generation of hazardous waste at the Hardee Unit 3 facility will be limited to small quantities (less than 100 kg/month) of spent solvents and other chemicals. These wastes will be collected onsite and disposed of by a licensed hazardous waste contractor. No hazardous waste will be stored onsite for more than 90 days before removal. The demineralizer regenerant wastewaters can contain up to 10 percent sulfuric acid or up to 5 percent sodium hydroxide along with the minerals removed from the ion exchange resins. Spent acidic and basic solutions used to treat the demineralizer resin bed ion exchangers will be treated to eliminate corrosivity. Since these solutions will be treated in "an enclosed neutralization unit" or "elementary neutralization unit," they will not be classified as hazardous wastes according to Florida Hazardous Waste Rules (F.A.C. 17-730.270) or Federal Hazardous Waste Rule [40 CFR 264.1(g)(6) and 40 CFR 265.1(c)(10)]. The neutralized wastewater will not be accumulated and will be routed from the neutralization unit to the wastewater collection sump and ultimately to the cooling reservoir as a nonhazardous waste. Acid-cleaning wastes are addressed in Section 3.6.5.

3.8 ONSITE DRAINAGE SYSTEM

The site drainage facilities for Hardee Unit 3 will be constructed and operated separately from the HPS existing units. No changes in design or operation of the site drainage system for the HPS existing units are proposed as part of the current certification application.

Site drainage facilities for the Hardee Unit 3 will be designed in accordance with SWFWMD criteria (Chapter 40D-4, F.A.C.) for water quality and water quantity control. A plant site drainage system of pipes, channels, and culverts will convey runoff to a stormwater detention pond. Discharge from this stormwater detention pond will flow to the unnamed tributary to Payne Creek. A conceptual stormwater management plan for Hardee Unit 3 is presented in Appendix 10.12.1.

3.8.1 STORMWATER DETENTION POND

Non-contact surface runoff from the area disturbed for new facility construction and plant operation will be collected and routed to the stormwater detention pond. This pond will be located in the southwestern portion of the Hardee Unit 3 Project site and will receive non-contact surface drainage from the entire Hardee Unit 3 facility.

The stormwater detention pond has been sized to address both the water quality and water quantity control criteria of SWFWMD. For water quality control, the stormwater detention pond will provide "on-line" wet detention for runoff from the first 2.5 cm (1 inch) of runoff. Treated stormwater from the pond will be discharged to the adjacent unnamed tributary to Payne Creek.

For water quantity control, the stormwater detention pond will provide sufficient volume for peak attenuation to limit the peak pond discharge rate to the pre-development site peak discharge rate for a 25-year, 24-hour rainfall event. The overflow weir structure will pass any flows that exceed the flow resulting from the 25-year, 24-hour rainfall event. Design calculations are presented in Appendix 10.12.1.

3.8.2 STORMWATER RUNOFF CONTROL DURING CONSTRUCTION

The stormwater detention pond will be built during initial construction to serve as a construction stormwater detention pond. A system of temporary construction ditches and piping will direct the stormwater runoff and dewatering water flow to the pond. The construction drainage system will follow the layout of the permanent ditch system where possible.

Site development will not significantly alter the grades or drainage patterns of the site. Existing vegetation will be removed as required during initial site preparation operations. Final grading will include seeding all disturbed areas not occupied by plant facilities or not surfaced with asphalt or crushed aggregate.

Existing natural and mine reclamation drainage patterns will be altered so that all runoff from the main plant site will be directed to the runoff detention pond.

The temporary erosion and sedimentation control measures will be designed to prevent sediment from being displaced and carried offsite by construction runoff. The primary destination of construction runoff will be the runoff detention pond.

Prior to beginning excavation activities, a silt fence or straw bales will be installed along the perimeter of the project where runoff to offsite areas is expected. This silt fence will filter sediments from construction runoff. During construction, the extent of earth disturbances will be minimized as much as practical. Areas outside of cut and fill operations will be protected against unnecessary equipment traffic. Aggregate-surfaced areas will be provided for construction parking and roads.

Erosion control during construction will also include periodic spraying of water to minimize fugitive dust from the project area. A sediment filter or small sediment trap will be provided at the culverts and ditches to reduce the sediment load carried into the drainage system and pond.

Diversion ditches and/or berms will be constructed as necessary to divert runoff from offsite areas around the construction site. Temporary control measures will be maintained as necessary throughout the construction period and removed at the end of construction.

Runoff from areas of the site not disturbed by construction activities or plant operations will be directed to the natural drainage systems within the area. Runoff from areas of the site disturbed by construction activities will be collected in the stormwater drainage system and routed to the stormwater detention pond. A sedimentation and erosion control plan for Hardee Unit 3 is included in Appendix 10.10.

As necessary, sediment collected during the construction phase will be removed to ensure adequate pond volume and disposed of onsite.

3.8.3 SITE DRAINAGE

Generally, the drainage in the area of the new facility will be directed away from the structures and routed to the stormwater detention pond. The main plant complex area will be graded with moderate slopes for effective drainage.

Site runoff will be conveyed to the stormwater detention pond through a drainage system of pipes, channels, and culverts (see Appendix 10.11.1).

3.8.4 FLOOD ELEVATIONS

The Hardee Unit 3 site is not located in a 100-year floodplain. The 100-year flood elevation of the nearby unnamed tributary is approximately 36.3 m-msl (119 ft-msl). The elevation of the site facilities will be approximately 39.0 to 39.3 m-msl (128 to 129 ft-msl), which is about 3 m (10 ft) above the flood elevation.

3.9 MATERIALS HANDLING

3.9.1 CONSTRUCTION MATERIALS AND EQUIPMENT

Construction materials and equipment will be delivered to the site by existing roads and railroads. As shown in Figure 3.2-1, the existing access road from CR 663 will be used during construction and operation of the Hardee Unit 3 Project. Figure 3.2-1 also shows the existing CSX rail line located east of the project site. Rail deliveries of equipment will be made at an existing siding near the site and transported to the site by truck.

Construction laydown areas for materials will be located as shown in Figure 3.2-3. Materials will be unloaded and moved around the site using portable cranes and trucks. Some of the heaviest items such as the CTs, generators, HRSGs, and transformers may require rail delivery as discussed in Section 3.9.3. Pollution control measures for the laydown areas will include runoff collection as described in Section 3.8. Main roads in the laydown areas will be surfaced with aggregate and treated with dust palliative to reduce dust. Water sprays will also be used, as required, to control dust due to traffic.

3.9.2 ROADS

Construction trucks will travel to the site via Fort Green Road and CR 663 and the existing site access road shown on Figure 3.2.0-1. This route was used during construction of the HPS existing units.

3.9.3 RAILROAD

A CSX Railroad branch-line currently runs north-south approximately 0.8 km (0.5 mile) east of the proposed power block location on the site. All rail deliveries of construction materials and equipment for the facility will be off-loaded at a rail siding near the CFI plant and transported by truck to the site. The branch-line is primarily used for phosphate rock shipments from local mines. This line can accommodate the shipments required for the project.

3.10 REFERENCES

The following references are cited in Chapter 3.

Black & Veatch. 1994. Data on Facility Design. Overland Park, KS.

KBN Engineering and Applied Sciences, Inc. (KBN). 1994. Data Collected and Analyzed for the Seminole Electric Cooperative Inc. Hardee Unit 3 Site Certification Application/Environmental Assessment. Gainesville, FL.

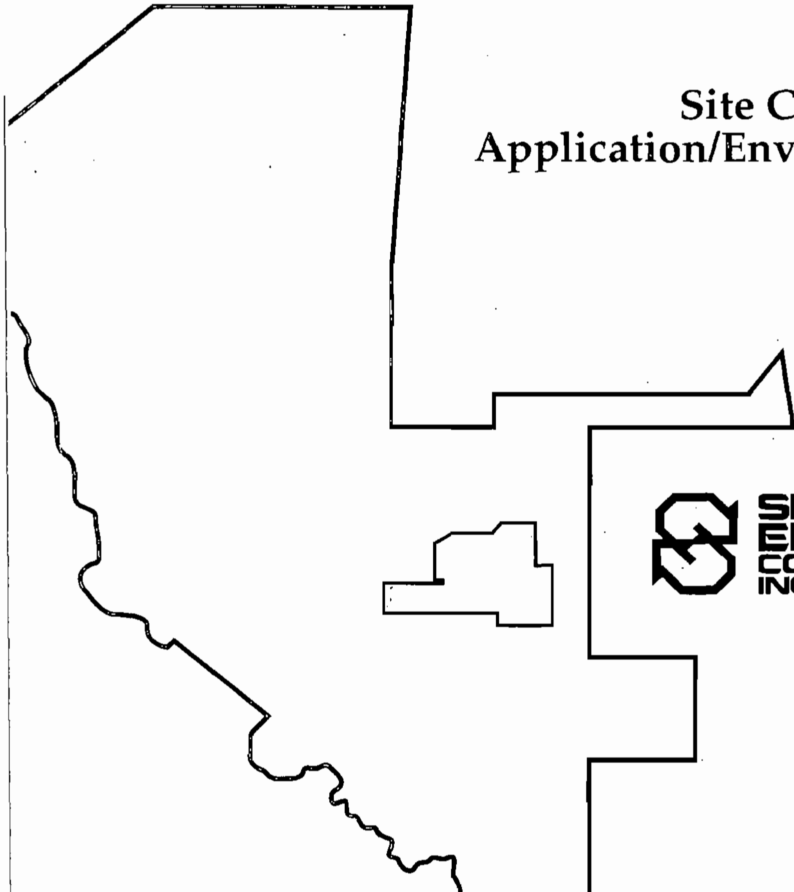
TECO Power Services/Tampa Electric Company/Seminole Electric Cooperative Inc. (TPS/SECI). 1989. Hardee Power Station Site Certification Application/Environmental Assessment.

U.S. Environmental Protection Agency (EPA). December 1, 1987. Memorandum from J.C. Potter (Assistant Administrator for Air and Radiation) to Regional Administrators.

U.S. Geological Survey (USGS). 1987. Baird and Fort Green Quadrangle Maps, Scale 1:24,000.

HARDEE UNIT 3

Site Certification Application/Environmental Analysis



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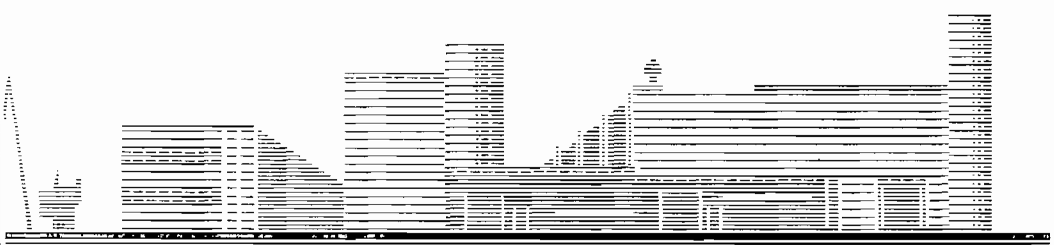

Chapter 4.0

4.0 EFFECTS OF SITE PREPARATION AND PLANT AND ASSOCIATED FACILITIES CONSTRUCTION

TABLE OF CONTENTS
(Page 1 of 2)

TABLE OF CONTENTS
(Page 2 of 2)

LIST OF TABLES

LIST OF FIGURES

4.1 LAND IMPACTS

4.1.1 GENERAL CONSTRUCTION IMPACTS

As discussed in Section 2.3.5, the land in the immediate vicinity of the proposed Hardee Unit 3 site currently is either being used for phosphate mining or is in the process of post-mining reclamation. Most of the land in the general area has already been disturbed by mining activities. The proposed facility will be located on a 20-hectare (ha) (50-acre) parcel adjacent to the HPS existing units and existing cooling reservoir within the existing Hardee Power Station (HPS) site. Therefore, general site preparation and construction will have minimal land impacts.

The Hardee Unit 3 power block will be constructed primarily on land that has been disturbed by mining and reclamation activities; other facility structures will be located on both unmined and mined land. The 230-ha (570-acre) existing cooling reservoir was constructed during the first phase of the HPS buildout entirely on mined lands. The cooling reservoir will not be expanded in size to accommodate Hardee Unit 3. The existing access road, which is 8 meters (m) [26 feet (ft)] wide with a 6 m (20 ft) wide paved center section and a 1 m (3 ft) shoulder on either side will provide access to the Hardee Unit 3 facility from Fort Green Road in Polk County which becomes County Road (CR) 663 at the Hardee County line. No new access roads will be constructed for Hardee Unit 3. Although the Hardee Unit 3 site is relatively flat, local site grading and leveling will be necessary for construction. Impacts to terrain will be minor. No blasting is anticipated for construction of the Hardee Unit 3 Project.

Laydown areas for equipment and supplies will be graded and surfaced with aggregate where needed. These areas will be used for the storage of construction materials and will be located as shown in Figure 4.1.1-1.

No impacts from disposal of construction wastes are anticipated. Combustible construction wastes (e.g., paper, wood, etc.) will be burned onsite in accordance with applicable regulations. Other construction wastes will be removed from the site for disposal at a facility approved by the Florida Department of Environmental Protection (FDEP). Any garbage (food containers, papers, etc.) will be collected in appropriate waste collection containers and disposed in accordance with FDEP and local regulations. Any waste oils or other chemical wastes generated during construction will be removed from the site and disposed of by a licensed contractor.

During construction, the construction labor force will utilize portable chemical toilets. All sanitary sewage will be frequently pumped from the individual toilets for transportation to an approved disposal facility by a licensed contractor.

Potable water for consumption during construction will be obtained from the existing wells or from offsite sources.

Fugitive dust and impacts on the human population are addressed in Sections 4.5 and 4.6, respectively.

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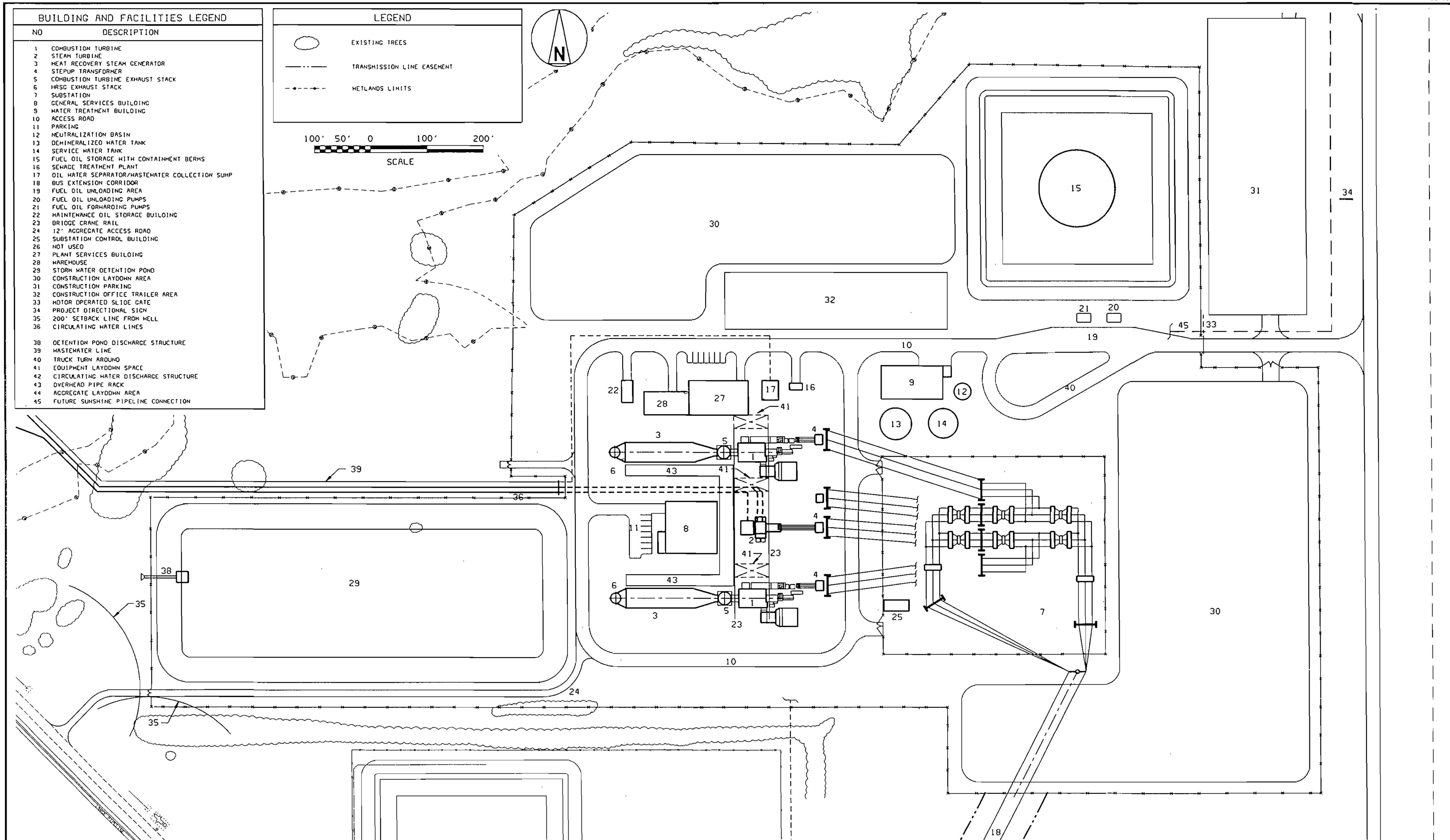

Figure 4.1.1-1
Hardee Unit 3 Plot Plan

Source: Black & Veatch, 1994.

4.1.2 ROADS

The Hardee Unit 3 Project will use the existing access road that connects the HPS facility with Fort Green Road in Polk County, just north of the Polk/Hardee County border. Fort Green Road becomes CR 663 in Hardee County. Therefore, no new access roads to either county- or state-maintained roads will be required. Short road connections will be required to access the Hardee Unit 3 site within the existing HPS site.

4.1.3 FLOOD ZONES

As part of its mining/reclamation permit approval program, Agrico conducted a 100-year flood elevation study for Payne Creek. Based on this study, the 100-year flood elevation in the vicinity of the HPS site generally corresponds with the limits of the forested floodplain and related wetland vegetation associated with Payne Creek, and does not extend to the project area. The flood study indicated that the floodplain elevation was generally about elevation 33.5 meters above mean sea level (m-msl) [110 feet above mean sea level (ft-msl)], while the HPS site is generally higher than 37.2 m-msl (122 ft-msl). These flood elevation study results were submitted to regulatory agencies as part of the approval process for Agrico's mining and reclamation plan.

All Hardee Unit 3 facilities have been designed to comply with all applicable Southwest Florida Water Management District (SWFWMD), Hardee County, and FDEP requirements regarding flood protection and control. No structures or fill will be placed in the Payne Creek floodplain; therefore, no reduction in cross-section flow-way or flood storage will occur. No adverse impact on the 100-year flood elevations or flood flows in Payne Creek are anticipated, because stormwater design will comply with SWFWMD regulations that restrict postdevelopment peak flow rates to predevelopment flow rates.

With the exception of the water circulating pipes, all structures associated with the Hardee Unit 3 Project will be outside of the unnamed tributary to Payne Creek; the circulating water pipes will cross the unnamed tributary in a manner that will not affect water flow and will minimize impacts to associated wetlands.

4.1.4 TOPOGRAPHY AND SOILS

Current topographic features at the HPS site reflect past mining and reclamation activities.

The site location for the Hardee Unit 3 facility consists of unmined and reclaimed land. This area of the HPS site is gently sloping, bordered by the access road to the east and south and a wetland area to the north and west. General site grading for the Hardee Unit 3 facility will take place by matching of cuts and fills, as needed. It is anticipated that a net import of soil materials will be required. Major structures in the power block area will be constructed on land previously disturbed during reclamation activities.

Bearing strengths of the fine sands are sufficient, and shearing failures of the foundations will not occur. Auger cast pilings, if required to support heavily loaded major equipment foundations, may be used. Where compaction is necessary for construction, a densification program will be instituted. Structures will not be constructed on unstable soils; adequate support and retaining structures will be utilized.

Construction runoff from the site will be collected in the detention pond upgradient of the unnamed tributary wetland. Areas not covered by structures and roads will be left in a natural state so that rainfall will percolate into the surficial aquifer.

During construction, an erosion control and sedimentation plan (see Appendix 10.10) will be implemented to prevent discharge of sediment from the site. This plan will include a detention pond, silt nets, straw baling, and other techniques to retain sediments onsite. As each area is final graded, vegetation will be established. Areas near switchyards and permanent ditches will be protected with coarse stone to prevent erosion and to promote infiltration of stormwater.

Construction-related changes in site topography or soils should have no adverse effect on aesthetics or viewshed based on elevations and relative distance from roads.

4.2 IMPACT ON SURFACE WATER BODIES AND USES

4.2.1 IMPACT ASSESSMENT

4.2.1.1 SURFACE HYDROLOGY - PHYSICAL AND CHEMICAL

Payne Creek and its unnamed tributary are the only natural surface water bodies in the immediate vicinity of the HPS site. The primary potential impacts to Payne Creek and its unnamed tributary from site preparation and plant construction are erosion and sedimentation due to earthmoving and material placement associated with the plant. Discharges associated with construction dewatering may also be considered a potential impact to the surface waters of Payne Creek and its unnamed tributary. These impacts will be controlled and minimized through proper design and placement of runoff control features (see Erosion Control and Sedimentation Plan, Appendix 10.10).

Runoff from areas of the site disturbed by construction activities, including material laydown areas, and dewatering flows, will be collected in pipes, an open channel system, and/or catch basin and directed to the permanent site stormwater detention pond. This pond will be located adjacent to the power block area and will be built early during construction to serve as a construction runoff detention pond. Sediments which are trapped by and accumulate in the stormwater detention pond will be removed as necessary. The construction drainage system will follow the layout of the permanent ditch system where possible. The treated runoff will be discharged into the unnamed wetland tributary.

With the exception of new cooling water intake and return structures, no changes to the existing cooling reservoir structure will be made as part of the Hardee Unit 3 Project. The design of the cooling water intake and return structures will be similar to those constructed for HPS existing units.

4.2.1.2 ECOLOGICAL SYSTEMS

No direct impacts to the aquatic systems of Payne Creek or its associated floodplain will occur from construction activities associated with Hardee Unit 3 because no structures will be placed in the flowing creek or in the floodplain.

Construction of the circulating water pipes will result in minor impacts to IMC/Agrico's reclaimed wetland (Area No. 1 in Figure 4.2.1-1). Impacts associated with the reclaimed wetland include clearing 0.02 ha (0.06 acre) of wetland, permanently filling 0.006 ha (0.015 acre) of wetland within the 0.024 ha (0.06 acre) clearing for pipe support structures, and temporarily filling 0.002 ha (0.006 acre) of wetland within the 0.024 ha (0.06 acre) clearing to construct two temporary pads for equipment work area (Table 4.2.1-1).

Clearing 0.024 ha (0.06 acre) of reclaimed wetland will consist of removing fewer than 32 planted trees. A total of 32 trees were slated to be removed when the impact area was 21 m (70 ft) wide. However, the impact area has been reduced to 12 m (40 ft) wide, so the number of trees to be removed has also been reduced. These trees are approximately 0.9 to 1.5 m (3 to 5 ft) tall and were planted 2 years ago by IMC/Agrico. Additionally, a few large oak trees located along the upland/wetland boundary will also be removed for constructing the circulating water pipes. The only fill to remain in the reclaimed wetland upon construction of the circulating water pipes will be two concrete support structures each 0.9 m by 5.5 m (3 ft by 18 ft) in size. After the circulating water pipes are constructed, the original 0.024 ha (0.06 acre) cleared area will be returned to original grade, planted with native herbaceous species, and maintained as a herbaceous wetland.

Wetland impacts associated with a highly disturbed portion of the unnamed tributary wetland will occur southwest of the proposed construction laydown area (Area No. 2 in Figure 4.2.1-1). A total of only 0.004 ha (0.01 acre) will be filled and 0.001 ha (0.003 acre) will be excavated to construct a retainment berm. This proposed impact area is herbaceous in nature and has been extensively disturbed by feral hog activity.

An access road is proposed to be constructed in the southwest corner of the site and will cross an existing FDEP and USACE jurisdictional drainage ditch wetland (Area No. 5 in Figure 4.2.1-1). Two culverts will be placed in the drainage ditch to ensure passage of the 25-year storm peak. A second drainage ditch which forms the eastern boundary of the project site will be crossed by two culverts (Areas Nos. 6 and 7 in Figure 4.2.1-1). These crossings will provide access to the power plant from the existing access road. A total of 0.004 ha (0.01 acre) will be excavated and 0.09 ha (0.22 acre) will be filled to install these two culverts. These roadside drainage ditches will continue to be mowed and maintained. Therefore, ecological impacts to these ditches will be minor.

A detailed description of the mitigation plan, which compensates for these wetland impacts, is provided in the dredge and fill application (see Appendix 10.1.4).

Construction of the power block area and the stormwater detention basin will impact 2.12 ha (5.24 acres) of wetlands which are jurisdictional only by USACE (Areas No. 3 and 4 in Figure 4.2.1-1). These wetlands were inadvertently created during post-mining reclamation. They provide low ecological value and are colonized by weedy species such as cattail, primrose willow, and Carolina willow. Impacts to these wetlands are not expected to result in a loss of significant wildlife habitat.

Table 4.2.1-1. Summary of Wetland Impacts for Each Jurisdictional Agency

Regulatory Jurisdiction	Permanent Clearing	Permanent Filling	Temporary Filling	Excavation
SWFWMD	0.06 acre across tributary wetland	0.015 acre for pipe support structures in tributary wetland 0.07 acre for culverts across west drainage ditch	0.006 acre for temporary pads in the tributary wetland	0.015 acre for installation of support structure 0.015 acre for culverts across west drainage ditch
FDEP	0.06 acre across tributary wetland	0.015 acre for pipe support structures in tributary wetland 0.01 acre for retainment berm 0.07 acre for culverts across west drainage ditch 0.22 acre for culverts across east drainage ditch	0.006 acre for temporary pads in the tributary wetland	0.015 acre for installation of support structure 0.003 acre for retainment berm 0.015 acre for culverts across west drainage ditch 0.010 acre for culverts across east drainage ditch
USACE	0.22 acre across tributary wetland	0.085 acre for pipe support structures in tributary wetland 4.69 acre in power block area 0.01 acre for retainment berm 0.17 acre for stormwater detention basin 0.07 acre for culverts across drainage ditch	0.006 acre for temporary pads in the tributary wetland	0.30 acre in stormwater detention basin 0.85 acre for installation of support structures 0.003 acre for retainment berm 0.01 acre for culverts across drainage ditch

Note: acres x 0.4047 = hectares.

Source: KBN, 1994.

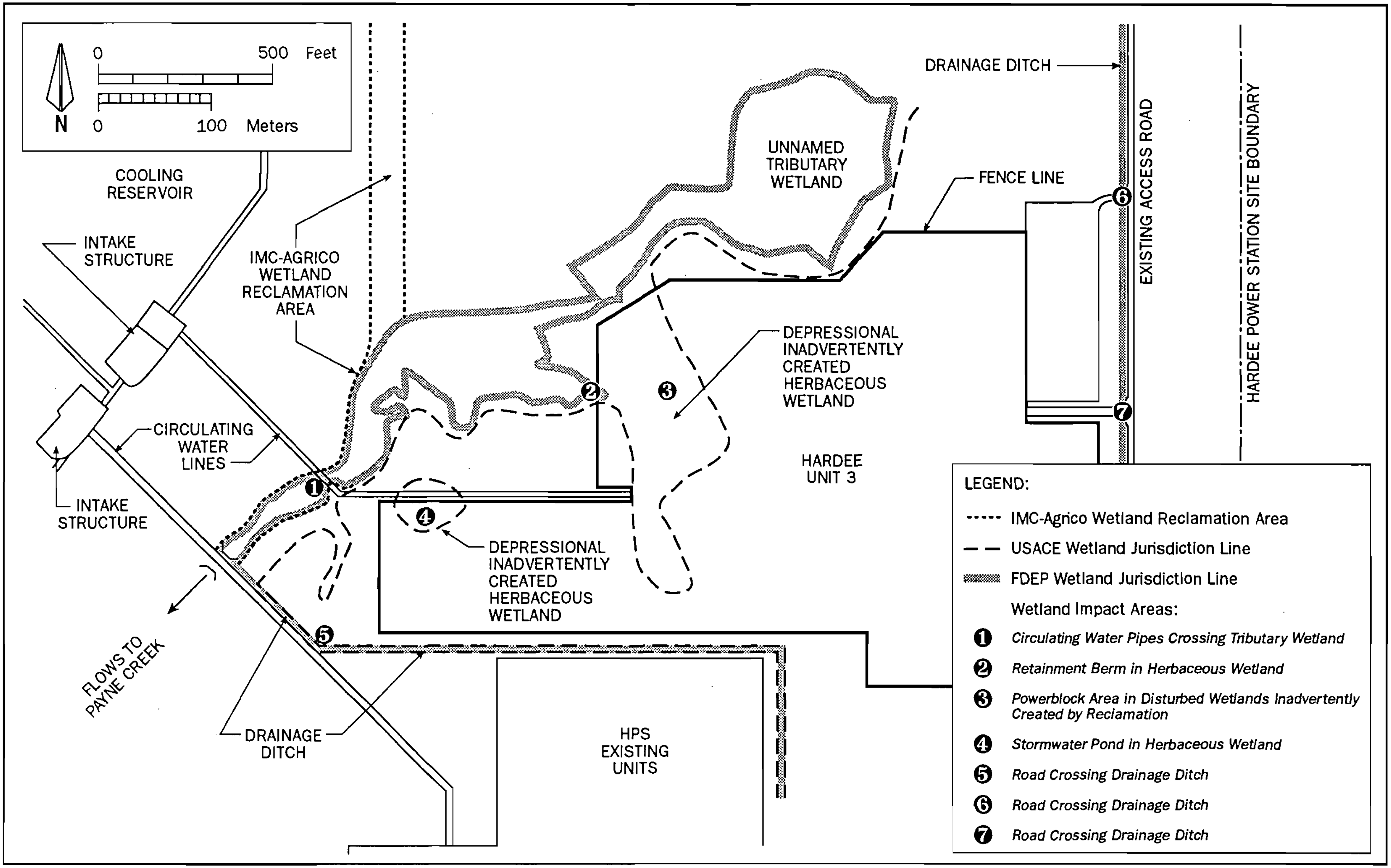

Figure 4.2.1-1
Location of Jurisdictional Wetlands in Relation to Hardee Unit 3 Site Plan

Source: KBN, 1994.

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4.2.2 MEASURING AND MONITORING PROGRAMS

Because of the proposed erosion control measures, no anticipated water quality impacts to Payne Creek or the unnamed tributary are expected. However, turbidity will be monitored in the unnamed tributary wetland during construction.

4.3 GROUNDWATER IMPACTS

4.3.1 PHYSICAL AND CHEMICAL EFFECTS OF DEWATERING

Some dewatering will be required during excavation for construction of plant structures. The site facilities requiring dewatering include:

- Foundations,
- Circulating water piping,
- Intake structure, and
- Miscellaneous underground utilities.

The circulating water piping system will require the most extensive dewatering. The dewatering flow is estimated to be 315 liters per minute (Lpm) [83 gallons per minute (gpm)] per 30 meters (m) [100 linear feet (ft)] of pipe, regardless of pipe size. Assuming 152 m (500 linear ft) of pipe is excavated and dewatered at a time [maximum depth = 0.9 m (3 ft)], a dewatering flow of 1,575 Lpm (332 gpm) would be anticipated, with a radius of influence of approximately 91.4 m (300 ft). These flows would exist during the construction period, which will last approximately 1 month for each 152-m (500-ft) section. The total period for dewatering will be 6 months. After construction, granular backfill will be used in the circulating water trench so that natural groundwater flow is not disrupted.

The intake structure located in the southeast reservoir berm will be constructed within a sheetpile enclosure which will minimize dewatering. The dewatering flow for the system is estimated to be approximately 828 Lpm (218 gpm) for a 1-month period.

The underground utilities will be installed in shallow trenches. The shallow groundwater table will require open trench sumping to control groundwater. Based on the anticipated length of open trench, the quantity of dewatering is estimated to be on the order of 380 Lpm (100 gpm).

The primary impact of dewatering is that groundwater from the surficial aquifer will be withdrawn and the aquifer phreatic line will be depressed locally. To minimize the impact of dewatering, the pumpage from wellpoints in the power block area will be directed to the detention pond, which provides for natural infiltration and replenishment of the surficial aquifer. Thus, the dewatering flows removing groundwater are balanced a short distance away by recharge from the detention pond.

Dewatering can cause increases in vertical stresses. In this case, the increase will not be significant enough to cause settlement or depressions. Foundations in the power block area will not be at risk because they will be constructed following the completion of dewatering activities.

Chemical effects of dewatering will result primarily from oxidation of the groundwaters. The sands of the surficial aquifer are predominantly quartzitic, although soluble calcite will liberate calcium ions and bicarbonate anions, which will increase the hardness of the water.

No impacts to the intermediate aquifer are predicted since the excavation/dewatering will be limited to the surficial aquifer groundwater regime.

4.3.2 MEASURING AND MONITORING PROGRAM

No monitoring is proposed for dewatering activities.

4.4 ECOLOGICAL IMPACTS

4.4.1 IMPACT ASSESSMENT

4.4.1.1 AQUATIC SYSTEMS

As discussed in Section 4.2.1.2, no structures will be placed in Payne Creek. During construction, surface runoff, including water from construction dewatering, will be routed into a detention pond, and erosion prevention measures will be used. Treated runoff, if discharged, will flow into the adjacent unnamed tributary. No adverse ecological impacts to the Payne Creek aquatic system are anticipated.

4.4.1.2 TERRESTRIAL SYSTEMS

The power plant and related onsite facilities such as parking lots, detention ponds, and roads will occupy approximately 20 ha (50 acres) of land. Nearly all of this area will be located on recently mined land that has been reclaimed to upland pasture.

The reclaimed wetland will be crossed by the circulating water pipes. The pipes will be supported on permanent concrete structures, thus filling 0.006 ha (0.015 acre) within the reclaimed wetland. In order to construct the circulating water pipes, 0.024 ha (0.06 acre) within the reclaimed wetland will be cleared. Temporary pads will be built on both sides of the reclaimed wetland to construct the circulating water pipes. After construction of the pipes is complete, the pads will be removed, and the impacted area will be revegetated with native herbaceous wetland species. The impacted area will then be maintained as a herbaceous wetland. Ecological impacts to the reclaimed wetland are expected to be minor because the only permanent impacts will be concrete support structures and because the area will be maintained as a herbaceous wetland.

Approximately 2.12 ha (5.24 acres) of USACE-jurisdictional wetlands will be impacted by construction of the power block area and stormwater detention basin (Figure 4.2.1-1). These impacted areas are characterized by weedy wetland species that colonized low pockets which were inadvertently created after reclamation occurred. Due to the low ecological value of these areas, ecological impacts are expected to be minor. Construction of a retainment berm will impact 0.01 ha (0.03 acre) of highly disturbed herbaceous wetlands, and installing two culverts across a drainage ditch will impact 0.03 ha (0.08 acre) of the ditch. Both of these impacts are considered minor given the disturbed condition of both the herbaceous wetland and drainage ditch.

The potential impacts to the vegetation communities onsite due to construction activities include the following:

1. Sedimentation due to stormwater runoff into the tributary from laydown areas, roads, and areas under construction;
2. Damage to wetlands due to construction dewatering; and
3. Tree clearing [approximately 21 m (70 ft) wide] for intake and discharge pipes to cross the reclamation wetland.

Uncontrolled stormwater runoff into Payne Creek and onsite wetlands will be prevented by the implementation of temporary and permanent water collection and detention measures (see Section 4.2.1.1). Erosion and sediment control measures employed during construction will include seeding and mulching exposed areas, minimizing unnecessary clearing of vegetation, and redirecting stormwater runoff by using dikes, basins, and sediment curtains. The detention basin will be constructed for control and treatment of stormwater.

Dewatering activities will occur onsite (see Section 4.3.1). The maximum predicted drawdown is 2.4 m (8 ft). The zone of drawdown influence is predicted to extend 152 m (500 ft). The duration of the dewatering will last for 30 days at any given location. This means that saturated water conditions will not occur in the dewatering zone during this period. The unnamed tributary wetland occurs within the predicted zone of dewatering. No significant effects to wetland vegetation are anticipated because of the short duration of dewatering and the fact these wetlands are currently receiving surface water from upgradient areas offsite.

Potential impacts to wildlife communities due to construction activities include the following:

1. Vegetation removal and loss of habitat,
2. Noise, and
3. Road traffic and road kills.

Most of the wildlife habitat area has been previously altered by mining operations. Some wildlife habitats, i.e., floodplain forest of Payne Creek, do exist on the HPS site. Since these habitats will not be impacted by construction of the Hardee Unit 3 Project, no significant impacts on local or regional wildlife habitats will occur.

The increased noise from construction equipment may cause temporary avoidance behavior in area wildlife. This behavior is expected to be minimal since existing wildlife are acclimated to the noise generated by existing mining and power plant operations.

Wildlife habitats such as wetlands, water bodies, etc., are currently accessible by existing roads. Any additional traffic to these areas will not affect wildlife conditions in these habitats.

A temporary increase in road kills may be expected from construction traffic. Some small mammals (e.g., opossums) and reptiles (e.g., snakes) may be killed. No important wildlife species are expected to be affected.

The wildlife species present on the site are considered typical of the region. No unique species or habitats or significant populations of recreationally and commercially important species will be affected during construction.

4.4.2 MEASURING AND MONITORING PROGRAMS

Because of the absence of anticipated ecological impacts, no biological monitoring is proposed during the construction period. Proposed wetland mitigation monitoring is described in the wetland mitigation plan (Appendix 10.1.4).

4.5 AIR IMPACT

4.5.1 ESTIMATED EMISSIONS

The air quality impacts during the construction phase of the project will be associated primarily with the land clearing and site preparation activities. These activities will result in the generation of fugitive particulate matter (PM) and an increase in the level of exhaust emissions from construction equipment. Air emissions will be temporary and will vary substantially from day to day during each phase of construction depending on the level of activity, the specific operations, and prevailing weather conditions.

Activities that may produce fugitive PM emissions include building and road construction. These emissions will be associated with land clearing, ground excavation, cut and fill operations, and actual construction of the facility when approximately 20 ha (50 acres) of the facility site will be exposed. A large portion of the fugitive emissions will result from vehicular traffic over roads at the construction site (e.g., heavy-equipment traffic and traffic due to construction workers entering and leaving the site). The plant site arrangements are shown in Figure 3.2.0-4, and specific acreage requirements are discussed in Section 3.2.

Wind erosion from the exposed land areas may also be a source of fugitive dust. Because of the variable nature of such emissions, emissions of fugitive PM are extremely difficult to quantify. The emissions are dependent upon a number of factors, including specific activities conducted, level of activity, and meteorological conditions.

The maximum impacts from vehicular exhaust emissions will occur during the construction phase when equipment will be onsite for concrete placement and major equipment installation. Vehicle exhausts include primarily nitrogen oxide (NO_x) and carbon monoxide (CO) emissions as well as particulate matter (PM), sulfur dioxide (SO_2), and volatile organic compounds (VOCs). However, air quality impacts from construction-related vehicle exhaust emissions are expected to be negligible.

4.5.2 CONTROL MEASURES

For the emissions described in Section 4.5.1, the local air quality impact from fugitive PM will be minimized by the use of appropriate dust suppression control methods, such as spraying or paving roads. The impacts will cease when construction activities are terminated and the facilities are ready for operation.

The site will be revegetated after completion of construction. The construction process will disturb the site only temporarily.

The major roads surrounding and leading to the plant site are paved, and new roads on the plant site will be paved at the end of the construction period. Dust suppressors, water and water-based sprays will be applied to the roads as required to control fugitive dust emissions during construction. Spilled or tracked dirt or other materials will be removed promptly.

4.5.3 POTENTIAL IMPACTS

As discussed in Section 4.5.1, the air quality impacts due to the construction activities will vary substantially from day to day depending on the level of activity, the specific operations, and prevailing weather conditions. Because of the type and nature of potential emission sources at the facility site, the maximum impacts are expected to occur near the construction activities in areas on or near plant property because such dusts settle quickly. Based on the proposed controls presented in Section 4.5.2, the air quality impacts are expected to be minimized by the control measures implemented during construction.

Most of the construction activities will be conducted during daylight hours. As a result, the scheduling of the construction activities will act to reduce impacts since better atmospheric dispersion conditions exist during the daytime as opposed to nighttime. Also, many of the construction operations, such as land clearing, site filling and grading, and foundation work, will be intermittent and of short duration.

No significant air quality impacts are expected off plant property locations due to construction activities, based upon the intermittent nature of construction activities and the control measures, such as water spraying, implemented to reduce emissions.

4.6 IMPACT ON HUMAN POPULATIONS

4.6.1 NOISE IMPACTS

Construction of Hardee Unit 3 is expected to occur in four phases:

1. Site preparation,
2. Foundations,
3. Erection of structures and equipment, and
4. Facility startup.

Typically, construction equipment associated with site preparation includes heavy earth-moving equipment necessary to excavate and grade the site. Construction of foundation structures includes pouring of concrete and the placement of supporting piles, whereas erection of equipment typically includes the use of cranes and heavy equipment to move and secure power plant equipment and structures. Startup activities include site finishing and cleanup, plant startup, and system blow-out (i.e., steam blows).

Based on the types and numbers of equipment to be used for each construction phase, it is expected that activities associated with the erection of structures and equipment will most likely produce the highest noise impacts in the vicinity of the site. This is because the numbers and types of high noise level equipment to be used for this phase are more extensive than for other phases of construction. The exception may be the use of a pile driver for placement of sheet piling, which will be used during construction of the circulating water intake and return structures. This equipment has a very high noise level, i.e., 101 A-weighted decibels (dBA) at 50 ft (15 m); however, the noise is intermittent in nature. It is expected that the level of continuous noise may be greater during the erection phase of the construction project and would therefore represent a worst-case construction noise scenario.

A list of equipment to be used for erecting structures and equipment, along with the quantity, usage factor, and average sound pressure level (SPL) at a distance of 50 ft (15 m) from the source, is presented in Table 4.6.1-1. The usage factor is based on the fraction of daylight hours that the equipment will be operating. As shown, it is estimated that 28 pieces of construction equipment will be used for this construction phase of the project, with the air compressor being used most often. Average equipment SPLs range from 78 to 88 dBA [at 50 ft (15 m)].

Predicted noise levels were developed using the NOISECALC model. NOISECALC was developed by the New York State Department of Public Service (NYSDPS) to assist with noise calculations for major power projects. Noise sources can be entered as octave-band sound power levels or as octave-band SPLs at a given reference distance. If SPLs are entered, NOISECALC will back-calculate the sound power level based on the reference distance provided. Coordinates, either polar or rectangular, can be specified by the user for source and receiver locations. 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 (ANSI) Method for 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 were calculated by the model. Background noise levels were incorporated into the program and were used to calculate overall SPLs. For the purposes of this analysis, only atmospheric attenuation was included in the analysis in order to present worst-case construction noise impacts.

Worst-case noise impacts were predicted for the construction equipment proposed for use during the equipment and structures erection phase of the project. Construction activities for Hardee Unit 3 are expected to occur during daytime hours only. For the purpose of this analysis, equipment was assumed to operate continuously, simultaneously, and at peak load conditions. For the modeling analysis, construction equipment was placed at various locations around the plant site to most adequately simulate an area of typical operation for that equipment type. Because NOISECALC assumes that all of the construction equipment will be operating continuously <u>and</u> at peak levels, the noise level impacts predicted by the model are conservative in nature. In reality, not all of the construction equipment will be operating simultaneously nor at peak load conditions. Therefore, actual noise level impacts due to construction activities are anticipated to be lower than predicted by the modeling analyses.

Octave band data for each equipment type were developed using U.S. Environmental Protection Agency's (EPA) *Noise From Construction Equipment and Operations, Building Equipment, and Home Appliances* (EPA, 1971). These octave bands were developed based on sound levels measured at 50 ft (15 m) from the equipment type. Octave band data were available for all equipment types projected for use for the project except the trencher. Because no octave band data were available, the use of the trencher was excluded from the modeling analysis.

Noise levels were predicted at six receiver sites: at the north property boundary, at two sites along the east property boundary, at the south property boundary, along the west property boundary, and at the nearest residence located south of the site along Roberts Road. These sites are depicted in Figure 4.6.1-1.

Predicted construction noise impacts are presented in Table 4.6.1-2. Predicted noise levels for each receiver site are presented and take into account representative background levels at each site. These background levels include the operation of a portion of the existing combined cycle units at the HPS facility. The background level at the residential area was determined based on a previous noise study for the Hardee Power Station.

As presented, predicted construction noise impacts at the property boundary range from 54.9 dBA at Receiver Site D to 68.9 dBA at Receiver Site B. Predicted construction noise impacts in the vicinity of the plant are below the EPA guideline value of 70 dBA. Again, the predicted impacts assume simultaneous and peak load operation of all projected construction equipment. In reality, construction noise will be more intermittent in nature, with equipment not always operating at peak load. Therefore, projected noise levels will most likely be lower during the construction phase of the project.

Predicted construction noise levels at the nearest residence are expected to be approximately 46.6 and 50.8 dBA for the daytime L_{eq} and L_{dn} values, respectively. Therefore, potential construction noise levels at the residential area are below the EPA guideline value of 55 dBA (L_{dn}).

Table 4.6.1-1. Summary of Noise Data for the Erection of Equipment and Structures Phase of the Construction Project

Equipment Type	Average Noise Level at 50 ft (dBA)[a]	Quantity	Usage Factor	Sound Power Level (dB) for Octave Band Center Frequency									Overall Sound Power Level (dBA)
				31.5	63	125	250	500	1K	2K	4K	8K	
Mobile Crane	83	1	0.12	0.0	111.6	118.6	116.6	114.6	109.6	104.6	98.6	92.6	115.6
Tractor Trailer	88	4	0.13	0.0	0.0	118.6	116.1	113.1	109.6	106.1	102.1	0.0	115.3
Backhoe	85	1	0.02	0.0	111.6	118.6	116.6	114.6	109.6	104.6	98.6	92.6	115.6
Front End Loader	84	1	0.02	0.0	111.6	118.6	116.6	114.6	109.6	104.6	98.6	92.6	115.6
Truck	88	4	0.02	0.0	0.0	118.6	116.1	113.1	109.6	106.1	102.1	0.0	115.3
Trencher	82	1	0.10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Stationary Crane	88	3	0.08	0.0	115.6	122.6	120.6	118.6	113.6	108.6	102.6	96.6	119.6
Drill	85	1	0.02	0.0	100.6	105.6	106.6	107.6	110.6	111.6	107.6	107.6	116.6
Saw	78	2	0.10	0.0	91.6	86.6	84.6	84.6	96.6	91.6	93.6	96.6	101.2
Torque Wrench	85	10	0.10	0.0	94.6	97.6	98.6	100.6	106.6	110.6	110.6	108.6	116.1
Air Compressor	81	1	0.40	0.0	109.6	101.6	98.6	94.6	102.6	96.6	88.6	79.6	104.5

Note: NA = not available.

[a] For operation of a single unit.

Sources: Black & Veatch, 1994; KBN, 1994.

Table 4.6.1-2. Summary of Predicted Construction Noise Impacts for Hardee Unit 3

Receiver Site	Predicted Background Noise Level[a] (dBA)	Construction Equipment Noise Level (dBA)	Total Noise Level[b] (dBA)	EPA Guideline Value (dBA)
A	47.2[c]	66.2	66.2	70
B	48.7[d]	68.8	68.9	70
C	48.7[d]	57.6	58.1	70
D	42.0[e]	54.7	54.9	70
E	42.0[e]	56.9	57.0	70
F	43.9[f]	43.2	46.6/50.8[g]	55[h]

Note: Receiver sites are shown in Figure 4.6.1-1, and monitoring sites are shown in Figure 2.3.8-1.

[a] Based on L_{eq} value from monitoring data. Background includes operation of existing HPS Unit 1 and steam turbine (except for Site F).
[b] Background plus construction noise levels.
[c] Ambient monitoring data collected for Monitoring Site 2 used as background.
[d] Ambient monitoring data collected for Monitoring Site 1 used as background.
[e] Ambient monitoring data collected for Monitoring Site 4 used as background.
[f] Background value based on a previous analysis for predicted noise levels due to the existing Hardee Power Station.
[g] L_{eq}/L_{dn}. For L_{dn} determination, assume daytime impacts include background and predicted construction noise levels and nighttime impacts include background only since construction activities will occur only during daytime hours.
[h] L_{dn} measurement.

Source: KBN, 1994.

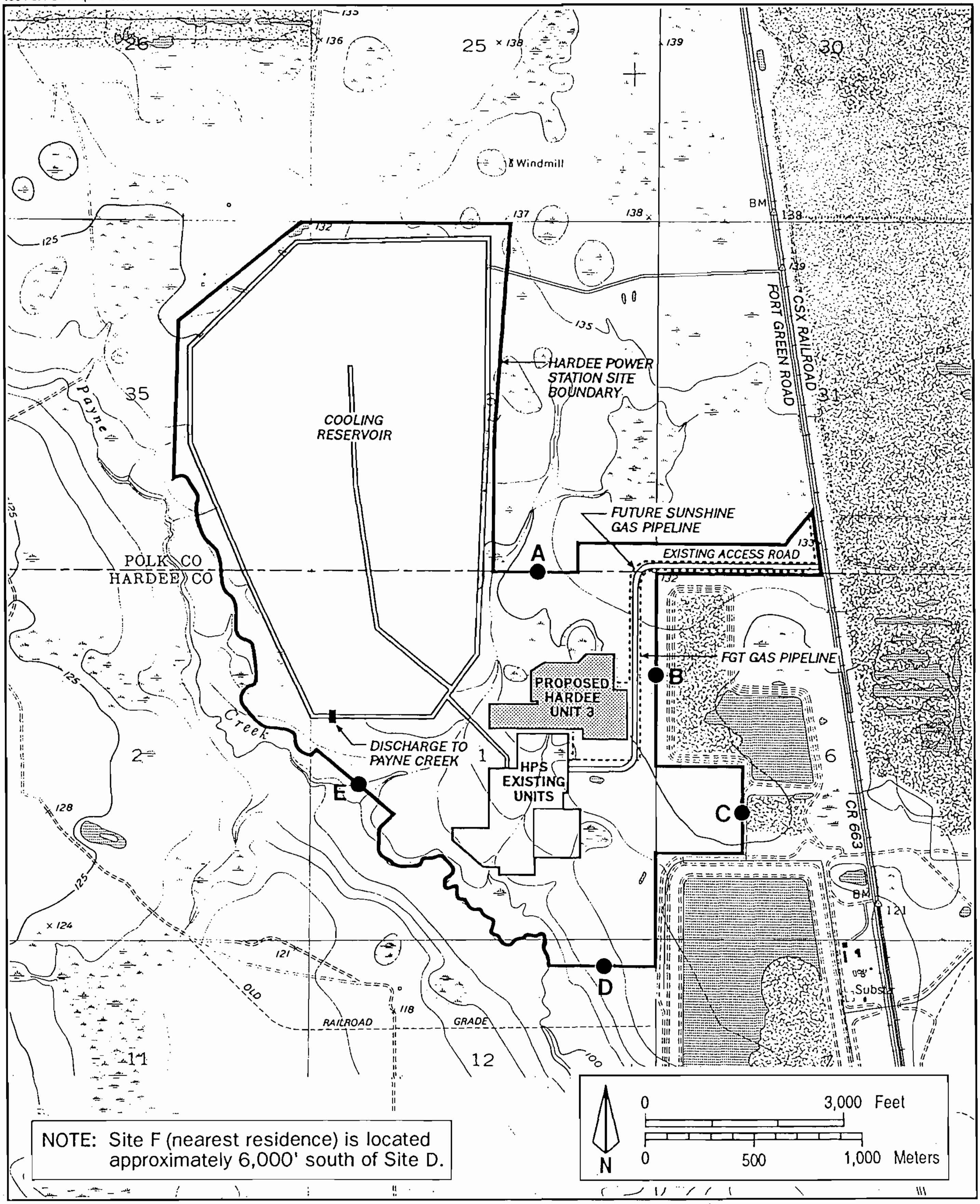

Figure 4.6.1-1
Receiver Sites Used for the Construction Noise Impact Analysis

Sources: USGS, 1987; KBN, 1994.

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4.6.2 CONSTRUCTION EMPLOYMENT

Employment opportunities created by the construction of the Hardee Unit 3 Project will begin in January 1997 and conclude in December 1998. Figure 4.6.2-1 shows the estimated construction employment requirements for the Hardee Unit 3 Project. The average construction workforce is 229 employees per month over the 2-year period. The peak employment period will last approximately 3 months in late 1997 and total approximately 450 workers per month. Sixty-seven percent of the employment demand is expected to occur during the first year of construction.

Based on regional population distribution and workforce availability, it is anticipated that approximately 85 percent of the workforce will come from Polk and Hillsborough counties. The remaining 15 percent will likely originate from Hardee, DeSoto, Manatee, and Sarasota counties.

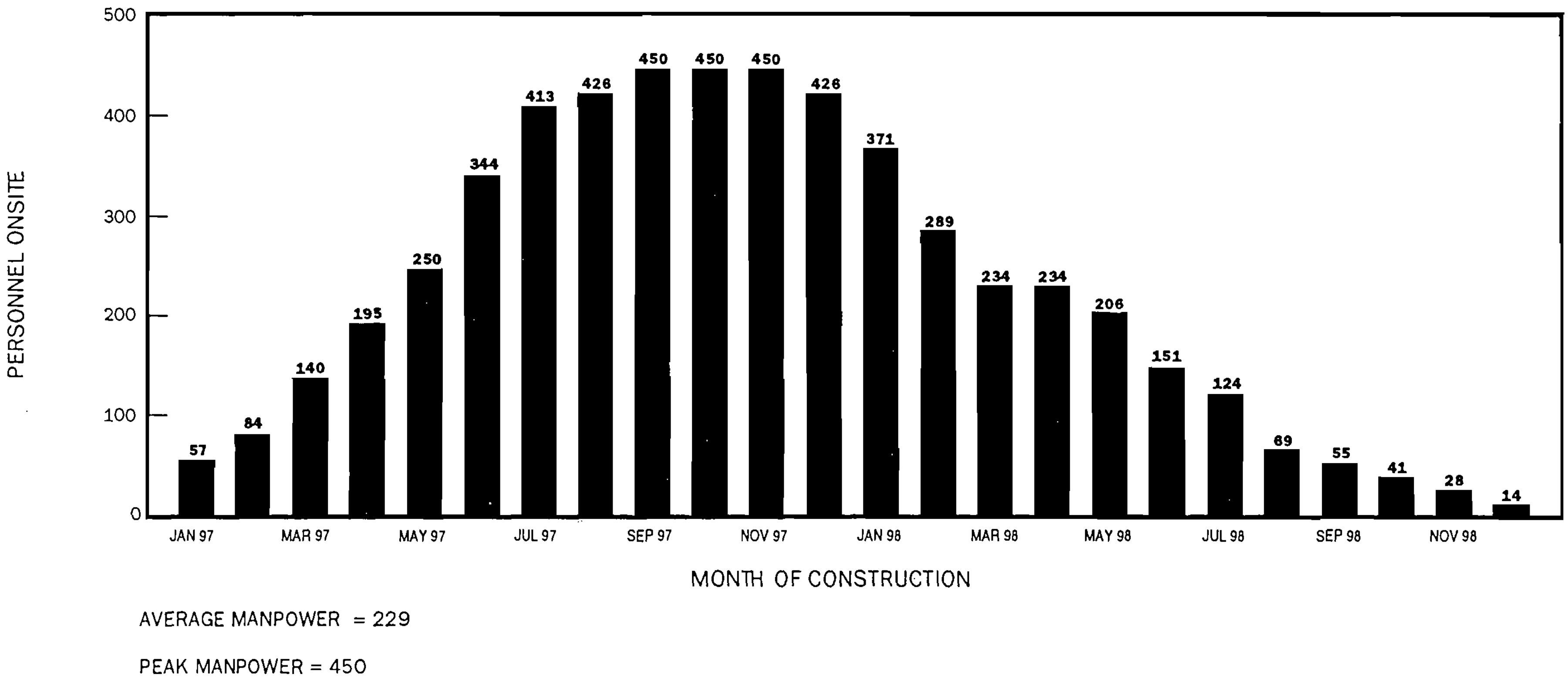

Figure 4.6.2-1
Estimated Average Monthly Personnel Onsite During Construction

Sources: Black & Veatch, 1994; KBN, 1994.

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4.6.3 TRANSPORTATION IMPACTS

This section analyzes the estimated vehicular traffic impacts to the local roadway network associated with the construction of the Hardee Unit 3 Project. In addition to this project, two new power plants have recently been approved for construction and operation in southwest Polk County. The TECO Polk Power Station is located south of Bradley in Polk County and has received site certification approval to construct and operate 260 MW, with an ultimate site capacity of 1,150 MW. The TECO facility site is located approximately 9.7 km (6 miles) north of the existing HPS site (see Figure 4.6.3-1). FPC received site certification approval to construct and operate a 470-MW power plant facility located west of Homeland in Polk County. The FPC Polk County site has an ultimate capacity of 3,000 MW and is located approximately 21 km (13 miles) northeast of the existing HPS site (see Figure 4.6.3-1). To determine the cumulative impacts associated from all three facilities, the transportation sections in TECO's and FPC's Site Certification Applications were incorporated into this analysis. The projected trips generated by each project were then added in the transportation network to be utilized by construction workers associated with the Hardee Unit 3 Project. Since both FPC and TECO projects are anticipated to begin construction in 1994, the 1997 background analysis includes project traffic from both of the new power plant facilities.

The primary mode of transportation to the Hardee Unit 3 plant site during the construction phase is expected to be workers driving their own vehicles over the rural highway network of Polk and Hardee counties (see Section 2.2.7.2). The location of the plant site on the northwest Hardee County/southwest Polk County border limits the number of potential access routes to the site from nearby population centers and the available construction labor supply.

It is anticipated that a majority of the workers who will be employed in the construction of the plant will come from within 97 km (60 miles) of the plant site and will reside primarily in Polk and Hillsborough counties. For the purposes of this analysis, it is assumed that up to 85 percent of the construction workers will come from the population centers of Lakeland, Winter Haven, and Plant City which are located within about 40 to 56 km (25 to 35 miles) north, northeast, and northwest of the site. This area also includes the smaller communities of Bartow and Mulberry, as well as Bradley Junction and Fort Meade. It is expected that the balance of other construction workers will be split about evenly between those who come from the south and southeast in Hardee and DeSoto counties and those who come from the more distant coastal population centers of Sarasota and Manatee counties. These assumptions are based on population distribution in the area (refer to Table 2.2.3-1) and labor availability.

The vehicular traffic associated with the construction of the Hardee Unit 3 Project was determined by dividing the peak number of construction employees, 450 (see Figure 4.6.2-1), by a vehicle occupancy rate of 1.4 persons per vehicle. This rate was obtained from the most conservative figures used in the recent power plant certification studies identified above. Assuming that all of the construction employees will be arriving and departing the site at the same time, a total of 321 vehicles were distributed on the local roadway network (see Figure 4.6.3-2). The traffic was distributed 85 percent to the north and 15 percent to the south to correspond with the anticipated origin of the construction workforce. This distribution was then used to determine the traffic impact area (TIA).

The TIA was established by using Polk County's criteria identified in Ordinance 92-10, Concurrency Management Ordinance of Polk County, Florida, for determining an "Impacted Segment." The definition of an impacted segment is "Any segment on the Concurrency Determination Network on which the project traffic consumes five percent or more of the peak hour level of service 'C' generalized planning capacity." These criteria are the most stringent of all of the local governmental and agency study area requirements. The project traffic volume used to determine the TIA for the construction phase was the peak-hour volume during the peak phase of construction which will occur in the last quarter of 1997. Construction employment will be substantially lower for the remainder of the construction schedule, thereby, minimizing any projected impacts to the TIA. Table 4.6.3-1 lists the results of the TIA analysis. From this analysis, the following list depicts the local roadway segments within the Hardee Unit 3 Project TIA (those links with project traffic greater than 5 percent LOS C capacity):

CR 663 from SR 62 to HPS Site
Fort Green Road from HPS to CR 630
SR 37 from CR 630 to Old Highway 37
SR 37 from Old Highway 37 to CR 640
CR 630 from SR 37 to Fort Green Road
CR 630 from Fort Green Road to CR 555
CR 630 from CR 555 to US 17/SR 35

A roadway segment link analysis was performed on these identified segments using the 1985 Highway Capacity Manual (HCM) software. To analyze the roadway segment links within the TIA, 1993 Polk County and FDOT traffic counts were projected to 1997 conditions using a 2.1 percent growth rate compounded annually. This growth rate of 2.1 percent is consistent with the previous transportation studies conducted. After calculating the 1997 conditions, the FPC and TECO projects' anticipated traffic was added to 1997 conditions. The results of the analyses are depicted in Table 4.6.3-2. All roadway links are expected to operate at a LOS B or better. The HCS summary reports are located in Appendix 10.13.

In addition to the segment analysis, an analysis was conducted at each major intersection within the TIA which are indicated below:

Fort Green Road and CR 630
CR 630 and SR 37
CR 630 and CR 555
CR 630 and US 17/SR 35
CR 640 and SR 37
CR 663 and SR 62

The methodology used to predict 1997 conditions for the link analyses was also used for the intersection analyses. The counts obtained for the intersection analysis were obtained from the FPC and TECO reports and were augmented by KBN in 1993 and 1994 where necessary. The analysis was performed using the 1985 HCM non-signalized intersection methodology except for the intersection of CR 630 and US 17/SR 35 and the intersection of SR 37 and CR 640. As was shown in the FPC study, a signal would be warranted for the 1997 background traffic at the CR 640/SR 37 intersection; therefore, the intersection was modeled assuming a signal would be in place. Table 4.6.3-3 summarizes the p.m. peak-hour peak construction conditions for the above-referenced intersections in the TIA.

In addition to the construction workforce traffic, truck and rail traffic associated with delivering equipment and supplies to the site will have an impact to the local transportation network. These impacts should be minimal as most of the deliveries are expected to occur throughout the workday and are not expected to access the site during the a.m. or p.m. peak hours.

Based on traffic analyses, no significant impacts to the network are anticipated. It should also be noted that 67 percent of the construction workforce demand will be required during the first year of construction, and project traffic during operation of the plant (after completion of construction) will be greatly reduced (i.e., peak-hour traffic generated will be only 28 vehicles). Therefore, any impacts caused during construction will be temporary.

Table 4.6.3-1. Construction Phase Traffic Impact Area (Page 1 of 2)

Roadway Segment	Peak-Hour LOS C Volume		Project Traffic	Percent of Capacity Utilized by Project Traffic[a]	
	Polk County	FDOT		Polk County	FDOT
POLK COUNTY					
Fort Green Road					
HPS Entrance to CR 630	540	NA	272	50.4	NA
CR 630					
SR 37 to Fort Green Road	540	NA	122	22.5	NA
Fort Green Road to CR 555	540	NA	131	24.3	NA
CR 555 to US 17/98	540	NA	96	17.8	NA
SR 37					
SR 674 to CR 630	540	460	12	2.2	2.6
CR 630 to Old Hwy 37	540	460	108	0.20	23.5
Old Hwy 37 to CR 640	540	460	91	16.9	20.4
CR 640 to Cameron Street	540	460	22	4.1	4.8
Old Hwy 37					
CR 630 to SR 37	540	NA	10	1.8	NA
CR 640					
Hillsborough County Line to SR 37	540	NA	23	4.3	NA
SR 37 to CR 555	540	NA	18	3.3	NA

Table 4.6.3-1. Construction Phase Traffic Impact Area (Page 2 of 2)

Roadway Segment	Peak-Hour LOS C Volume		Project Traffic	Percent of Capacity Utilized by Project Traffic[a]	
	Polk County	FDOT		Polk County	FDOT
POLK COUNTY (cont.)					
CR 555					
CR 630 to CR 640	540	NA	21	3.8	NA
US 17					
CR 630 to South 9th Street	1,090	1,540	14	1.3	0.9
US 17/98					
CR 640 to CR 630	2,280	2,190	78	3.4	3.6
HARDEE COUNTY					
CR 663					
Polk County Line to SR 62	NA	460	49	NA	10.7
SR 62					
SR 37 to CR 663	NA	460	15	NA	3.3
CR 663 to US 17	NA	460	21	NA	4.6

[a] To determine the percentage of traffic utilized by the project, the more conservative peak-hour level of service volume was used.

Sources: Polk County, 1992.
FDOT, 1992.
KBN, 1994.

Table 4.6.3-2. Peak-Hour Link Analysis for Construction Traffic

Roadway Link	1997 Background Traffic	FPC Traffic	TECO Traffic	Project Traffic	Total Traffic	Level of Service
POLK COUNTY						
Fort Green Road						
HPS to CR 630	69	0	1	272	342	B
CR 630						
SR 37 to Fort Green Road	255	0	0	122	377	B
Fort Green Road to CR 555	274	24	41	131	470	B
CR 555 to US 17/SR 35	282	125	27	108	542	B
SR 37						
CR 630 to Old Hwy 37	220	0	61	108	389	B
Old Hwy 37 to CR 640	241	0	0	91	332	A
HARDEE COUNTY						
CR 663						
HPS Entrance to SR 62	122	0	0	49	171	A

Sources: TECO, 1992.
FPC, 1992.
KBN, 1994.

Table 4.6.3-3. 1997 Construction--Peak-Hour Intersection Analysis

	Lowest LOS Designation per Intersection Movement	
Intersection	1997 Background Level of Service	1997 Project Traffic Level of Service
POLK COUNTY		
SR 37 and CR 630	C	D
SR 37 and CR 640	B	B
CR 630 and Fort Green Road	C	D
CR 630 and CR 555	C	D
CR 630 and US 17/SR 35	C	C
HARDEE COUNTY		
CR 663 and SR 62	A	A

Note: All intersections were analyzed using non-signalized intersection methodology except the intersection of SR 37 and CR 640 and the intersection of CR 630 and US 17/SR 35.

Sources: KBN, 1994.
TRB/NRC, 1985.
USDOT/FHA, 1987.

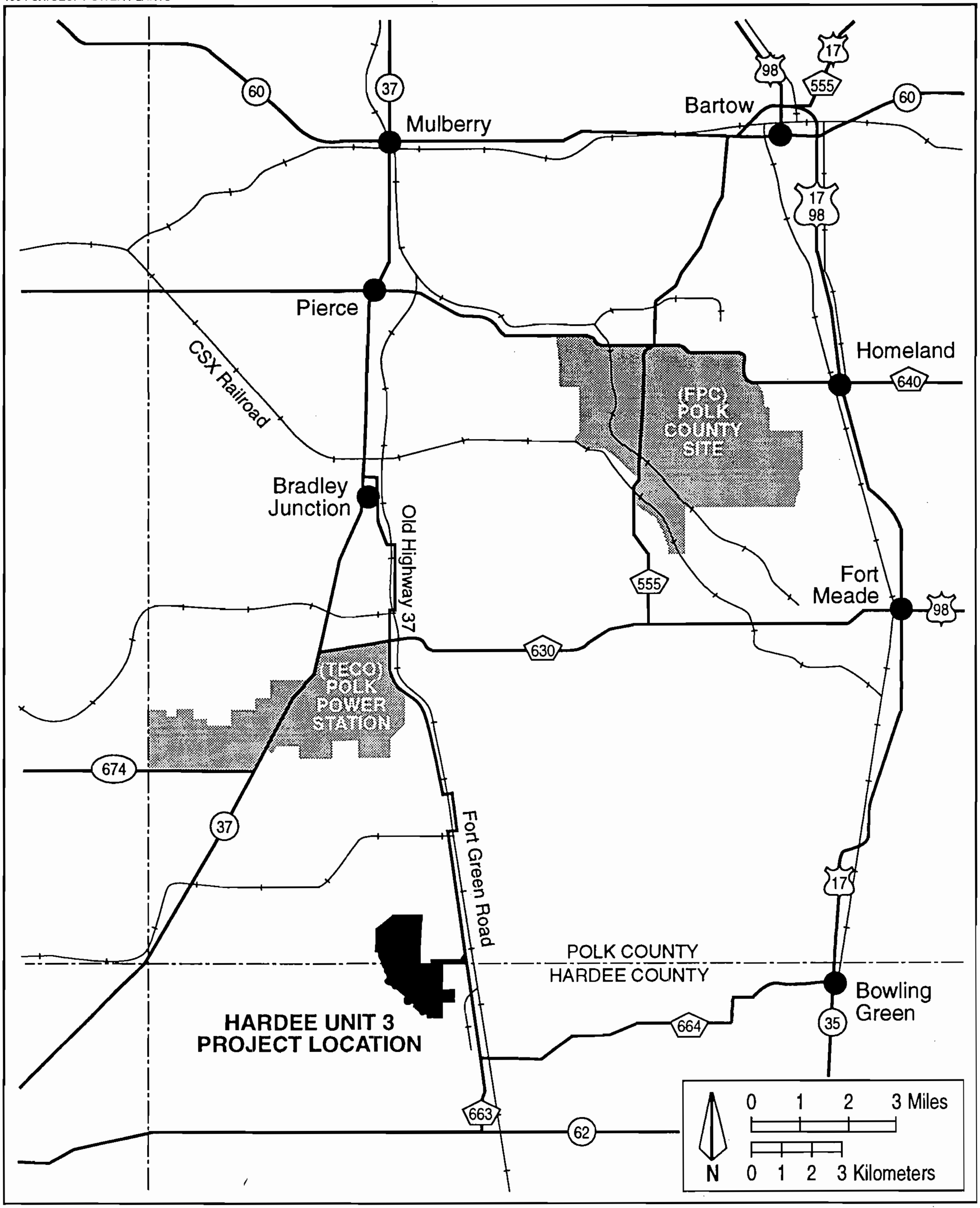

Figure 4.6.3-1
Certified Power Plants Located in the Vicinity of the Hardee Unit 3 Project

Sources: SECI, FPC, TECO, KBN, 1994.

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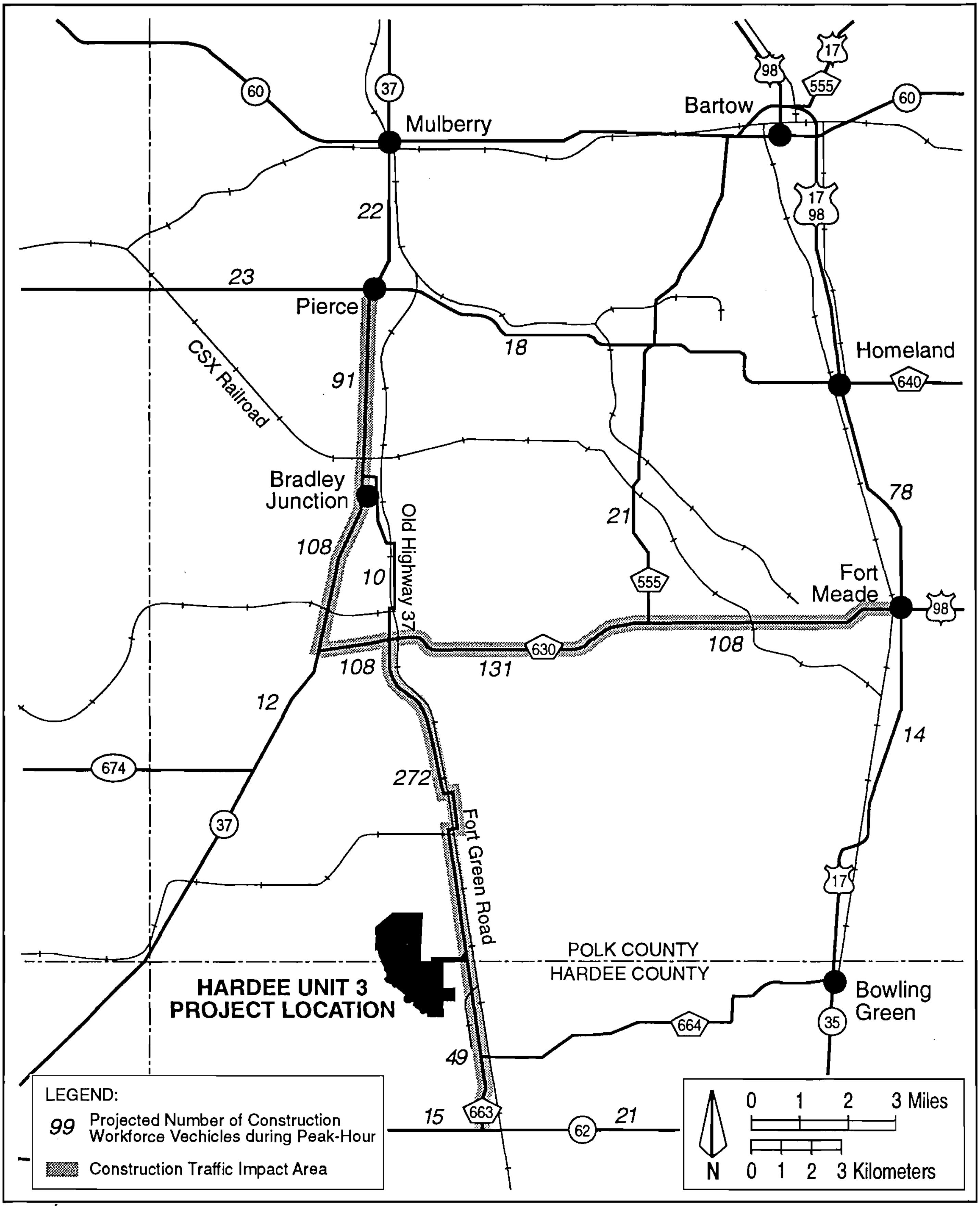

Figure 4.6.3-2
Hardee Unit 3 Peak-Hour Construction Traffic Distribution

Source: KBN, 1994.

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4.6.4 HOUSING IMPACTS

According to the Florida Department of Labor and Employment Statistics (FDLES), approximately 10,000 construction workers reside within the Central Florida Region. Since a more-than-adequate labor supply exists within commuting distance, it is anticipated that workers will be hired from within the region with minimal relocation required. Consequently construction should have no effect on permanent housing within the region. As is typical with longer construction projects, some workers commuting from the longer distances may choose to drive a recreational vehicle to the area and camp near the site on a weekly basis, returning to their permanent homes and families on weekends. Several campgrounds providing various amenities and more than 1,000 full hookups for recreational vehicles are located within the region which could serve these weekly commuters. Since commuting is not anticipated to be a problem, the number of workers who utilize the campground facilities is not expected to be sufficient to cause a change in usage patterns of regular users of these facilities.

With the exception of the occasional use of campgrounds, no new impacts are expected on community services and facilities within the region as a result of the construction effort. Those workers hired from the area will have already established usage patterns and will probably continue to frequent the same facilities and establishments that they used prior to employment on this project. Consequently, any new demands will be dispersed throughout the region and should not create any noticeable change in the availability of area resources.

4.7 IMPACT ON LANDMARKS AND SENSITIVE AREAS

No federal, state, regional, or local scenic, cultural, or natural landmarks are located within the 8-km (5-mile) study area surrounding the proposed facility. Consequently, the construction of Hardee Unit 3 will have no effect on any such resources.

4.8 IMPACT ON ARCHAEOLOGICAL AND HISTORIC SITES

No significant archaeological and historic sites or sites recommended for preservation occur on the HPS site (see Section 2.2.6 and Appendix 10.6). Therefore, no impact mitigation is expected to be required for construction and operation of Hardee Unit 3. If any site or sites are found during construction, the Applicant will implement a "chance/find" procedure where a certified archaeologist will evaluate the site and will determine the significance of the find in consultation with the Division of Historical Resources (DHR). If the site is considered significant by DHR, measures will be taken by the Applicant to preserve or mitigate the impact to the site.

4.9 SPECIAL FEATURES

There will be no unusual products, raw materials, garbage disposal services, incinerator effluents, or residues produced during construction that will have an influence on the environment or ecological systems of the plant site and the adjacent areas.

4.10 BENEFITS FROM CONSTRUCTION

Numerous benefits will result directly from site preparation and construction activities. Site preparation and construction will create job opportunities within Hardee and Polk counties, a region that is currently suffering from high unemployment. A detailed description of the socioeconomic benefits associated with construction of Hardee Unit 3 is presented in Chapter 7.0.

4.11 VARIANCES

No variances from applicable standards due to construction will be sought as part of the state certification procedures.

4.12 REFERENCES

The following references are cited in Chapter 4.0.

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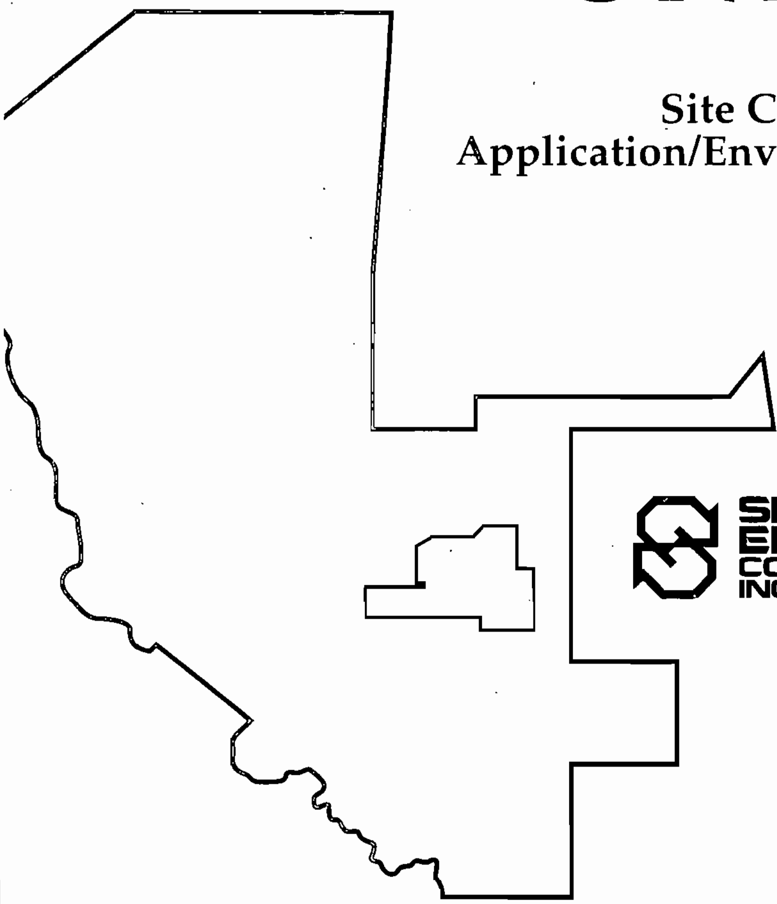
Chapter 5.0

HARDEE UNIT 3

Site Certification Application/Environmental Analysis



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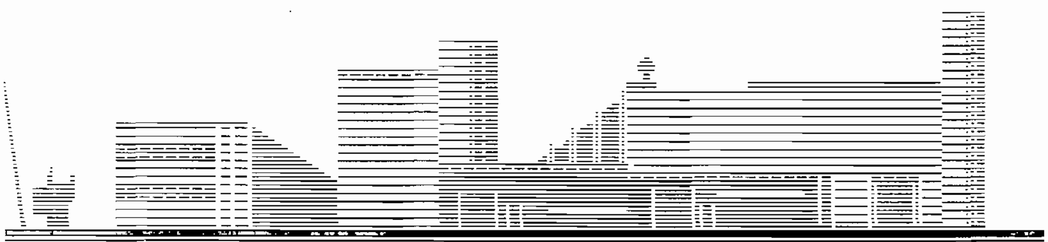

5.0 EFFECTS OF PLANT OPERATION

TABLE OF CONTENTS
(Page 1 of 3)

TABLE OF CONTENTS
(Page 2 of 3)

TABLE OF CONTENTS
(Page 3 of 3)

LIST OF TABLES
(Page 1 of 2)

LIST OF TABLES
(Page 2 of 2)

LIST OF FIGURES

Figure

5.1 EFFECTS OF THE OPERATION OF THE HEAT DISSIPATION SYSTEM

5.1.1 TEMPERATURE EFFECT ON RECEIVING BODY OF WATER

As previously described in Section 3.5, the existing 230-hectare (ha) (570-acre) cooling reservoir will be used for condenser cooling/heat dissipation for the steam portion of Hardee Unit 3. There will be no physical or operational changes to the reservoir related to Hardee Unit 3 with the exception of the new intake and return structures for the circulating water pipes. The reservoir will function as the condenser cooling water supply, condenser cooling point of discharge, and heat dissipation system for the total 880-MW HPS, including the TPS 440-MW Units 1A and 1B and the SECI 440-MW Hardee Unit 3. The cooling reservoir has been designed to: (1) collect, store, and supply water for use in condenser cooling, and (2) reject heat through evaporative, radiation, and other cooling mechanisms.

As a recirculating/recycling cooling system, the reservoir is designed to maximize water reuse and thereby minimize groundwater withdrawals. Reservoir water will include direct rainfall, runoff and seepage from the upland watershed, treated wastewaters, and as necessary pumped deep well (Floridan aquifer) water. To accommodate the infrequent discharges (i.e., in response to the 10-year, 24-hour rainfall event), the reservoir has an existing overflow to Payne Creek.

To evaluate the potential discharge impacts of the cooling reservoir operation on the adjacent Payne Creek, several component analyses were conducted. First, a reservoir thermal analysis was conducted to determine the reservoir performance and operating conditions during the annual cycle, including a determination of the "cooled" recirculating water/reservoir discharge temperature. Second, a long-term reservoir water balance analysis was conducted to determine water makeup requirements and reservoir discharge conditions. Finally, a mixing zone analysis was conducted to determine the extent of thermal impacts in Payne Creek due to potential reservoir discharges. The reservoir point of discharge has been defined in the conditions of certification as the point where reservoir overflow meets Payne Creek.

To evaluate and predict cooling reservoir performance (e.g., temperature and evaporation), a monthly thermal model analysis was performed. The thermal model was developed based on work by Sonnichsen (1975) and utilized an energy budget/equilibrium temperature approach for determining the exchange of energy between air and water. This approach uses a variety of available meteorological data (e.g., 37 years of air temperature, dewpoint, relative humidity, wind speed, etc.).

The modeling conducted in this analysis was a real-time simulation of 37 years of meteorological data; therefore, reservoir water temperatures have been estimated for each of the 444 months of historical data. As noted elsewhere, the average load scenario is defined as the expected station demand that ranges from 27 to 100 percent for Units 1A and 1B and from 28 to 100 percent for Unit 3. The annual average load factor for the average load scenario is approximately 57 percent for the "average load" scenario. The maximum load scenario is defined as all HPS units (i.e., Units 1A and 1B and Hardee Unit 3) operating at 100 percent load. For reporting purposes, monthly average and monthly maximum values are presented for each of the two load scenarios (i.e., average load and maximum load). Thus, the cases presented in the following discussions are defined as follows:

1. Average operating conditions, average monthly temperature--When the station is operating under average load conditions, the average value for a given month (e.g., the average of the estimated 37 June temperatures equals the June average monthly temperature).
2. Average operating conditions, maximum monthly temperature--When the station is operating under average load conditions, the maximum value for a given month (e.g., the maximum of the estimated 37 June temperatures equals the June maximum monthly temperature).
3. Maximum operating conditions, average monthly temperature--When the station is operating under maximum load conditions, the average value for a given month (e.g., the average of the estimated 37 June temperatures equals the June average monthly temperature).
4. Maximum operating conditions, maximum monthly temperature--When the station is operating under maximum load conditions, the maximum value for a given month (e.g., the maximum of the estimated 37 June temperatures equals the June maximum monthly temperature).

The temperature within the reservoir was modeled for the full 880-MW buildout using the available regional meteorological data for two operational scenarios: (1) the normal operating conditions, and (2) a maximum, worst-case condition. The results of this reservoir thermal analysis are summarized in Tables 5.1.1-1 and 5.1.1-2. During average anticipated operating conditions, the predicted maximum temperature on the cold side is 35.4 degrees Celsius (°C) [95.7 degrees Fahrenheit (°F)] during June; during the maximum, worst-case conditions, the predicted maximum temperature on the cold side is 37.5°C (99.5°F) during June. These values for the 880-MW buildout compare to the 660-MW facility maximum temperatures of 34.4°C (94.0°F) under average operating conditions and 36.6°C (97.9°F) for the maximum, worst-case conditions. These are monthly average temperatures; daily variations within these months may occur and result in slightly higher or lower temperatures. It is also of note that the above maximum values represent hot, dry summer conditions, and the probability of these values being experienced during a discharge event is unlikely because discharge will occur only in response to prolonged wet-season conditions.

Regarding the accuracy and applicability of this model, it should be noted that the natural equilibrium water temperature (e.g., reservoir water temperature without reservoir plant loading) was estimated as part of the overall analysis process. Using the available data, the calculated monthly equilibrium water temperatures generally correspond with temperatures that could be expected in a shallow lake in central/south Florida. More critical, the calculated annual total lake evaporation of 126 centimeters per year (cm/yr) (49.6 inches/yr) corresponds with the various estimates of lake evaporation in the region ranging from 119 to 130 cm/yr (47 to 51 inches/yr). Therefore, it is concluded that this analysis' methodology accurately represents the evaporative phenomenon in the geographic region of the proposed plant and, therefore, is an accurate estimate of the anticipated evaporation from the cooling reservoir.

To evaluate the frequency of discharge, a reservoir water balance analysis was conducted. Water flows into the reservoir include:

1. Rainfall into the reservoir,
2. Surface runoff and surficial aquifer seepage from the upland basin,
3. Treated wastewater discharged to the reservoir, and
4. Makeup water pumped from the Floridan aquifer.

Water losses from the reservoir include:

1. Evaporation,
2. Seepage out into the surficial aquifer,

3. Leakance down through the confining layers into deeper confined aquifers, and
4. Discharges to Payne Creek.

The flows into and out of the cooling reservoir were estimated using the methodology employed in the original application (TPS/SECI, 1989). The methodology is presented in Appendix 10.8.1.

To facilitate water management during varying climatic conditions, 0.6 meter (m) [2 feet (ft)] of allowable operational fluctuation in reservoir water level is maintained. This will allow storage of water during wet conditions within the reservoir for later use and evaporative consumption during later dry periods. If the water level were to fall below the minimum limit [i.e., 0.6 m (2 ft) below the design maximum], sufficient makeup water will be pumped from the Floridan aquifer well(s) to maintain the reservoir at the minimum elevation of 37.19 meters above mean sea level (m-msl) [122.0 feet above mean sea level (ft-msl)]. Conversely, if the water level were to rise above the maximum limit (i.e., during extreme meteorological conditions), sufficient water will flow over the control weir to maintain the reservoir at the design maximum elevation. Reservoir makeup and discharge requirements were estimated based on this allowable operational fluctuation.

Based on this monthly water balance analysis for the 37-year period 1953-1970 and 1973-1991, predicted reservoir elevations are presented in Figure 5.1.1-1. This analysis shows the cooling reservoir level will operate below the control/discharge elevation of 37.8 m-msl (124 ft-msl) most of the time.

Based on the long-term modeling analysis and given a maximum control elevation of 37.8 m-msl (124 ft-msl) and a minimum control elevation of 37.2 m-msl (122 ft-msl), the cooling reservoir elevation typically will be maintained below 37.5 m-msl (123 ft-msl). Thus, based on 37 years of long-term analysis, the reservoir would have exceeded 37.5 m-msl (123 ft-msl) during only two periods during the 37-year period of record and would not have exceeded 37.8 m-msl (124 ft-msl) at any time during that period.

Based on this monthly water balance analysis, no reservoir discharge is estimated during the 37-year period of analysis. Any discharges would occur only during extremely wet meteorological conditions.

These extremely limited discharge occurrences are a direct result of: (1) significant reservoir water losses due to evaporation, and (2) the positive impact of the 0.6 m (2 ft) of allowable operational fluctuation in reservoir water level, allowing water management. Average annual evaporative losses are approximately 15.37 million liters per day (Lpd) [4.06 million gallons per day (mgd)]: average side seepage is approximately 3.483 million Lpd (0.920 mgd).

Based on this analysis, reservoir discharge will be very infrequent; when reservoir discharges do occur, they will be subject to significant dilution by the Payne Creek flow.

To evaluate event-specific discharges and the associated dilution, a HEC-1 model analysis was conducted for the Payne Creek and the cooling reservoir during the preparation of the TPS (1989) application.

The HEC-1 model has been used previously by Agrico to determine pre- and post-mining peak flows to Payne Creek for the preparation of its reclamation plan.

Two different extreme rainfall events were analyzed: the 10-year, 24-hour storm [19 centimeters (cm) (7.5 inches)] and the 25-year, 24-hour storm [23 cm (9.0 inches)]. Model geometry was determined based on available U.S. Geological Survey (USGS) topographic data and topographic (cross section) data collected as part of the monitoring program. Soil conditions were estimated based on curve numbers presented and used in the Agrico modeling program. In accordance with the methodology previously used and accepted by DNR in the Agrico modeling program, the HEC-1 Payne Creek peak flows were adjusted by a factor of 0.7 to account for surface storage in the wetlands and detention and/or routing through the relatively flat Payne Creek sub-basin. For this analysis, a base flow of 22 cubic feet per second (cfs) was included, reflecting an average water yield of approximately 0.9 cfs per square mile (based on USGS data for Payne Creek as presented in Section 2.3.4).

Based on the prediction and analysis of anticipated reservoir elevations (see Figure 5.1.1-1), the initial (i.e., pre-event) reservoir elevation was assumed to be 37.5 m-msl (123 ft-msl) for the initial modeling condition. As previously discussed, this condition is predicted to occur only two times in 37 years, or approximately once every 18 years. Therefore, the assumed initial reservoir elevation of 37.5 m-msl (123 ft-msl) reflects a conservative estimate of wet-season reservoir elevation. This conservative estimate of wet-season reservoir water elevation and the estimate of infrequent extreme rainfall events (i.e., the 10-year and 25-year, 24-hour storms) represent worst-case discharge conditions.

Based on the HEC-1 analysis, the anticipated Payne Creek runoff hydrograph at the plant site for the 10-year, 24-hour rainfall is presented in Figure 5.1.1-2. Peak Payne Creek flow is estimated to be 4,167 cfs and occurs approximately 17 hours after the start of rainfall. The tail of the HEC-1 Payne Creek hydrograph was extended using a constant rate of recession (e.g. constant percentage decrease with each time step).

Under the previously described reservoir conditions [i.e., wet-season elevation of 37.5 m-msl (123 ft-msl)], no discharge from the reservoir is predicted as a result of the 10-year, 24-hour rainfall. The 0.3 m (1 ft) of storage provided within the reservoir below the discharge weir is sufficient to retain the direct rainfall and runoff into the reservoir from the 10-year, 24-hour rainfall. Under these 10-year, 24-hour rainfall conditions, the reservoir water level will rise from 37.5 m-msl (123 ft-msl) to 37.7 m-msl (123.86 ft-msl) or just under the 37.8 m-msl (124 ft-msl) control or discharge elevation.

Based on this HEC-1 analysis, the anticipated Payne Creek runoff hydrograph at the plant site for the 25-year, 24-hour rainfall is presented in Figure 5.1.1-3. Peak Payne Creek flow is estimated to be 5,372 cfs and occurs approximately 17 hours after the start of rainfall. Peak flow unit discharge was calculated to be 231 cfs per square mile; the peak flow unit discharge determined in the previous Agrico HEC-1 modeling was calculated to be 215 cfs per square mile. Thus, the peak flows in Payne Creek predicted in this analysis are very similar to those previously predicted in the Agrico studies. Given that the actual portions of Payne Creek modeled under these two studies were different, this small difference is not considered to be significant. The tail of the HEC-1 Payne Creek hydrograph was extended using a constant relative rate of recession (e.g., constant percentage decrease with each time step). Based on this recession, Payne Creek flow decreases to the average (base) flow of 22 cfs in approximately 3 days.

The cooling reservoir water budget modeling (in both 1989 and 1994) showed the maximum observed water elevation in the reservoir to be slightly above 37.5 m-msl (123 ft-msl). In order to "create" the discharge that can possibly occur from the reservoir, large storm events (i.e., the

10-year, 24-hour and 25-year, 24-hour events) were artificially imposed on the reservoir when it was at its predicted maximum. If a discharge from the reservoir occurs under similar circumstances, the base flow in Payne Creek will be high prior to the addition of the 10/25-year, 24-hour events and, therefore, will not decrease as rapidly as predicted in the HEC-1 modeling. Therefore, the 22 cfs used for the discharge modeling represents a conservatively low flow estimate because it ignores saturated condition of the watershed that would have to occur in order for a reservoir discharge to be possible.

Reservoir discharge in response to the 25-year, 24-hour rainfall is presented in Figure 5.1.1-4. During this storm, no reservoir discharge occurs early during the rainfall; reservoir discharge begins 20 hours after the start of rainfall. Prior to this time, the 1 ft of storage provided by the reservoir prevents reservoir discharge; discharge occurs only after the available reservoir storage is filled. Peak reservoir discharge of approximately 0.33 cfs occurs at approximately 33 hours and then begins decreasing. Maximum water elevation in the reservoir is estimated to be 37.8 m-msl (124.04 ft-msl), or approximately 1.2 cm (0.04 ft) above the control elevation.

For the cooling reservoir, the decline in the rate of discharge from the reservoir was estimated based on the decline in the volume of water accumulated in the reservoir above the weir elevation. This volume and associated reservoir level were estimated based on losses from the reservoir due to weir discharges and net evaporative/seepage losses. Based on the revised water balance information, the reservoir will operate on a average daily deficit of 9,850,000 Lpd [2,602,000 gallons per day (gpd)], if no makeup water is pumped from the Floridan aquifer wells. Weir discharge losses were estimated based on the declining water level above the 10-ft sharp crested weir set at 37.8 m-msl (124 ft-msl). Based on these two factors, reservoir discharge will decrease to 0 approximately 6.5 days after the beginning of the 25-year, 24-hour rainfall.

Potential for discharge impacts was evaluated by comparing the Payne Creek and the reservoir discharge hydrographs for the 25-year, 24-hour rainfall. These two hydrographs are superimposed and presented in Figure 5.1.1-5. (Note: These hydrographs are presented on two radically different scales.) Due to the slower rate of recession of the reservoir discharge as compared with Payne Creek flows, the relative dilution of discharge waters with Payne Creek decreases after the storm.

Given these worst-case modeling analyses, the worst-case dilution conditions would occur if Payne Creek were to recede to average base flow conditions (22 cfs) while the reservoir continued to discharge at the predicted peak rate of 0.33 cfs for the 25-year, 24-hour storm. This corresponds to a relative dilution of 1.5 percent. As this is less dilution than that which is estimated by comparing the Payne Creek and the reservoir discharge hydrographs, this represents the worst-case conditions which would result from discharges from the 25-year, 24-hour rainfall event. Given that actual dilution will probably be greater, this analysis is conservative.

The mixing and dispersion of these reservoir discharges to Payne Creek and resulting temperature impacts were estimated using the following dispersion model presented by Fischer *et al.* (1979). To execute the dispersion analysis, the various model parameters and coefficients were estimated based on available data and information. For the purposes of this analysis, the water quality parameter of interest (i.e., temperature) was considered to be a conservative parameter. Potentially, there may be some additional radiant or evaporative cooling within the discharge swale and plume areas; therefore, the assumption is conservative since it overestimates the magnitude of the impact.

Reservoir discharge thermal impact modeling conditions were estimated based on the average predicted reservoir discharges and Payne Creek flow conditions during these discharge conditions. Although most significant discharge conditions are predicted to occur in the fall (the wet season), worst-case (i.e., July) temperature conditions in the cooling reservoir were assumed. For the reservoir discharge conditions, a worst-case condition of 36.5°C (97.7°F) was assumed to reflect the average worst-case conditions [35.4°C (95.7°F)] predicted for June, plus an additional 1.1°C (2°F) loading to reflect short-term reservoir variability, adverse meteorological conditions, etc. For Payne Creek, the maximum observed stream temperature of 30°C (86°F), based on historical monitoring data previously collected by Agrico, was used as maximum, worst-case conditions. As such, these modeling conditions reflect maximum reservoir and creek thermal conditions.

The results of this modeling analysis are summarized in Table 5.1.1-3. Based on this modeling analysis, the cooling reservoir discharges will be diluted quickly by Payne Creek flows. For example, at a distance of 25 m (75 ft) below the point of discharge, the maximum plume temperature is 31.2°C (88.1°F), or approximately 1.1°C (2°F) above background conditions. At this point, the thermal plume will comply with the thermal standards in Chapter 17-302.520, F.A.C.

To evaluate potential thermal impacts during cooler periods (i.e., during those times when creek organisms may be acclimated to colder temperatures and thus potentially more susceptible to thermal shock), an additional analysis was conducted to reflect potential worst-case creek and cooling reservoir temperatures in October. For the reservoir discharge conditions, a worst-case condition of 29.3°C (84.7°F) was assumed to reflect the predicted October worst-case load conditions (28.2°C or 82.7°F) plus an additional 1.1°C (2°F) loading to include short-term reservoir variability, adverse meteorological conditions, etc. For Payne Creek, a minimum October stream temperature of 21.1°C (70°F) was assumed to reflect worst-case receiving water conditions (i.e., maximum difference between reservoir effluent and creek conditions). This minimum October stream temperature is significantly lower than the observed October stream temperature of 24°C (75°F) measured in the monitoring program and lower than the estimated natural or the calculated equilibrium water temperature of 22.6°C (72.6°F). As such, this combination of maximum reservoir and minimum creek temperatures and the resulting temperature differential of 8.3°C (15°F) represent a potential worst-case condition regarding thermal shock.

The results of this modeling analysis are summarized in Table 5.1.1-4. As previously demonstrated by similar modeling analyses, the cooling reservoir discharges will be quickly diluted by Payne Creek flows. For example, at a distance of 25 m (75 ft) below the point of discharge, the maximum plume temperature is 22.2°C (71.9°F), or approximately 1.1°C (2°F) above background conditions. At this point, the thermal plume will approximate background conditions.

This substantial mixing and dispersion is a direct function of the Payne Creek conditions during the infrequent periods when a cooling reservoir discharge is required. As previously discussed, due to the evaporative losses and the ability of the reservoir to accommodate fluctuations in level to manage available water, discharges from the cooling reservoir will be required only during extreme meteorological conditions. Similarly, during the extreme meteorological conditions, Payne Creek flows will increase substantially. Thus, discharges from the reservoir will occur during high-flow conditions in Payne Creek; during these periods, there will be a substantial dilution of the reservoir water. The impacts of these infrequent discharges are further minimized by existing sheetflow discharge from the reservoir into Payne Creek.

Based on the available data and the impact analysis presented herein, it is anticipated that discharges from the cooling reservoir will not cause adverse thermal impacts, will not significantly increase the temperature of Payne Creek, and will not impair or interfere with its existing or anticipated future beneficial use. This is because of the comparatively high creek flows which will quickly dilute all reservoir discharges. With the previously permitted mixing zone [e.g., 15 m (50 ft)], the proposed infrequent reservoir discharges will meet all requirements of Chapter 17-302.520, F.A.C.

Table 5.1.1-1. Summary of Predicted Reservoir Temperatures for Average Load Conditions for 880-MW Buildout

Month	Unit 1A and 1B Load Factor (%)	Unit 3 Load Factor (%)	Water Temperature at Reservoir Inlet (°F)	
			Average Month	Maximum Month
January	27	59	65.0	71.1
February	27	58	66.5	70.4
March	27	28	68.6	71.7
April	100	100	77.3	82.2
May	51	69	80.2	85.3
June	27	69	86.5	95.7
July	27	73	89.3	94.0
August	27	76	88.1	92.3
September	27	68	82.3	86.7
October	100	68	77.0	82.7
November	51	100	72.6	76.9
December	27	78	68.0	70.5
Annual	43	70	—	—

Note: °C = (°F - 32) 5/9

Source: KBN, 1994.

Table 5.1.1-2. Summary of Predicted Reservoir Temperatures for Maximum Load Conditions for 880-MW Buildout

Month	Unit 1A and 1B Load Factor (%)	Unit 3 Load Factor (%)	Water Temperature at Reservoir Inlet (°F)	
			Average Month	Maximum Month
January	100	100	69.6	75.8
February	100	100	71.1	75.3
March	100	100	74.2	78.1
April	100	100	77.3	82.2
May	100	100	83.0	88.2
June	100	100	90.1	99.5
July	100	100	92.8	97.7
August	100	100	91.6	96.0
September	100	100	86.2	90.8
October	100	100	78.0	83.7
November	100	100	74.3	78.6
December	100	100	70.7	74.3
Annual	100	100	—	—

Note: °C = (°F - 32) 5/9

Source: KBN, 1994.

Table 5.1.1-3. 880-MW HPS Cooling Reservoir Water Discharge and Payne Creek Dispersion Modeling - Maximum (July) Temperature Conditions

Distance Downstream (ft)	Temperature (°F) versus Distance Across Payne Creek										
	0	2	4	6	8	10	12	14	16	18	20
25	89.7	89.5	89.0	88.3	87.6	87.0	86.6	86.3	86.1	86.1	86.0
50	88.6	88.5	88.4	88.1	87.7	87.4	87.1	86.8	86.6	86.4	86.4
75	88.1	88.1	88.0	87.8	87.6	87.4	87.2	87.0	86.9	86.8	86.8
100	87.9	87.8	87.8	87.7	87.6	87.4	87.3	87.2	87.1	87.0	87.0
125	87.7	87.7	87.7	87.6	87.5	87.4	87.4	87.3	87.2	87.2	87.2
150	87.6	87.6	87.6	87.5	87.5	87.4	87.4	87.3	87.3	87.3	87.3
175	87.5	87.5	87.5	87.5	87.5	87.4	87.4	87.4	87.4	87.3	87.3
200	87.5	87.5	87.5	87.5	87.5	87.4	87.4	87.4	87.4	87.4	87.4
225	87.5	87.5	87.5	87.5	87.5	87.4	87.4	87.4	87.4	87.4	87.4
250	87.5	87.5	87.5	87.5	87.5	87.4	87.4	87.4	87.4	87.4	87.4
275	87.5	87.5	87.5	87.5	87.4	87.4	87.4	87.4	87.4	87.4	87.4
300	87.5	87.5	87.5	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4
325	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4
350	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4
375	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4
400	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4
425	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4
450	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4
475	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4
500	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4

Creek Velocity	0.50	ft/sec
Shear Velocity	0.259	ft/sec
Average Creek Depth	2.5	ft
Creek Width	20	ft
Discharge Location	0	ft from shore
Effluent Temperature	97.70	°F
Effluent Discharge Rate	0.330000	cfs
Background Creek Temperature	86.00	°F
Creek Discharge Rate	22.0	cfs
Transverse Mixing Coefficient	0.389	ft^2/sec

Note: °C = (°F - 32) 5/9
ft x 0.3 = m

Source: KBN, 1994.

Table 5.1.1-4. 880-MW HPS Cooling Reservoir Water Discharge and Payne Creek Dispersion Modeling - October Temperature Conditions

Distance Downstream (ft)	Temperature (°F) versus Distance Across Payne Creek										
	0	2	4	6	8	10	12	14	16	18	20
25	73.2	73.0	72.6	72.0	71.4	70.9	70.5	70.3	70.1	70.1	70.0
50	72.3	72.2	72.0	71.8	71.5	71.2	70.9	70.7	70.5	70.4	70.3
75	71.9	71.8	71.7	71.6	71.4	71.2	71.1	70.9	70.8	70.7	70.7
100	71.6	71.6	71.5	71.5	71.4	71.3	71.1	71.0	71.0	70.9	70.9
125	71.5	71.5	71.4	71.4	71.3	71.3	71.2	71.1	71.1	71.0	71.0
150	71.4	71.4	71.4	71.3	71.3	71.3	71.2	71.2	71.1	71.1	71.1
175	71.3	71.3	71.3	71.3	71.3	71.3	71.2	71.2	71.2	71.2	71.2
200	71.3	71.3	71.3	71.3	71.3	71.3	71.2	71.2	71.2	71.2	71.2
225	71.3	71.3	71.3	71.3	71.3	71.3	71.2	71.2	71.2	71.2	71.2
250	71.3	71.3	71.3	71.3	71.3	71.3	71.2	71.2	71.2	71.2	71.2
275	71.3	71.3	71.3	71.3	71.3	71.3	71.2	71.2	71.2	71.2	71.2
300	71.3	71.3	71.3	71.3	71.3	71.3	71.2	71.2	71.2	71.2	71.2
325	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.2	71.2	71.2	71.2
350	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.2	71.2	71.2	71.2
375	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.2	71.2
400	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3
425	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3
450	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3
475	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3
500	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3

Creek Velocity	0.50	ft/sec
Shear Velocity	0.259	ft/sec
Average Creek Depth	2.5	ft
Creek Width	20	ft
Discharge Location	0	ft from shore
Effluent Temperature	87.70	°F
Effluent Discharge Rate	0.330000	cfs
Background Creek Temperature	70.00	°F
Creek Discharge Rate	22.0	cfs
Transverse Mixing Coefficient	0.389	ft^2/sec

Note: °C = (°F - 32) 5/9
ft x 0.3 = m

Source: KBN, 1994.

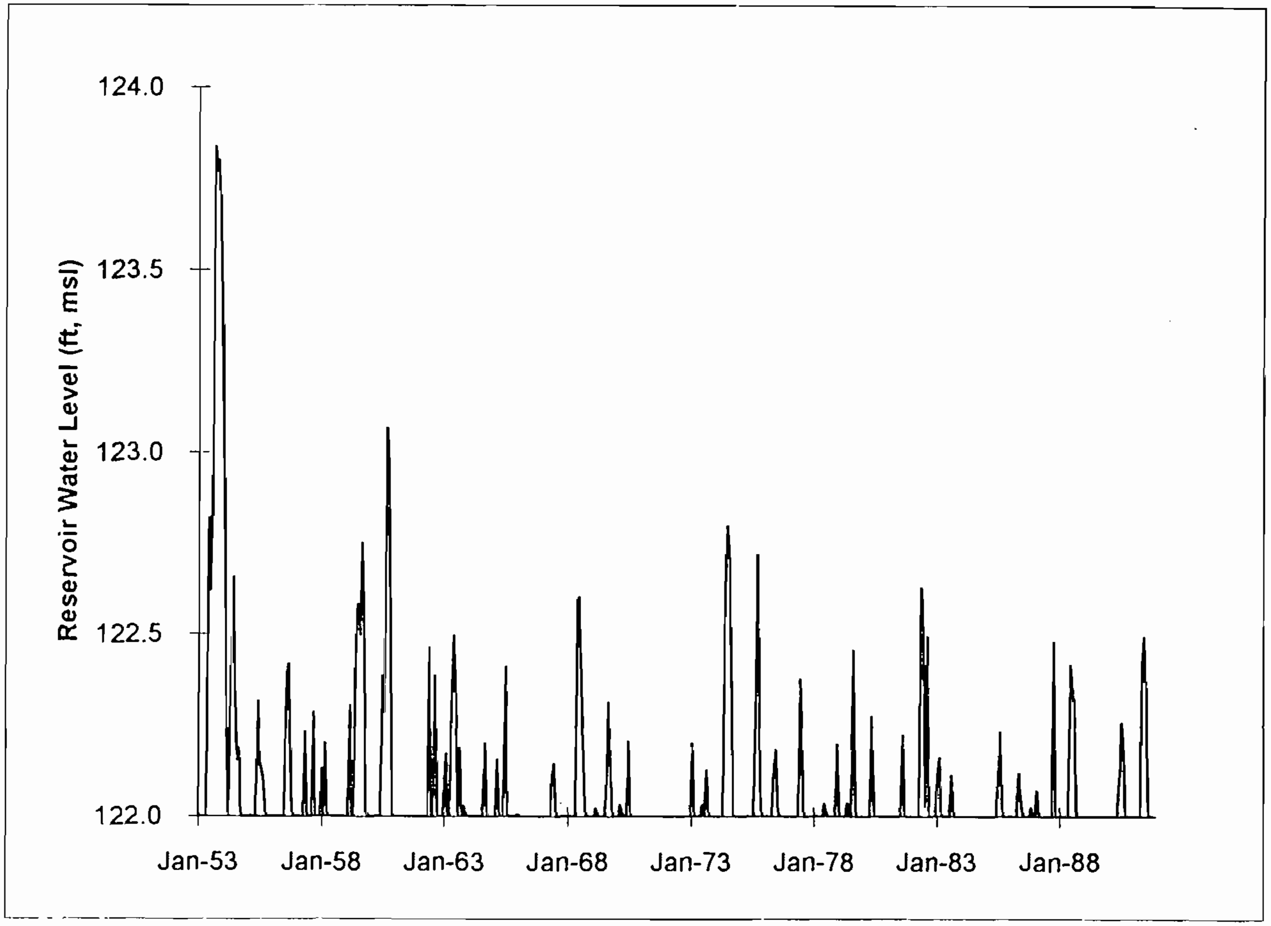

Figure 5.1.1-1
Predicted Cooling Reservoir Elevations
(38 Years)

Source: KBN, 1994.

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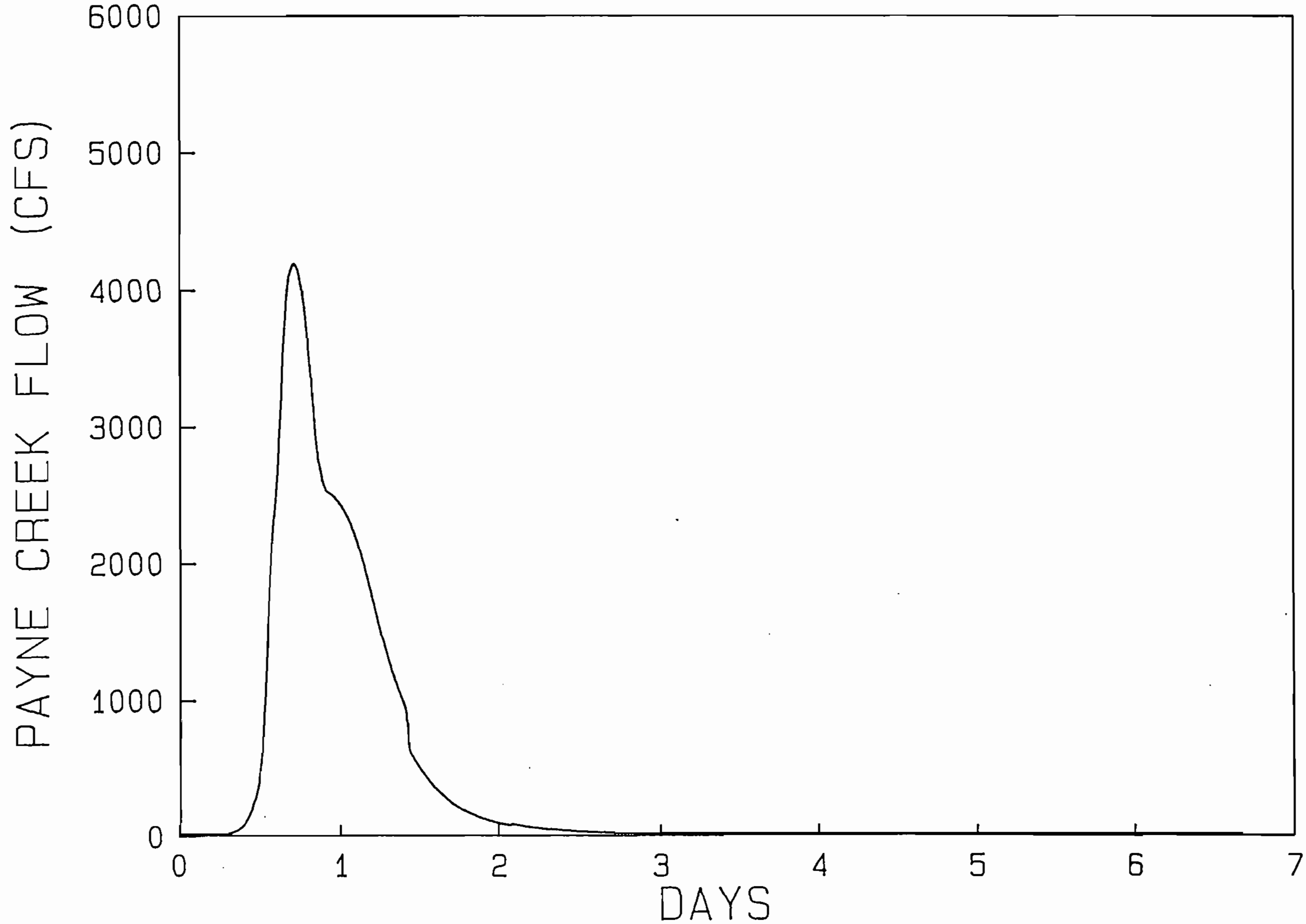

Figure 5.1.1-2
Payne Creek Runoff Hydrograph
(10-Year, 24-Hour Storm)

Source: TPS/SECI, 1989.

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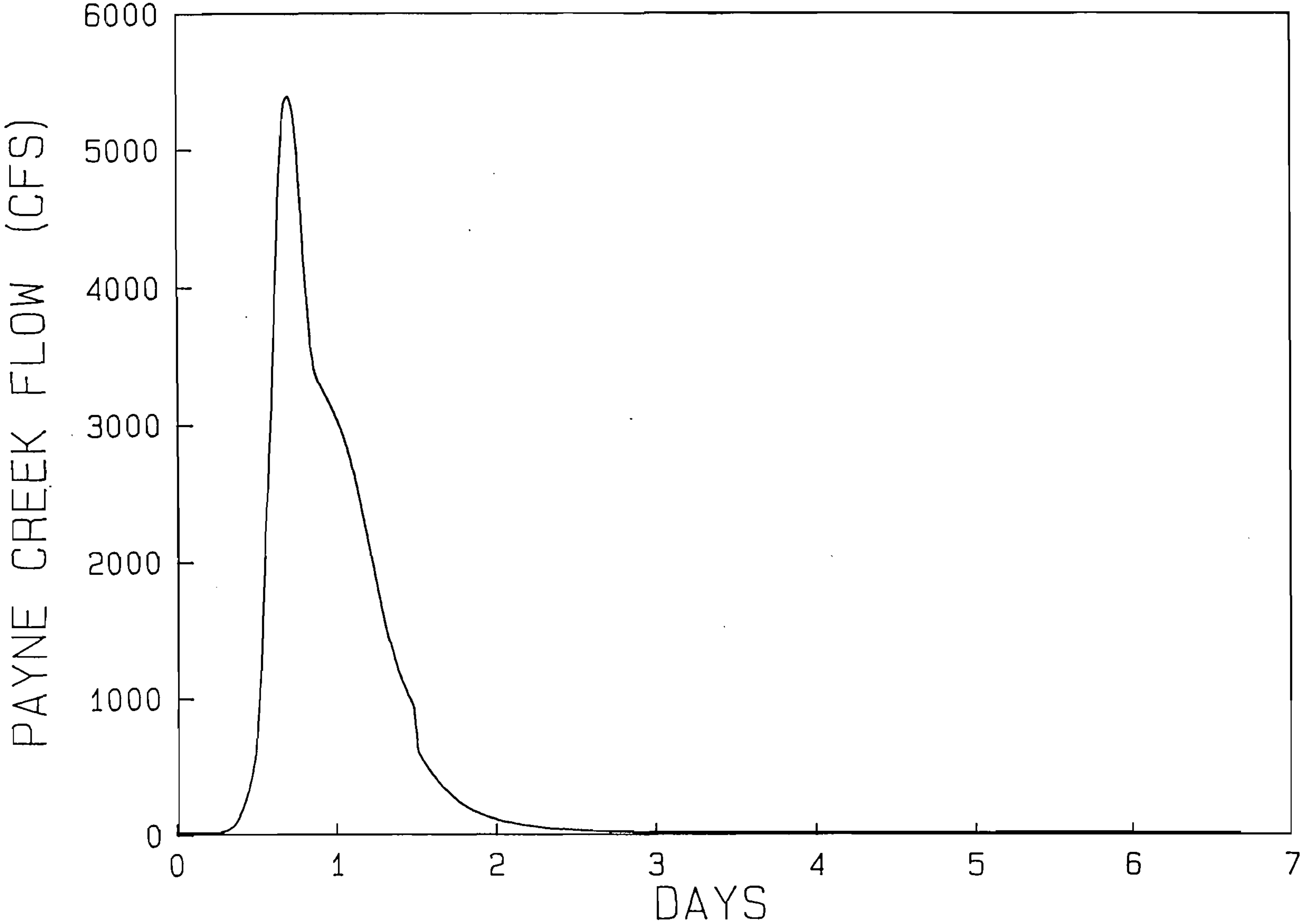

Figure 5.1.1-3
Payne Creek Runoff Hydrograph
(25-Year, 24-Hour Storm)

Source: TPS/SECI, 1989.

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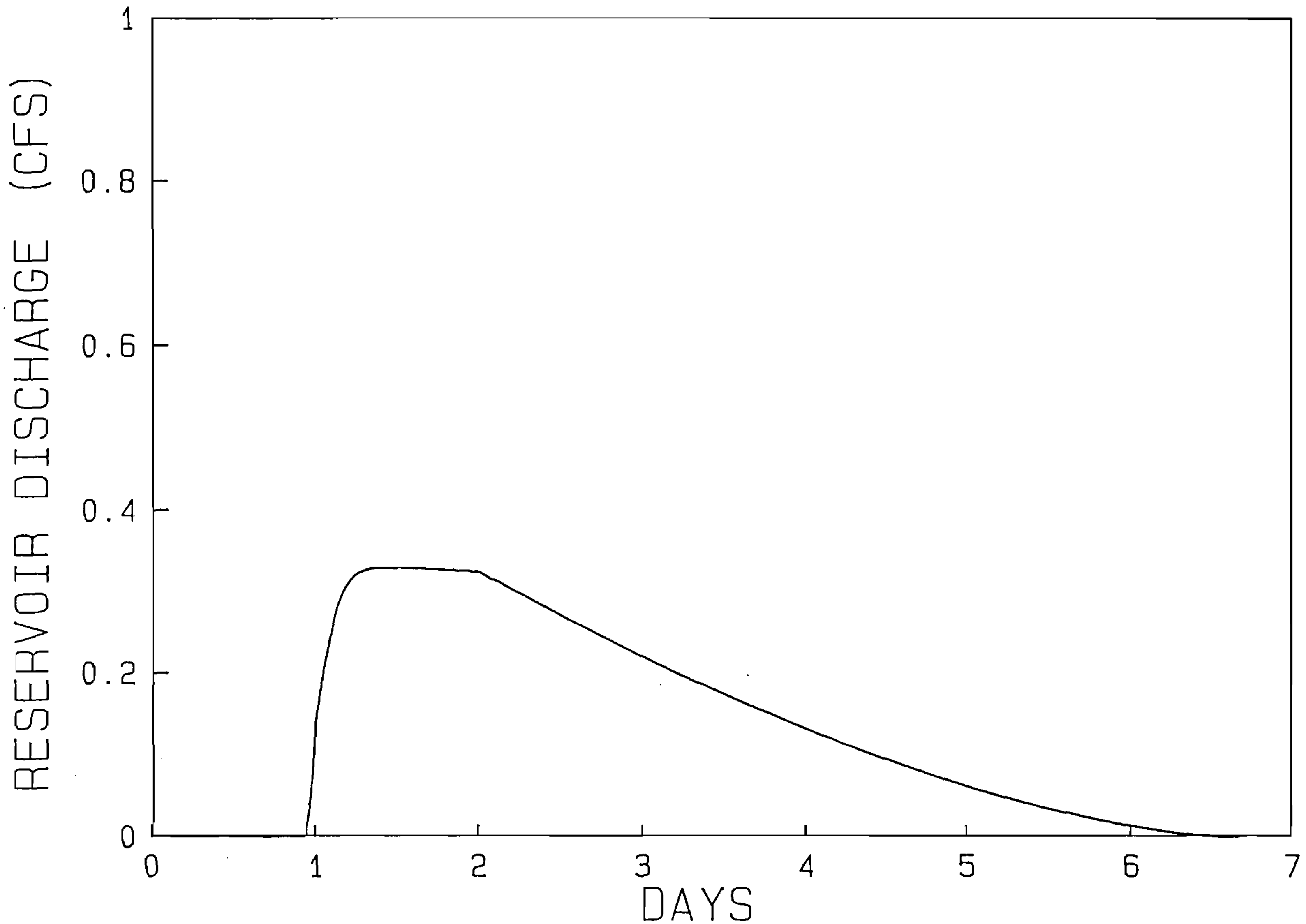

Figure 5.1.1-4
Predicted Cooling Reservoir Discharge
(25-Year, 24-Hour Storm)

Source: TPS/SECI, 1989.

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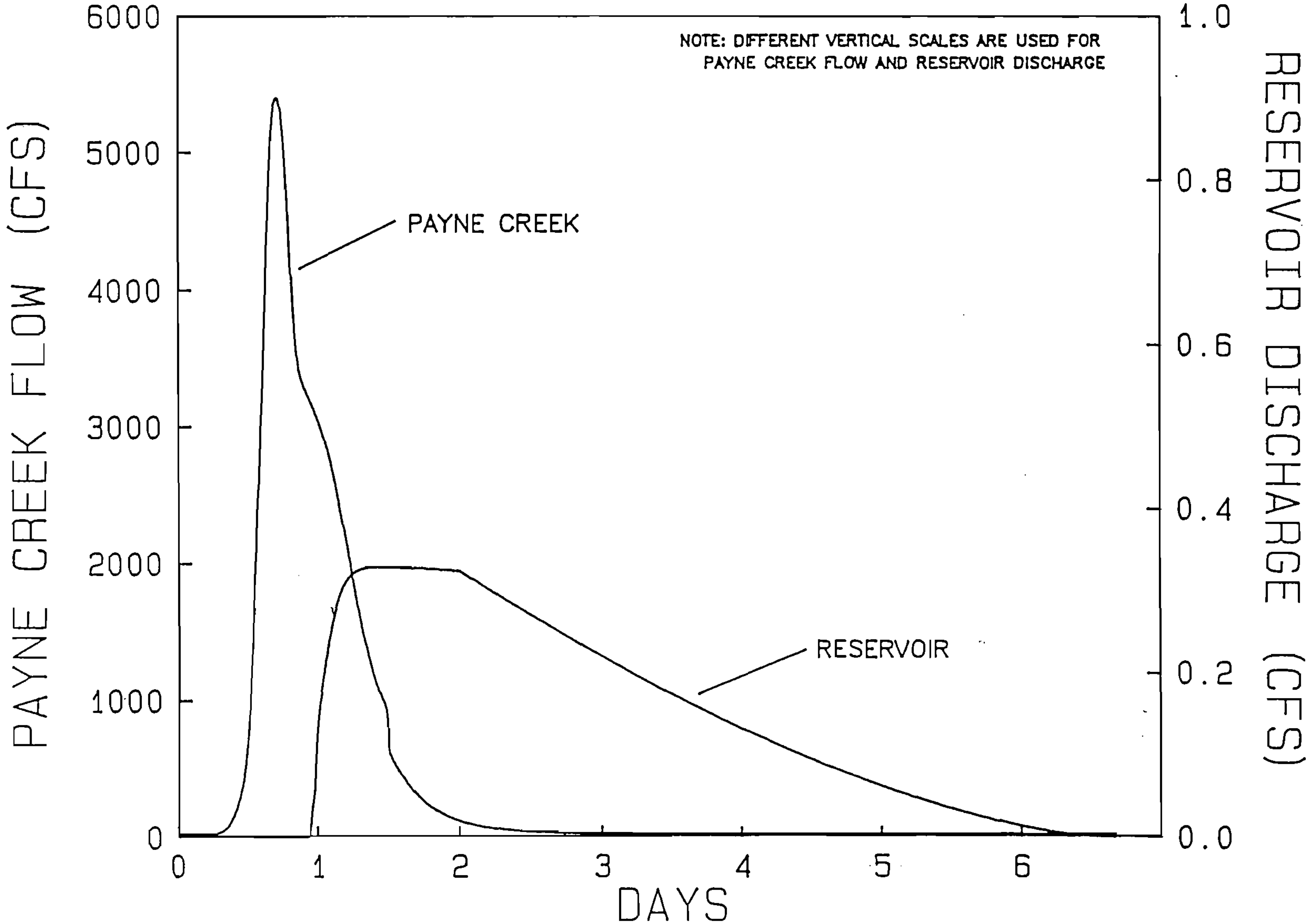

Figure 5.1.1-5
Comparison of Payne Creek Flow and Reservoir Discharge
for the 25-Year, 24-Hour Storm

Source: TPS/SECI, 1989.

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5.1.2 EFFECTS ON AQUATIC LIFE

5.1.2.1 THERMAL IMPACTS

The proposed incremental thermal increase in the cooling reservoir from Hardee Unit 3 will not be significantly different from the expected discharge from the originally certified HPS. Reservoir discharge could occur only during very intensive, wet periods, such as hurricanes or major frontal storms, i.e., 10-year, 24-hour storm. These periods of discharge will coincide with natural high flow in the creek, thus the effluent will be subject to significant dilution.

The predicted maximum average reservoir temperature under average load conditions is conservatively estimated to be 31.8°C (89.3°F) during July and the maximum monthly temperature under average load conditions is 35.4°C (95.7°F) during June (see Section 5.1.1). The predicted maximum average discharge temperature conditions are within the acceptable water quality criteria for peninsular Florida, and thus should not affect the aquatic resources. Discharge of effluent at the predicted maximum worst-case temperature will exceed the water quality temperature limitation for peninsular Florida [criterion of 33°C (92°F) versus discharge of 35.4°C (95.7°F)]. However, applicable temperature criterion will be met outside the established mixing zone (see Section 5.1.1). Based on creek flow and anticipated dilution, the temperature impacts under worst-case conditions should be localized in the immediate vicinity of the point of discharge. At a distance of 25 m (75 ft), the thermal plume will approximate background conditions; therefore, no impacts to aquatic life are anticipated outside the mixing zone.

5.1.2.2 IMPINGEMENT AND ENTRAINMENT

Impingement and entrainment effects are not potential sources of impact because all plant make up water will be groundwater, surface runoff and precipitation. Surface waters will not be used as a source of makeup water.

5.1.2.3 THERMAL SHOCK

Based on the assumption that the highest Payne Creek water temperature of 30°C (86°F) occurs during July, and that the estimated average worst-case plant discharge during the summer is 35.4°C (95.7°F), a temperature differential of 5.4°C (9.7°F) may occur within the mixing zone under ambient conditions.

Payne Creek water temperatures are within 1.1°C (2°F) of ambient for 90 percent of the stream's width at the edge of the thermal mixing zone. Thus, the potential for greatest thermal shock will be localized within 8 m (25 ft) downstream from the discharge point which is within the currently permitted mixing zone (see Table 5.1.1-3). During the summer, aquatic organisms are acclimated to high-temperature conditions and are more tolerant to higher temperatures. Fish and invertebrates can detect and avoid areas of thermal stress. Because of the localized area of impact, no thermal blockage to movement by aquatic animals will occur. Additional modeling was carried out to evaluate potential worst-case conditions during the winter months. The assumptions included a reservoir temperature of 27°C (80°F) and a creek temperature of 21.1°C (70°F). The model predicted that the cooling reservoir discharge will be quickly diluted by Payne Creek flows. Within the currently permitted mixing zone [60 m (200 ft)], the plume temperature is predicted to be <1.1°C (<2.0°F) above background (see Table 5.1.1-4).

5.1.3 BIOLOGICAL EFFECTS OF MODIFIED CIRCULATION

No water intakes will be placed in Payne Creek, and no additional cooling water discharges will occur in Payne Creek. Based on the physical and biological conditions of Payne Creek, the thermal mixing zone described in Section 5.1.1 will not have an adverse impact on the biological communities of Payne Creek. Due to the size and subsequent dilution of the cooling reservoir and the anticipated retention time in the system, no major changes in water quality are anticipated in Payne Creek from the incremental increase from Hardee Unit 3, thus no impacts (TPS/SECI, 1989) are anticipated on the aquatic communities.

Because of the existing preventative measures (e.g., weir, riprap, etc.) associated with the HPS discharge structure and because there will be no change in the discharge flows and volumes, no scouring, erosion and deposition of suspended solids is expected to occur to Payne Creek with the addition of Hardee Unit 3. The overflow is directed to a protected channel which results in sheetflow to the floodplain. This sheetflow is 9 m (30 ft) or more in length and 5 m (15 ft) or more in width before it reaches the creek. During periods of discharge, the discharge volume will not increase over existing volumes, and no effect to the biological communities will occur.

5.1.4 EFFECTS OF OFFSTREAM COOLING

Operation of the Hardee Unit 3 facility will not affect the previously certified use and operational parameters of the existing cooling reservoir. The use of the existing cooling reservoir for condenser cooling for the Hardee Unit 3 facility will not affect groundwater resources since no physical or operational modifications to the reservoir are proposed.

5.1.4.1 GROUNDWATER/SURFACE WATER INTERCHANGE

Groundwater and surface waters interchange directly along Payne Creek which forms the southwestern boundary of the site. Except for recent alluvium, the material in the bed of Payne Creek is comprised of clays of the Bone Valley Formation which also forms the base of the surficial aquifer. Groundwater flows parallel to the water table toward Payne Creek where it is discharged. Slug test data collected for the evaluation of the cooling reservoir indicate that the seepage through the reservoir berm is about 3,480,000 Lpd (920,000 gpd). Operation of the cooling reservoir has not modified this general pattern.

5.1.4.2 FOGGING

The potential to increase the number of days of fogging due to HPS was addressed in the original Site Certification Application (SCA) (TPS/SECI, 1989). It was determined that operation of the cooling reservoir would not result in a significant increase in the amount of fog that existed in the area. The proposed Hardee Unit 3 facility will rely on the existing reservoir for condenser cooling. Since the additional heat load represents an incremental increase, it is not expected that significant additional fogging will result from the Hardee Unit 3 Project.

The Tampa area experiences approximately 22 days a year during which fog reduces visibility to 0.4 kilometer (km) (0.25 mile) or less. Night ground fog occurs frequently during the cooler winter months. The annual frequency of night fog occurrence at the project site is expected to be similar to that of the Tampa area. However, at the project site, fog will vary in duration and intensity during the day from that observed in the Tampa area because of the inland location of the project site.

5.1.5 MEASUREMENT PROGRAM

5.1.5.1 GROUNDWATER

Information regarding the implementation of a groundwater monitoring plan for the HPS existing facilities was previously submitted to FDEP in the original SCA/EA document (TPS/SECI, 1989). The approved monitoring plan requires the installation of six monitor wells at selected locations around the cooling and detention ponds at the existing HPS site facilities. The existing well locations are described in Section 2.3.2.1.1., with well locations presented in Figure 2.3.2-2, and a summary of analytical results is presented in Table 2.3.2-3. TPS will continue to maintain the existing groundwater monitoring program.

Groundwater monitoring at the Hardee Unit 3 site is proposed to be conducted in a manner consistent with ongoing activities. Locations for proposed additional monitor wells have been selected to characterize potential impacts to groundwater quality in the surficial aquifer and include the following areas:

1. Upgradient from Hardee Unit 3 site to characterize background conditions,
2. Upgradient from Hardee Unit 3 detention pond,
3. Downgradient from Hardee Unit 3 detention pond, and
4. Downgradient from Hardee Unit 3 power block and upgradient from HPS existing facilities.

It is intended that groundwater monitoring at these locations will characterize ambient groundwater quality trends, identify potential groundwater quality impacts due to plant operation, and provide a means to distinguish between potential sources of impacts. Information required by Chapter 17-522, F.A.C., regarding the details of the proposed groundwater monitoring plan for the Hardee Unit 3 site are presented in Appendix 10.5.2.

5.1.5.2 SURFACE WATER

The temperature monitoring program resulting from the original certification was structured to provide the necessary data on operational water temperatures at the site for determination of project compliance and impacts. Temperatures will be recorded if discharge occurs from the cooling reservoir (Station RES-1). The location of the temperature monitoring station is shown in Figure 5.1.5-1.

No additional surface water monitoring for temperature is proposed.

5.1.5.3 BIOLOGICAL MONITORING

Because of the absence of anticipated ecological impacts, no biological monitoring is proposed.

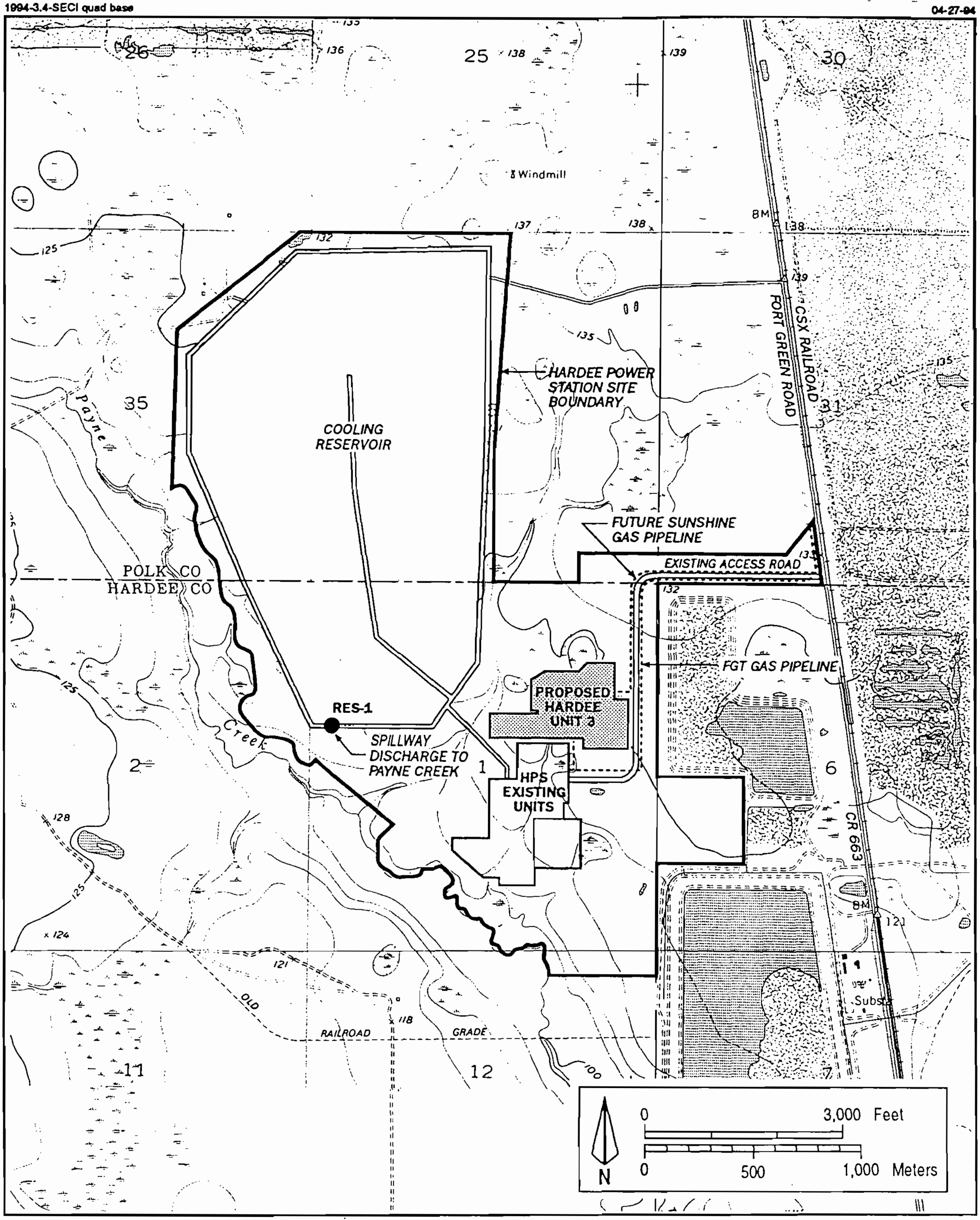

Figure 5.1.5-1
Operational Monitoring Temperature and Water Quality
Station Location

Sources: USGS, 1987; KBN, 1994.

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5.2 EFFECTS OF CHEMICAL AND BIOCIDE DISCHARGES

5.2.1 INDUSTRIAL WASTEWATER DISCHARGES

5.2.1.1 SURFACE WATER DISCHARGES

In addition to the previously described recirculating cooling system discharges, Hardee Unit 3 will have three other types of wastewater discharges: low-volume plant wastewaters; plant-related sanitary wastewater; and plant site stormwater. Treatment and potential impacts of low-volume plant wastewaters are discussed below; plant site stormwater and plant-related sanitary wastewater are discussed in Sections 5.3 and 5.5, respectively.

The proposed plant as designed will treat, retain, and/or recycle all wastewater flows minimizing offsite surface water discharges, consistent with Florida Department of Environmental Protection (FDEP) policy. As such, the proposed plant wastewaters will have virtually no adverse surface water quality impacts on downstream water quality of Payne Creek.

Power plant low-volume wastewaters include plant and equipment drain wastes, boiler blowdown, demineralizer regenerant wastestreams, plant water pretreatment filter backwash, and sanitary wastewaters. Anticipated generation rates for these wastewater streams are presented in Figures 3.5-3 through 3.5-5. Given the anticipated fuels (i.e., gas or oil), no fuel or flue gas desulfurization related wastewaters will occur.

The proposed plant will incorporate a neutralization unit to treat demineralizer regenerant wastestreams and miscellaneous chemical drain wastes prior to discharge to the cooling reservoir. This proposed neutralization unit will treat these wastes by pH neutralization, flow equalization, sedimentation, and mixing and dilution. These neutralized and treated wastewaters will be collected and recycled to the cooling reservoir. Miscellaneous floor drains will be directed to an oil separator and then discharged to the cooling reservoir for reuse as cooling water.

Given the plant size, overall design, and anticipated fuels, low-volume plant wastewaters will be relatively small flows and relatively good quality. Under average annual conditions, the total quantity of these wastewaters will be approximately 352 m^3/day (93,000 gpd) for Hardee Unit 3 under average annual load conditions. Anticipated low-volume wastewater quality is discussed in

Section 3.5. The cooling reservoir will be neither waters of the State of Florida nor waters of the United States; therefore, no discharge criteria or water-quality-based effluent limitations apply.

Use of the cooling reservoir to receive treated plant wastewaters maximizes the retention and recycling of treated wastewater flows and thus minimizes offsite surface water discharges while maximizing water reuse.

The net dilution received by these wastewaters within the reservoir, prior to surface or subsurface discharge from the reservoir, is a function of the total freshwater entering the reservoir. As presented in Figure 3.5-1, approximately 20,130 m^3/day (5,318,400 gpd) of rainfall, upland runoff, and lower Floridan aquifer makeup water will enter the reservoir. Therefore, plant wastewaters will receive an overall 30:1 dilution based on inflows within the reservoir prior to release to adjacent surface or subsurface waters as either surface water or groundwater discharges.

Based on the anticipated plant and cooling reservoir water balance for the total 880-MW facility (presented in Figure 3.5-1) and reservoir inflow water quality (including the treated plant wastewaters and sanitary wastewaters), the long-term reservoir water quality has been estimated. Given the increased evaporative losses and the minimized discharge, some evapo-concentration of water quality constituents will occur over the life of the reservoir. The long-term (i.e., 30 years of facility operation after complete buildout) reservoir water quality has been estimated based on a mass balance of all reservoir water inflows and outflows; see Table 5.2.1-1. FDEP Class III water quality criteria applicable to discharges from the reservoir are presented for comparison.

In evaluating these estimates of reservoir quality, two important factors merit special note when considering the conservative nature of the analyses. First, these reservoir effluent estimates are based on chemical mass balances of water inflows and outflows and do not take into account any chemical reaction, precipitation, sedimentation, deposition or biological activity which will likely occur in the reservoir. These physico-chemical and/or biological activities may result in significant removal of suspended and/or dissolved material from the water column; such removal would significantly reduce actual reservoir and discharge concentrations. Following the conservative basis of the analyses, credit for the above types of mass losses was not included in the water quality estimations.

Second, in the determination of neutralization unit or reservoir concentrations for the various parameters in which one or more source waters were less than the analytical detection limit, the source water concentration was mathematically assumed to be at the reported analytical detection limit or modified per the provisions of Chapter 17-4.426(8), F.A.C. Given the concentrating effect of long-term cooling reservoir operation and the demineralizer resin regeneration, this presumption of the presence of these parameters at these concentrations significantly influences the long-term reservoir concentration. If these parameters are present at concentrations substantially less than the analytical detection limits, predicted long-term reservoir concentrations will be reduced proportionally. Thus, the mathematical assumption of these concentrations at the reported analytical detection limits results in a maximum or worst- case estimate.

Given both factors (the absence of physico-chemical and/or biological removal and the assumption of the analytical detection limit as the actual concentration), these estimates of reservoir discharge quality are conservative.

Based on these conservative, long-term (30-year) water quality estimates, the cooling reservoir discharge at the weir may exceed the applicable FDEP Class III water quality criteria for the parameters listed in Table 5.2.1-2.

To assess mixing and dilution of the these discharges and to estimate the mixing zone necessary to meet the applicable FDEP Class III water quality criteria, the runoff and mixing models previously described in Section 5.1.1 were used. As previously estimated using the reservoir water balance and HEC-1 models, the reservoir will only discharge for storms which exceed the 10-year, 24-hour rainfall. Thus, reservoir discharges will be infrequent and subject to substantial dilution.

Based on the predicted discharge and streamflow rates for the 25-year, 24-hour storm, the estimated mixing zone lengths and widths are summarized in Table 5.2.1-2. Given the low discharge rates and relatively high streamflow rates, mixing zone lengths are typically very short and mixing zone widths correspondingly narrow. The mixing depth will extend the entire depth of the water column. For all these parameters, the mixing zone length required to meet the applicable FDEP Class III water quality criteria is 15 m (50 ft) or less. This calculated mixing zone is within the previously certified 61 m (200 ft) mixing zone length.

The mixing zone calculations and requirements for the several parameters listed in Table 5.2.1-2 are discussed below:

1. Turbidity--The estimated reservoir concentration for turbidity is 31 NTU, and the receiving water concentration is 1.7 NTU. The Class III water quality standard for turbidity is the ambient concentration plus 29 NTU (i.e., 30.7 NTU for Payne Creek). The required mixing zone for turbidity is minimal (i.e., <50 ft) because the estimated reservoir and Payne Creek concentrations are approximately equal.
2. Cyanide--The estimated reservoir concentration for cyanide is 0.01 mg/L, and the receiving water concentration is <0.004 mg/L. The Class III water quality standard for cyanide is 0.005 mg/L. The required mixing zone for cyanide is minimal (i.e., <50 ft) because the dilution required to bring the estimated reservoir discharge concentration below Class III standards is relatively small (i.e., 6:1) compared to the total dilution available in Payne Creek at the lowest flow conditions (i.e., 67:1).
3. Beryllium--The estimated reservoir concentration for beryllium is 1.6 μg/L, and the receiving water concentration is <0.1 μg/L. The Class III water quality standard for beryllium is 0.13 μg/L. According to Chapter 17-4.426(8), F.A.C., when the receiving water concentration is below the analytical detection limit and the standard is greater than the detection limit, a value of 50 percent of the detection limit (i.e., 0.05 μg/L) can be used as the ambient concentration during the modeled discharge event. Using this method, the required mixing zone for beryllium is minimal (i.e., <50 ft) because the dilution required to bring the estimated reservoir discharge concentration below Class III standards is relatively small (i.e., 11:1) compared to the total dilution available in Payne Creek at the lowest flow conditions (i.e., 67:1).
4. Cadmium--The estimated reservoir concentration for cadmium is 1.0 μg/L, and the receiving water concentration is <0.4 μg/L. The Class III water quality standard for cadmium is 0.82 μg/L. The required mixing zone for cadmium is minimal (i.e., <50 ft) because the dilution required to bring the estimated reservoir discharge concentration below Class III standards is relatively small (i.e., 1:1) compared to the total dilution available in Payne Creek at the lowest flow conditions (i.e., 67:1).
5. Copper--The estimated reservoir concentration for copper is 9.9 μg/L, and the receiving water concentration is 7 μg/L. The Class III water quality standard for copper is 8.3 μg/L. The required mixing zone for copper is minimal (i.e., <50 ft) because the dilution required to bring the estimated reservoir discharge concentration

below Class III standards is relatively small (i.e., 2:1) compared to the total dilution available in Payne Creek at the lowest flow conditions (i.e., 67:1).

6. Lead--The estimated reservoir concentration for lead is 6.8 μg/L, and the Class III water quality standard for lead is 1.9 μg/L. The measured lead concentrations in Payne Creek have ranged from <5 to 7 μg/L, and those associated with the higher flows have been <5 μg/L. The lead concentration in Payne Creek used in the analysis was 0.95 μg/L (i.e., 50 percent of the standard) per the provisions of Chapter 17-4.426(8), F.A.C. Using this methodology, the required mixing zone for lead is minimal (i.e., <50 ft) because the dilution required to bring the estimated reservoir discharge concentration below Class III standards is relatively small (i.e., 6:1) compared to the total dilution available in Payne Creek at the lowest flow conditions (i.e., 67:1).
7. Mercury--The estimated reservoir concentration for mercury is 0.097 μg/L, and the Class III water quality standard for mercury is 0.012 μg/L. The measured mercury concentrations in Payne Creek were <0.2 μg/L for the higher flow events. The mercury concentration in Payne Creek used in the analysis was 0.006 μg/L (i.e., 50 percent of the standard) per the provisions of Chapter 17-4.426(8), F.A.C. Using this methodology, the required mixing zone for mercury is minimal (i.e., <50 ft) because the dilution required to bring the estimated reservoir discharge concentration below Class III standards is relatively small (i.e., 14:1) compared to the total dilution available in Payne Creek at the lowest flow conditions (i.e., 67:1).
8. Selenium--The estimated reservoir concentration for selenium is 40 μg/L, and the receiving water concentration is <5 μg/L. The Class III water quality standard for selenium is 5 μg/L. According to Chapter 17-4.426(8), F.A.C., when the receiving water concentration is below the analytical detection limit and the standard is greater than the detection limit, a value of 50 percent of the detection limit (i.e., 2.5 μg/L) can be used as the ambient concentration during the modeled discharge event. Using this methodology, the required mixing zone for selenium is minimal (i.e., <50 ft) because the dilution required to bring the estimated reservoir discharge concentration below Class III standards is relatively small (i.e., 14:1) compared to the total dilution available in Payne Creek at the lowest flow conditions (i.e., 67:1).
9. Silver--The estimated reservoir concentration for silver is 0.14 μg/L, and the receiving water concentration is <0.07 μg/L. The Class III water quality standard

for silver is 0.07 μg/L. According to Chapter 17-4.426(8), F.A.C., when the receiving water concentration is below the analytical detection limit and the standard is greater than the detection limit, a value of 50 percent of the detection limit (i.e., 0.035 μg/L) can be used as the ambient concentration during the modeled discharge event. Using this methodology, the required mixing zone for silver is minimal (i.e., <50 ft) because the dilution required to bring the estimated reservoir discharge concentration below Class III standards is relatively small (i.e., 2:1) compared to the total dilution available in Payne Creek at the lowest flow conditions (i.e., 67:1).

10. Zinc--The estimated reservoir concentration for zinc is 370 μg/L and the receiving water concentration is 7 μg/L. The Class III water quality standard for zinc is 75 μg/L. The required mixing zone for zinc is minimal (i.e., 50 ft) because the dilution required to bring the estimated reservoir discharge concentration below Class III standards is relatively small (i.e., 4:1) compared to the total dilution available in Payne Creek at the lowest flow conditions (i.e., 67:1).
11. Gross alpha--The estimated reservoir concentration for gross alpha is 22.2 pC/L, and the receiving water concentration is 1.9 pC/L. The Class III water quality standard for gross alpha is 15 pC/L. The required mixing zone for gross alpha is minimal (i.e., <50 ft) because the dilution required to bring the estimated reservoir discharge concentration below Class III standards is relatively small (i.e., 2:1) compared to the total dilution available in Payne Creek at the lowest flow conditions (i.e., 67:1).
12. Radium 226--The estimated reservoir concentration for radium 226 is 7.9 pC/L, and the receiving water concentration is 0.7 pC/L. The Class III water quality standard for radium 226 is 5 pC/L. The required mixing zone for radium 226 is minimal (i.e., <50 ft) because the dilution required to bring the estimated reservoir discharge concentration below Class III standards is relatively small (i.e., 1:1) compared to the total dilution available in Payne Creek at the lowest flow conditions (i.e., 67:1).

Given the anticipated reservoir water quality, the treatment provided to plant wastewaters, the infrequent occurrences of discharge (discussed in Section 5.1.1), and immediate and substantial dilution afforded by Payne Creek flows during the infrequent discharge events, no adverse water quality impacts are predicted. As seen in Table 5.2.1-1, the estimated changes in reservoir water quality between the existing 660-MW configuration and the proposed 880-MW configuration are minimal. Based on these data, surface discharge of cooling reservoir water will not significantly or adversely increase water quality concentrations of Payne Creek, impair or interfere with any existing or anticipated future beneficial use of these waters, or cause or contribute to any contravention of FDEP General or Class III water quality criteria.

5.2.1.2 GROUNDWATER DISCHARGES

There will be no direct chemical or biocide discharges to groundwater. Possible indirect discharges could occur from seepage from the cooling reservoir and the runoff detention pond and as accidental spills from chemical handling and storage areas.

The cooling reservoir is constructed of *in-situ* earth materials creating a permeable filter bed. Given the depth of the reservoir, seepage is primarily to the surficial aquifer. As described in the previous section and in Section 3.5, the reservoir receives direct rainfall, surface runoff, wellwater from the Floridan aquifer as makeup and various treated plant wastewater flows. This results in a minimum of 30:1 dilution for wastewaters prior to any seepage to groundwater. It also results in an increase in concentration of various water quality parameters over time. Design water analysis and current water quality in the cooling reservoir are shown in Table 3.5-3.

The impact of seepage of water with the anticipated quality can be considered by comparing concentrations of key parameters to existing water quality in the surficial aquifer and to pertinent groundwater standards. These parameters (total dissolved solids, chlorides, and sulfates) were chosen because they are widely reported, conservative groundwater parameters. The relative differences found can also be applied to other parameters. Table 5.2.1-1 provides a summary of projected reservoir concentrations after 30 years and groundwater standards for the three parameters.

A contour map showing the selected groundwater quality parameters after 30 years of plant operation are shown in Figure 5.2.1-1. This map was prepared using a two-dimensional finite element model to simulate the concentrations produced by full contact of the reservoir water with the surficial aquifer groundwater. Solute concentrations were held constant for the full depth of the aquifer directly under the reservoir. No retardation or adsorption of the cations by clayey soils was taken into account in this simulation. Transport of solute was allowed by advection within the pores of the surficial aquifer at a uniform groundwater velocity of 5 mm/day toward the south-southwest. Both longitudinal and transverse dispersivity and molecular diffusion were taken into account using parameters derived from Freeze and Cherry (1979).

The analysis indicated that the concentrations remain localized in the immediate vicinity of the reservoir. Concentrations at the end of 30 years are indistinguishable from background levels within 0.4 km (0.25 mile) of the reservoir. At the end of 30 years, the 500 mg/L TDS isopleth will have moved a maximum of 320 ft from the inside of the southern end of the cooling reservoir berm (see Figure 5.2.1-1). The TDS isopleth shown in Figure 5.2.1-2 was used to show the decrease of a conservative indicator parameter. All other water quality parameters will show the same trend. At the edge of this zone of discharge [as defined in the existing conditions of certification for HPS (100 ft from the outside toe of the cooling reservoir)], groundwater concentrations will meet the applicable groundwater quality standards. This established zone of discharge continues to be in compliance with FDEP regulations, Chapter 17-28.700(4), F.A.C. The edge of this zone of discharge is within the HPS property boundary and will not threaten or impair any present or future water supplies. It is of note that the zone of discharge compliance is achieved even with the conservative reservoir concentration estimates (e.g., all compounds remain soluble at all times) and the conservative modeling assumption of no retardation (e.g., sorption of metals into the clay soils).

Seepage from the runoff detention pond will be discontinuous and much less than seepage from the cooling reservoir. In addition, there is no recycling activity to concentrate water quality parameters. The pond will be designed to satisfy criteria for maintenance of water quality. As a result, no adverse impact to groundwater quality should occur.

Impacts to groundwater resulting from accidental spills will also be precluded by design of the chemical (including oil) storage and handling areas. Berms and impermeable liners will surround oil, acid and caustic tanks such that any spills are contained and seepage to groundwater is prevented.

5.2.1.3 BIOLOGICAL IMPACTS

All plant-related wastewaters associated with the Hardee Unit 3 project will be collected, treated, and recycled to the cooling reservoir. No direct discharge of chemical and biocide wastes will be allowed to enter any natural surface water or groundwater.

The long-term reservoir water quality with the Hardee Unit 3 facility is presented in Table 5.2.1-1. For those parameters estimated to exceed the FDEP water quality criteria, a mixing zone was defined in Section 5.2.1 (Table 5.2.1-2). The parameters requiring a mixing zone are estimated to be at concentrations not acutely or chronically toxic to freshwater aquatic life. Therefore, no significant biological impacts to Payne Creek are anticipated from discharges from the cooling reservoir.

Intermittent shock chlorination will be used to prevent biofouling of the circulating water system. Based on the anticipated residence time of the water in the cooling reservoir, the dilution factors, and the natural decay, the level of total residual oxidants near the reservoir discharge outfall will be undetectable. If other biocides are used in the cooling reservoir and the circulating system in the future, under similar conditions, they should also be undetectable if discharged as part of the reservoir outfall.

The sanitary wastewater system and the makeup water demineralization system will also use chemicals for their processes (refer to Section 3.5). Based on the treatment provided prior to discharge to the cooling reservoir, these influents to the cooling reservoir are not expected to be toxic. Chemicals used for cleaning of the heat recovery steam generator (HRSG) and feedwater piping will not be stored onsite and will be administered safely by means of a temporary system. The chemical cleaning contractor will dispose of the chemical cleaning wastes offsite. Stormwater will be treated prior to discharge (Section 3.8) to the wetland tributary and will have no impact on water quality or aquatic life.

5.2.1.4 BIOLOGICAL MONITORING

Because of the lack of anticipated ecological impacts, no biological monitoring is proposed.

Table 5.2.1–1. Estimated Cooling Reservoir Water Quality Characteristics After 30 Years of Operation at Average Load

Parameter	Units	Estimated Cooling Reservoir Water Quality		FDEP Water Quality Criteria	
		880 MW	660 MW	Class III Surface Water	Class G2 Ground Water
Calcium	mg/L as CaCO3	310	250		
Magnesium	mg/L as CaCO3	140	110		
Sodium	mg/L as CaCO3	210	190		696
Potassium	mg/L as CaCO3	20	20		
Total Hardness	mg/L as CaCO3	440	360		
Alkalinity	mg/L as CaCO3	360	280	>20	
Sulfate	mg/L as CaCO3	250	230		250
Chloride	mg/L as CaCO3	60	50		704
Silica	mg/L	70	60		
Fluoride	mg/L	5.4	4.4	10	2
Cyanide	mg/L	0.01	0.01	0.005	0.2
MBAS	mg/L	0.48	0.38		
Oil and Grease	mg/L	5	5	5	
Turbidity	mg/L	31	24	ambient + 29	
pH, units	std. units	7.5	7.5	6.0–8.5	6.5–8.5
Total Dissolved Solids	mg/L	1080	890		500
Specific Conductivity	μmho/cm	1240	1050	1275	
Total Kjeldahl Nitrogen	mg/L	1.2	1		
Ammonia Nitrogen	mg/L	0.5	0.4		
Unionized Ammonia	mg/L	0.017	0.014	0.02	
Organic Nitrogen	mg/L	0.7	0.6		
Nitrate+Nitrite–Nitrogen	mg/L	0.2	0.2		10
Total Nitrogen	mg/L	1.4	1.2		
Orthophosphorus	mg/L	0.6	0.5		
Total Phosphorus	mg/L	0.6	0.5		
Arsenic	μg/L	30	20	50	50
Barium	μg/L	200	160		2000
Beryllium	μg/L	1.6	1.3	0.13	4
Cadmium	μg/L	1.00	0.77	0.82	5
Chromium	μg/L	40	30	148	100
Copper	μg/L	9.95	7.90	8.3	1000
Iron	μg/L	990	770	1000	300
Lead	μg/L	6.8	4.6	1.9	15
Manganese	μg/L	63	48		50
Mercury	μg/L	0.097	0.072	0.012	2
Nickel	μg/L	60	50	111	
Selenium	μg/L	40	30	5	50
Silver	μg/L	0.14	0.08	0.07	100
Strontium	μg/L	800	640		
Zinc	μg/L	370	290	75	5000
Alpha, Gross	pC/L	22.2	17.7	15	
Radium 226	pC/L	7.9	6.3	5	

Table 5.2.1–2. Estimated Mixing Zones for Discharges from the HPS Cooling Reservoir

Parameter	Estimated Cooling Reservoir Quality (a)	Payne Creek Average Water Quality	Mixing Zone Length (ft)	Mixing Zone Width (ft)	FDEP Class III Surface Water Quality Criteria
Cyanide, mg/L	0.01	<0.004	<50	<3	0.005
Turbidity, NTU	31	1.7	<50	<3	29 above background
Beryllium, ug/L	1.6	<0.1	<50	<3	0.13
Cadmium, ug/L	1.0	<0.4	<50	<3	0.82
Copper, ug/L	9.9	7	<50	<3	8.3
Lead, ug/L	6.8	1	<50	<3	1.9
Mercury, ug/L	0.097	0.006	<50	<3	0.012
Selenium, ug/L	40	2.50	<50	<3	5
Silver, ug/L	0.14	<0.035	<50	<3	0.07
Zinc, ug/L	370	7	<50	<3	75
Alpha, Gross (pC/L)	22.2	1.9	<50	<3	15
Radium 226 (pC/L)	7.9	0.7	<50	<3	5

Note: All analyses were conducted by an FDEP–certified laboratory (Certification No. 870017G/5) using an FDEP–approved QA/QC plan.

(a) Based on revised water balance, 880–MW, and average annual load.

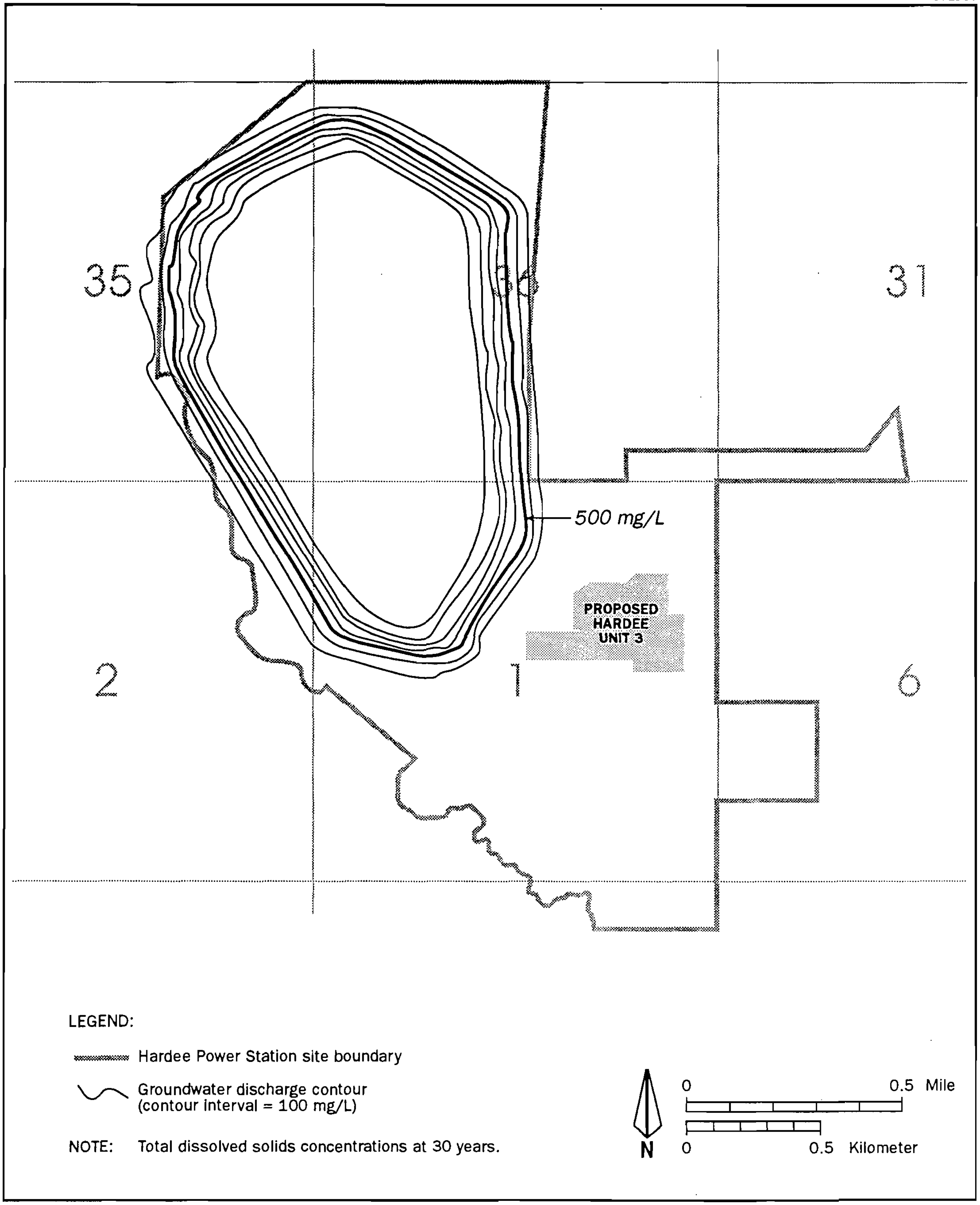

Figure 5.2.1-1
Predicted Groundwater Discharge for 880-MW Facility

Source: KBN, 1994.

SEMINOLE ELECTRIC COOPERATIVE INCORPORATED

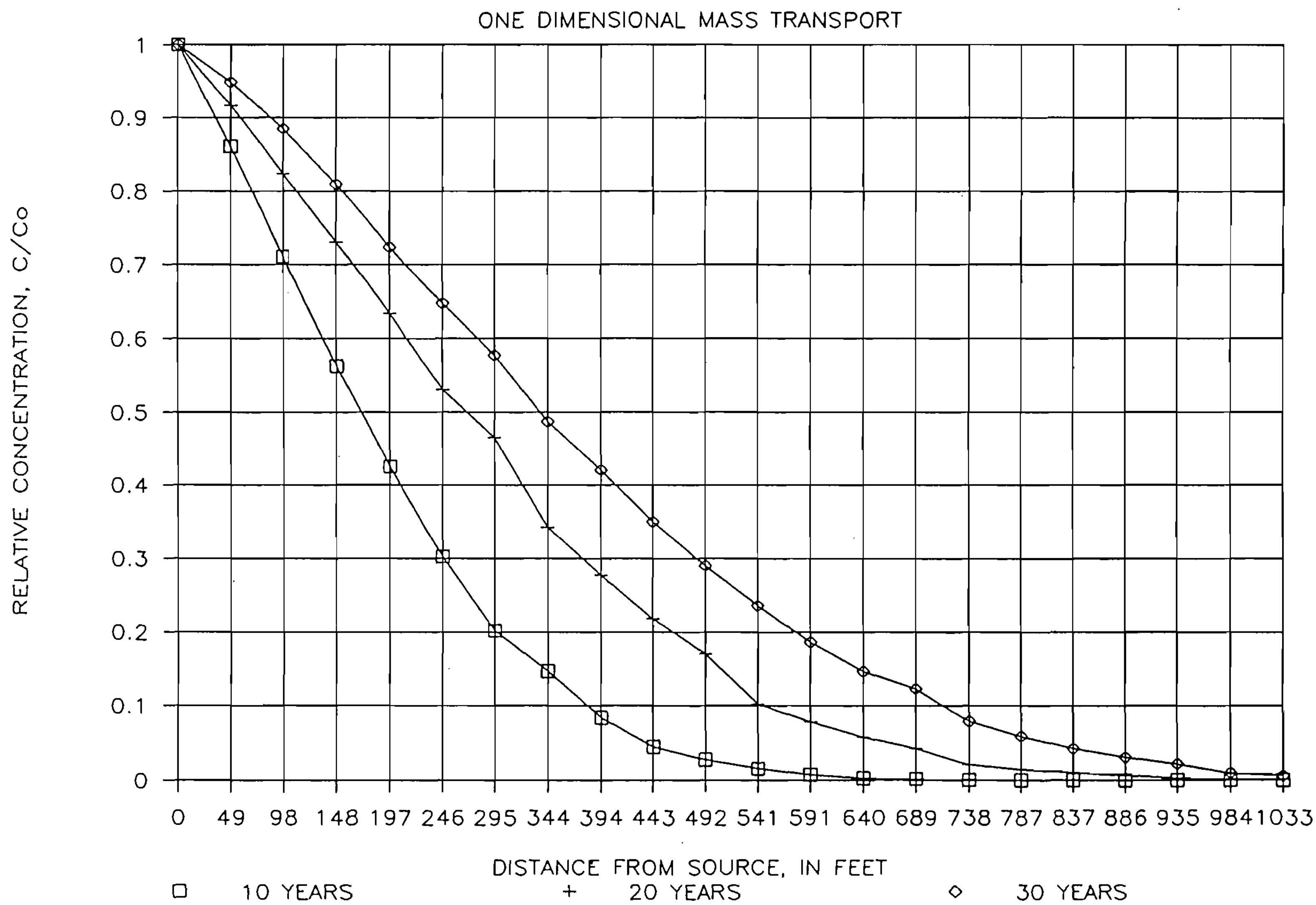

Figure 5.2.1-2
Predicted Solute Transport from Cooling Reservoir

Source: TPS/SECI, 1989; KBN, 1994.

SEMINOLE ELECTRIC COOPERATIVE INCORPORATED

5.2.2 COOLING TOWER BLOWDOWN

Cooling towers were not selected as the primary cooling alternative.

5.2.3 MEASUREMENT PROGRAMS

The cooling reservoir discharge station, Outfall 001, will be sampled during discharge events as follows:

1. Temperature--twice per day (grab), and
2. Other parameters (see those listed in Table 5.2.1-2)--once per day (grab).

5.3 IMPACTS ON WATER SUPPLIES

5.3.1 SURFACE WATER

There are no known consumptive water withdrawals from Payne Creek downstream of the proposed plant; therefore, no adverse impacts regarding consumptive surface water withdrawals are anticipated. Existing uses of Payne Creek include recreational uses and wetland/habitat functions. Potential impacts to wetland/habitat functions are discussed below.

Functionally, the cooling reservoir is a surface reservoir designed to manage all surface and subsurface water inflows and outflows. The cooling reservoir water balance is presented in Figures 3.5.0-1 and 3.5.0-2. Based on the cooling reservoir design, approximately 3,480,000 Lpd (920,000 gpd) will seep through the reservoir edge bordering Payne Creek and into the groundwater systems adjacent to Payne Creek.

5.3.2 GROUNDWATER

5.3.2.1 CONSUMPTIVE USE IMPACTS

The 880-MW power plant configuration will have the same groundwater allocation as the previously licensed 660-MW configuration (i.e., average monthly withdrawal of 3.8 mgd and a maximum monthly withdrawal of 8.64 mgd). There will be no incremental impacts on consumptive use from the Hardee Unit 3 Project because water use will not change.

5.3.2.2 RECHARGE OF WATER TABLE AQUIFER

There will be no incremental impacts related to water table aquifer recharge from the Hardee Unit 3 Project because no physical modification to the cooling reservoir will be made.

5.3.3 DRINKING WATER

There will be no impacts to potable water supplies. Payne Creek is not a source of drinking water. There are no municipal wells within 8 km (5 miles) of the site; most wells listed in Section 2.3.3 are in fact monitoring wells and are not used as potable drinking water supply wells. Predicted drawdown contours, discussed in Section 5.3.1, confirms that the cone of drawdown does not impact the domestic water supply wells of adjacent property owners.

5.3.4 LEACHATE AND RUNOFF

The plant site drainage and stormwater system will be designed to meet all applicable Southwest Florida Water Management District (SWFWMD) and FDEP stormwater quantity and quality control requirements. Plant runoff will be discharged, after treatment, to a tributary of Payne Creek. Details regarding this stormwater system design are presented in Appendix 10.11.

Given the anticipated fuels (i.e., gas or oil), no fuel-related stormwaters (e.g., coal pile runoff) are anticipated. Runoff from several "contact" areas such as the fuel unloading station and the transformer area will be routed to and treated by an oil-water separator prior to being routed to the cooling reservoir. Discharge of treated stormwater will have no adverse impacts on downstream water quality.

There are no sources of leachate on the proposed plant site.

5.3.5 MEASUREMENT PROGRAMS

Methodologies used to determine the impacts are discussed in detail in Section 5.3.1. No water supply monitoring is proposed.

5.4 SOLID/HAZARDOUS WASTE DISPOSAL IMPACTS

5.4.1 SOLID WASTE

Because of the types of fuel to be utilized at the Hardee Unit 3 (e.g., natural gas and fuel oil), only small quantities of solid wastes will be generated at the plant (see Section 3.7.1). Solid wastes will be limited to municipal solid waste, sanitary waste treatment sludge, and infrequent replacement of demineralized resins. The sanitary waste sludge will be disposed of offsite by a contractor. Other wastes will be disposed of by a trash disposal contractor to an available sanitary landfill. There will be no onsite disposal of solid wastes. Because of the small quantities of wastes generated, no significant impacts to existing landfill space are predicted.

5.4.2 HAZARDOUS WASTES

The only potential hazardous wastes generated by the operation of the Hardee Unit 3 facility are wastestreams produced during regeneration of the demineralizer resin bed ion exchangers and, periodically, boiler chemical cleaner wastes. The demineralizer wastestreams will be treated and neutralized in an elementary neutralization unit, which qualifies these wastes for exemption from obtaining a RCRA permit.

Boiler chemical cleaning wastes (see Section 3.6.5) will be disposed of offsite at a licensed facility. No onsite or offsite impacts will result from the wastes generated by the operation of the facility.

5.5 SANITARY AND OTHER WASTE DISCHARGES

As previously discussed in Sections 3.6.3 and 5.2.1, sanitary wastewaters will be treated and discharged to the cooling reservoir for dilution and reuse in the cooling system. Sanitary wastewaters will be treated in a sewage treatment plant designed to provide secondary treatment. All effluent will be chlorinated prior to discharge to the cooling reservoir.

No adverse cooling reservoir or offsite water quality impacts due to sanitary wastewater discharges are anticipated; details regarding cooling reservoir water quality and receiving water impacts are presented in Section 5.2.

No other wastewater discharges are anticipated.

5.6 AIR QUALITY IMPACTS

5.6.1 IMPACT ASSESSMENT

The proposed Hardee Unit 3 facility will be a new air pollution source that will result in increases in air emissions in Hardee County. The U.S. Environmental Protection Agency (EPA) has implemented regulations requiring a PSD review for new or modified sources that increase air emissions above certain threshold amounts. Because the threshold amounts will be exceeded by the proposed project, the project is subject to PSD review. PSD regulations are promulgated under 40 Code of Federal Regulations (CFR) Part 52.21 and implemented through delegation to the FDEP. Florida's PSD regulations are codified in Chapter 17-212.400, F.A.C. These regulations incorporate the EPA PSD regulations by reference.

The technical information and analysis required by the federal and state PSD regulations are contained in this PSD application document. Although this document is an appendix to the SCA for the facility, it has been prepared as a stand-alone PSD application to allow FDEP, EPA, and other involved agencies to readily review the project.

Based on the emissions from the proposed project, a PSD review is required for each of the following regulated pollutants:

- particulate matter (PM) as total suspended particulate matter (TSP),
- particulate matter with aerodynamic diameter of 10 microns or less (PM10),
- sulfur dioxide (SO_2),
- nitrogen dioxide (NO_2),
- carbon monoxide (CO),
- volatile organic compounds (VOC), and
- other trace elements.

Hardee County has been designated as an attainment area for all criteria pollutants [i.e., ozone (O_3), PM10, SO_2, CO, and NO_2] and is classified as a PSD Class II area for PM(TSP), SO_2, and NO_2; therefore, the PSD review will follow regulations pertaining to such designations.

The proposed methods and assumptions used in the air quality modeling and emission control technology analyses to support the air permit application were submitted in a separate protocol document to FDEP (KBN, 1993). The objective of developing and submitting a technical protocol document was to obtain concurrence with the proposed methodologies from FDEP and appropriate regulatory agencies prior to performing the detailed analyses. Based on the comments received from FDEP, the proposed protocol incorporated the recommended changes.

The following sections describe the methods and assumptions used to determine the air quality impacts due to the proposed Hardee Unit 3 and provide a summary of the maximum air quality impacts associated with the proposed project.

5.6.1.1 ANALYSIS APPROACH AND ASSUMPTIONS

GENERAL MODELING APPROACH

The general modeling approach followed EPA and FDEP modeling guidelines for determining compliance with AAQS and PSD increments. In general, when model predictions are used to determine compliance with AAQS and PSD increments, current policies stipulate that the highest annual average and highest, second-highest short-term (i.e., 24 hours or less) concentrations are to be compared to the applicable standard when a 5-year period of meteorological data is used. The highest, second-highest concentration is calculated for a receptor field by:

1. Eliminating the highest concentration predicted at each receptor,
2. Identifying the second-highest concentration at each receptor, and
3. Selecting the highest concentration among these second-highest concentrations.

This approach is consistent with the air quality standards, which permit a short-term average concentration to be exceeded once per year at each receptor.

To develop the maximum short-term concentrations for the proposed facility, the general modeling approach was divided into screening and refined phases. The basic difference between the two phases is that the receptor grid used to predict concentrations in the refined phase is more dense than that used in the screening phase.

After final lists of highest annual and highest, second-highest short-term concentrations were developed, the refined phase of the analysis was conducted by predicting concentrations for a refined receptor grid centered on the receptor at which the highest annual or highest, second-highest short-term concentration from the screening phase was produced. The air dispersion model was executed for the entire year with the refined receptor grid. This approach was used to ensure that valid highest, second-highest concentrations were obtained. Descriptions of the emission inventory and receptor grids used in the screening and refined phases of the analysis are presented in the following sections with detailed discussions given in the PSD Permit Application, Appendix 10.1.5.

MODEL SELECTION

The selection of a model was based on its applicability to simulate impacts in areas surrounding the proposed facility. Within 3.0 km of the proposed facility, the terrain can be described as simple, i.e., flat to gently rolling. As defined in the EPA modeling guidelines, simple terrain is considered to be an area where the terrain features are all lower in elevation than the top of the stack(s) under evaluation. Beyond 3.0 km and within 10 km of the proposed facility's site, the terrain has maximum elevations of 6.1 m (20 ft) above ground elevation at the facility. These areas are also considered to be simple since the stacks being modeled are greater than the terrain elevation. Therefore, a simple terrain model was used to predict maximum ground-level concentrations.

The Industrial Source Complex Short Term (ISCST2) dispersion model, Version 93109, (EPA, 1993a) was used to evaluate the pollutant emissions from proposed facility and existing major facilities. This model is contained in EPA's User's Network for Applied Modeling of Air Pollution (UNAMAP), Version 6 (EPA, 1988). The ISCST2 model is applicable to sources located in either flat or rolling terrain where terrain heights do not exceed stack heights.

The ISCST2 model has rural and urban options which affect the wind speed profile exponent law, dispersion rates, and mixing-height formulations used in calculating ground level concentrations. The criteria used to determine when the rural or urban mode is appropriate are based on land use near the proposed plant's surroundings (Auer, 1978). If the land use is classified as heavy industrial, light-moderate industrial, commercial, or compact residential for more than 50 percent of the area within a 3 km radius circle centered on the proposed source, the urban option should be selected. Otherwise, the rural option is more appropriate. Based on a review of the land use around the facility and discussions with the FDEP, the rural mode was selected because of the lack of residential, industrial and commercial development within 3 km of the proposed facility site.

For modeling analyses that will undergo regulatory review, such as PSD permit applications, the following model features are recommended by EPA (1993b) for rural mode and are referred to as the regulatory default options in the ISCST model:

1. Final plume rise at all receptor locations,
2. Stack-tip downwash,
3. Buoyancy-induced dispersion,
4. Default wind speed profile coefficients for rural mode,
5. Default vertical potential temperature gradients, and
6. Calm wind processing.

In this analysis, the EPA regulatory default options were used to address maximum impacts.

METEOROLOGICAL DATA

Meteorological data used in the ISCST2 model to determine air quality impacts consisted of a concurrent 5-year period of hourly surface weather observations and twice-daily upper air soundings from the National Weather Service (NWS) stations at Tampa International Airport and Ruskin, respectively. The 5-year period of meteorological data was from 1982 through 1986.

The NWS station in Tampa, located approximately 67 km to the west-northwest of the proposed site, was selected for use in the study because it is the closest primary weather station to the study area with similar surrounding topographical feature. In addition, FDEP requested the use of these meteorological data. This station also has the most readily available and complete database which is representative of the plant site. Descriptions of the meteorological data collected at this station are presented in Section 2.3.7 with the methods used to process the data discussed in the PSD Permit Application.

EMISSION INVENTORY

Stack and operating parameters and emission rates of criteria pollutants for the CTs were developed from design data supplied by the turbine manufacturer, Westinghouse, Inc., selected by SECI for this project. The design data were developed for the turbines firing natural gas and distillate fuel oil and operating at 50, 75, and 100 percent of maximum capacity (see Section 2.0). Because the inlet ambient air temperature directly affects turbine combustion and operation, design data were also provided for four ambient air temperatures that cover the range of temperatures for the project site location: 32, 59, 72, and 95°F. Air dispersion modeling was performed for the three operating loads and two extreme ambient temperatures of 32 and 95°F to provide a range of operating conditions that will potentially produce maximum ground-level impacts. These modeling scenarios encompass the operating conditions that will produce the maximum emissions on a short-term basis (i.e., 100 percent load at 32°F) and the minimum plume rise (i.e., 50 percent load at 95°F).

For most pollutants, the highest air impacts were based on the use of fuel oil since the maximum hourly and annual emission rates are generated with fuel oil combustion. For CO and NO_x, additional modeling was performed for the turbines firing natural gas. For CO, the short-term air impacts were also developed for the 1-hour and 8-hour averaging periods (basis of the averaging periods for the AAQS) assuming the turbines were firing natural gas for power augmentation. For NO_x, the annual impacts were also estimated for the PSD Class I increment consumption based on the turbines firing fuel oil (1,500 hours), natural gas (5,260 hours), and natural gas for power augmentation (2,000 hours).

In summary, the operating scenarios considered for the proposed turbines were as follows:

A. All pollutants and averaging periods when firing distillate fuel oil:
   1. Operating loads of 100, 75, and 50 percent; and
   2. Ambient temperatures of 32 and 95°F.

B. Additional analyses for CO concentrations (1-hour and 8-hour averaging period) when firing natural gas during power augmentation at 80°F and 95°F.

C. Additional analyses for NO_x concentrations (annual averaging period) for assessing impacts in the PSD Class I area for the following combinations of annual fuel combustion (turbines operating at 100 percent load):
   1. Distillate fuel oil (1,500 hours) at 59°F
   2. Natural gas (5,260 hours) at 59°F
   3. Natural gas for power augmentation (2,000 hours) at 80°F

The stack, operating, and emission data used in the air dispersion modeling are presented in Appendix 10.1.5, Tables 2-1 through 2-6 and Attachment A.

This modeling provided initial evaluations to determine the source's impacts relative to the significant impact levels and, where applicable, the distance at which the proposed source's impacts are below the significant impact levels. Based on this modeling, subsequent modeling analyses were performed based on the operating load which produced the maximum potential impacts for applicable pollutants and averaging times.

For AAQS and PSD Class II analyses, preliminary modeling indicated that the proposed facility's impacts were below the significant impact levels for the applicable pollutants (i.e., CO, NO_2), except for SO_2 and PM. As a result, further modeling of CO and NO_2 for comparison to applicable AAQS and PSD Class II increments was not required. Because the modeling demonstrated that the facility's impacts were predicted to be above the significant impact levels for SO_2 and PM, further modeling for these pollutants are required. The maximum SO_2 and PM concentrations from the proposed source were predicted to be greater than the significant impact levels at a distance of approximately 1 km from the facility for both pollutants. This distance was used to limit receptor locations and background sources to be modeled.

Emission inventories for background sources of SO_2 and PM were developed from available databases, such as FDEP's Air Pollution Inventory System (APIS), previous studies performed by KBN, and recent air construction permit applications submitted in Polk County (e.g., Tampa Electric Company's Polk County Station and Florida Power Corporation's Polk County site). Detailed discussions about the development of the emission inventory is presented in the PSD Permit Application (Appendix 10.1.5).

Emission inventories of background sources were developed for the proposed source's modeling area and screening area. The modeling area is defined as the significant impact area for the proposed source. The screening area extends 50 km beyond the modeling area. Within the modeling area, cumulative impact analyses are performed for the proposed source and all identified background sources located in the modeling and screening areas. Additional background sources beyond the screening area are also included in the modeling.

In order to reduce the model computation time, the "Screening Threshold" method developed by the North Carolina Department of Natural Resources and Community Development, and approved by EPA and FDEP, was used to effectively model facilities within the screening area that are most likely to interact with the proposed facility. The method is designed to objectively eliminate from the emission inventory those facilities that are unlikely to have significant interaction with the source undergoing evaluation. In general, those facilities that should be considered in the modeling analyses are those with emissions greater than a screening threshold value (in TPY) that is calculated by the following criteria:

$$Q = 20 \times D$$

where Q = the screening threshold value (TPY), and

D = for short-term analysis, the distance (km) from the proposed facility to the source undergoing evaluation; or

for long-term (annual) analysis, the distance (km) from the edge of the proposed source's significant impact area to the source undergoing evaluation.

For this analysis, the long-term criterion was used since fewer background facilities would be eliminated than with the short-term criterion. Also, the total emissions from a facility were used rather than emissions from individual sources for comparison to the screening threshold value. Both methods result in a more conservative approach to produce higher-than-expected concentrations. Those facilities with maximum allowable emissions that are below the calculated "screening threshold" were eliminated from further consideration in the AAQS and PSD Class II modeling analyses.

Summaries of the SO_2 and PM background emission facilities considered in the modeling analyses and those eliminated using the screening threshold technique are given in Tables 5.6.1-1 and 5.6.1-2. As indicated, most of the SO_2 emission sources (either existing sources or sources with air construction permits but not yet operating) are located more than 10 km from the proposed facility. Similar to the SO_2 emission facilities, most of the PM emissions occur beyond 10 km from the proposed facility.

For PSD Class I analyses, preliminary modeling indicated that the proposed facility's impacts were below the National Park Service (NPS)-recommended PSD Class I significant impact levels for PM and NO_2, but not for SO_2. As a result, further modeling of PM and NO_2 for comparison to applicable PSD Class I increments was not required. Because the modeling demonstrated that the facility's impacts were predicted to be above the NPS-recommended PSD Class I significant impact levels for SO_2, further modeling for this pollutant is required. Emission inventories for SO_2 were developed from available databases, as previously discussed for developing inventories for the AAQS and PSD Class II analyses. A detailed discussion about the development of the PSD Class I emission inventory is presented in the PSD Permit Application. A summary of the SO_2 background emission sources considered in the modeling analyses is presented in Table 5.6.1-3.

RECEPTOR LOCATIONS

As discussed in Section 5.6.1.1, the general modeling approach considered screening and refined phases to address compliance with maximum allowable PSD Class II increments and AAQS. In the ISCST modeling, concentrations were predicted for the screening phase using several receptor grids. The locations of the receptors were based on identifying the significant impact areas and the areas in which maximum concentrations would be expected due to the proposed source. For determining the significant impact areas, a total of 397 receptors were located in a radial grid centered on the proposed facility. The grid extended from the plant property out to 5.0 km from the plant site. After the significant impact areas were determined (i.e., 1.0 km for SO_2 and PM10), a total of 277 receptors were located in a radial grid that was centered on the proposed facility and extended out to 1 km. The specific locations of each receptor in each grid are presented in the PSD Permit Application.

After the screening modeling was completed, refined short-term modeling was conducted using a receptor grid centered on the receptor which had the highest, second-highest short-term concentrations. The receptors were located at intervals of 100 m between the distances considered in the screening phase along nine radials, at 2-degree increments, centered on the radial which the maximum concentration was produced.

To ensure that a valid short-term highest, second-highest concentration was calculated, concentrations were predicted for the refined grid for the entire year during which highest, second-highest concentration was predicted from the screening receptor grid. Refined modeling analysis was also performed for the annual average period. Concentrations were calculated at the receptor and for the entire year during which the highest annual average concentration was predicted in the screening analysis.

For PSD Class I analysis, the maximum concentrations were predicted at 13 receptors surrounding the PSD Class I area of the Chassahowitzka NWR, the closest PSD Class I area. These receptors have been provided by FDEP for use on previous applications.

BACKGROUND CONCENTRATIONS

To estimate total air quality concentrations, a background concentration must be added to the modeling results. Background concentrations are concentrations due to sources not associated with the proposed source. These concentrations consist of two components: impacts due to other modeled emission sources (i.e., non-project related) and impacts due to sources not explicitly modeled. Background concentrations due to other modeled sources were predicted with the air dispersion model based on the data developed in the emission inventory. Background concentrations due to sources not explicitly modeled were based on the highest concentrations measured at nearby stations. The background concentrations are added to the maximum concentrations predicted from the modeled source to produce the total air quality concentrations.

The non-modeled background concentrations, developed from the latest year of ambient monitoring data, were presented in Section 2.3.7.2. Based on this analysis, the background 3-hour, 24-hour, and annual average SO_2 concentrations are assumed to be 256, 50, and 11 $\mu g/m^3$, respectively. For PM concentrations, the background 24-hour and annual average concentrations are assumed to be 70 and 20 $\mu g/m^3$, respectively. These background levels were added to model-predicted concentrations to estimate total air quality levels for comparison to AAQS.

There has been minimal industrial or commercial growth in the area of Hardee Unit 3, indicating minimal, if any, increases of potential air emissions or air quality levels since the monitoring data were collected.

BUILDING DOWNWASH CONSIDERATIONS

Based on the building dimensions associated with buildings or structures at the proposed facility, the stack for the proposed unit will be less than GEP. Therefore, the potential for building downwash to occur is considered in the modeling analysis.

The procedures used for addressing the effects of building downwash are those recommended in the ISC Dispersion Model User's Guide. The building height, length, and width, which are input for each wind direction representing a 10-degree sector, are used to modify the dispersion parameters. The building dimensions considered for the proposed facility are presented in Table 3.2-1.

SUPPLEMENTARY PSD CLASS I AREA IMPACTS

A long-range transport modeling analysis was used as a supplemental air quality evaluation to determine compliance with the PSD Class I increment consumption for SO_2 concentrations at the Chassahowitzka NWA. Potential violations of the 3-hour and 24-hour PSD Class I increments were predicted with the ISCST2 model, which required the use of a refined model that accounts for long-range transport. This modeling analysis used the long-range transport model, MESOPUFF II, to address impacts from the proposed Hardee Unit 3 as well as other PSD increment consuming and expanding sources. The analysis is based on the Mesopuff II Modeling Protocol developed by the Interagency Workgroup on Air Quality Modeling (IWAQM). Descriptions of the methods and assumptions used for this analysis are presented in Section 6.9.2 of Appendix 10.1.5.

TOXIC AIR POLLUTANT ANALYSIS

Maximum air quality impacts of toxic air pollutants from the proposed source alone were modeled with the ISCST2 model for comparison to the no-threat levels established by FDEP (Version 3).

5.6.1.2 MODEL RESULTS

PROPOSED FACILITY ONLY

For the screening modeling analysis, a summary of the maximum SO_2, PM10, NO_2, CO, arsenic, beryllium, and sulfuric acid mist concentrations due to the proposed facility is presented in Table 5.6.1-4. These results are presented for a range of conditions for combined cycle and simple cycle operations that could produce high impacts. This analysis was performed for fuel oil combustion since the hourly emissions are generally higher with the use of fuel oil than natural gas. The conditions were as follows:

1. Combined cycle operation
   a. Baseload (100 percent) at ambient temperatures of 32 and 95°F
   b. 75 percent load at ambient temperatures of 32 and 95°F
   c. 50 percent load at ambient temperatures of 32 and 95°F
2. Simple cycle operation
   a. Baseload at ambient temperatures of 32 and 95°F
   b. 75 percent load at ambient temperatures of 32 and 95°F
   c. 50 percent load at ambient temperatures of 32 and 95°F

An additional analysis was performed to determine the maximum CO concentrations when firing natural gas during power augmentation since this operation produces the highest CO emissions.

The maximum predicted 3-hour, 24-hour, and annual SO_2 concentrations are 65.1, 27.8, and 0.18 $\mu g/m^3$, respectively. The maximum 24-hour concentration is above the *de minimis* monitoring level and, therefore, preconstruction monitoring data are required to be submitted by the Applicant as part of the permit application. As indicated in Section 2.3.7.2, existing monitoring data collected by the FDEP and other monitoring stations (i.e., TECO and FPC) are being used in this application to satisfy preconstruction monitoring requirements and to establish background concentrations.

The maximum predicted 24-hour and annual average PM10 concentrations are 21.5 and 0.12 $\mu g/m^3$, respectively. The maximum 24-hour concentration is above the *de minimis* monitoring level, and, therefore, preconstruction monitoring is required for the permit application. Similar to the SO_2 analysis, existing monitoring data collected by FDEP and other monitoring stations are being used to satisfy the preconstruction monitoring requirements and establish background concentrations.

The maximum predicted annual NO_2 concentration is 0.59 $\mu g/m^3$, which is below the *de minimis* monitoring level. Preconstruction monitoring requirements is not required for the permit application.

The maximum predicted 1-hour and 8-hour average CO concentrations are 255 and 115 $\mu g/m^3$, respectively. During power augmentation, the maximum 1-hour and 8-hour average concentrations are predicted to be 380 and 168 $\mu g/m^3$, respectively. These maximum values are less than the significance levels. The maximum 8-hour concentration is also less than the *de minimis* monitoring levels and, therefore, preconstruction monitoring is not required. Because the maximum predicted impacts due to the proposed facility are less than the CO significance levels, additional modeling is not required for this pollutant.

The maximum predicted 24-hour average beryllium concentration is 0.0014 $\mu g/m^3$, which is greater than the *de minimis* monitoring levels of 0.001 $\mu g/m^3$. This maximum concentration was predicted for the combustion turbines operating at 50 percent load during combined cycle mode. At 100 percent load, the maximum predicted 24-hour concentration is less than the *de minimis* concentration. Also, the maximum beryllium concentrations are predicted to be less than the NTLs for all operating loads. Because of the limited number of hours of expected fuel oil usage (1,500 hours or less) and the limited operation of the turbines, preconstruction monitoring is not warranted for this project.

For sulfuric acid mist and arsenic, there are no significant impact or *de minimis* monitoring levels established by EPA. However, these pollutants were addressed as toxic air pollutants for comparison to the Florida NTLs.

TOTAL AIR QUALITY IMPACT

From the refined modeling analysis, summaries of the maximum total SO_2 and PM10 concentrations predicted for comparison to the AAQS are presented in this section. The total concentrations are determined from the impacts of the modeled sources added to the background concentration determined from monitoring data.

SO_2 Concentrations

The maximum predicted total SO_2 concentrations from the refined analysis for all modeled AAQS sources are presented in Table 5.6.1-5. The 3-hour and 24-hour results are based on the maximum concentrations predicted when the Hardee Unit 3 facility was predicted to have significant impacts. Based upon the refined analysis results, the maximum total predicted SO_2 concentrations, including a non-modeled background concentration are as follows:

406 $\mu g/m^3$, HSH 3-hour average, or 31 percent of the AAQS of 1,300 $\mu g/m^3$
138 $\mu g/m^3$, HSH 24-hour average, or 53 percent of the AAQS of 260 $\mu g/m^3$
29 $\mu g/m^3$, annual average, or 48 percent of the AAQS of 60 $\mu g/m^3$

The AAQS modeling analysis indicates that the SO_2 air quality within the significant impact distance from the proposed plant will be in compliance with the AAQS, when the proposed unit was predicted to have a significant impact.

Based on these results, the maximum impacts predicted by the proposed plant by itself and together with other emission sources (when the proposed plant's impacts are predicted to be significant), including non-modeled background concentrations, will ensure compliance and maintenance of the AAQS.

PM10 Concentrations

The maximum refined PM10 concentrations for comparison to the AAQS are presented in Table 5.6.1-6. Based upon the refined analysis results, the maximum total predicted PM10 concentrations, including a non-modeled background concentration are as follows:

101 $\mu g/m^3$, HSH 24-hour average, or 67 percent of the AAQS of 150 $\mu g/m^3$
24 $\mu g/m^3$, annual average, or 48 percent of the AAQS of 50 $\mu g/m^3$

The AAQS modeling analysis, therefore, indicates that the PM10 air quality within the significant impact distance from the proposed plant will be in compliance with the AAQS.

Based on these results, the maximum impacts predicted by the proposed plant by itself and together with other emission sources, including non-modeled background concentrations, will ensure compliance and maintenance of the AAQS.

PSD CLASS II INCREMENT CONSUMPTION

SO_2 Concentrations

Results of the PSD Class II refined analysis are presented in Table 5.6.1-7. The 3-hour and 24-hour results are based on the maximum concentrations predicted when the proposed Hardee Unit 3 was predicted to have a significant impact. The maximum predicted Class II increment consumptions due to all increment consuming sources from the refined analyses are:

150 $\mu g/m^3$, HSH 3-hour average, or 29 percent of the allowable increment of 512 $\mu g/m^3$
45.4 $\mu g/m^3$, HSH 24-hour average, or 50 percent of the allowable increment of 91 $\mu g/m^3$
-4.0 $\mu g/m^3$, annual average, or less than 0 percent of the allowable increment of 20 $\mu g/m^3$

The PSD Class II modeling analysis indicates that the predicted maximum annual concentrations will be in compliance with the annual PSD Class II increment, when the proposed unit was predicted to have a significant impact.

Based on these results, the maximum impacts predicted by the proposed plant by itself and together with other emission sources (when the proposed plant's impacts are predicted to be significant) will ensure compliance and maintenance of PSD Class II increments.

PM10 Concentrations

The maximum predicted PM10 PSD Class II increment consumption impacts due to all increment-consuming sources from the refined analysis, presented in Table 5.6.1-8, are:

14 $\mu g/m^3$, HSH 24-hour average, or 47 percent of the allowable increment of 30 $\mu g/m^3$
0.6 $\mu g/m^3$, annual average, or 4 percent of the allowable increment of 17 $\mu g/m^3$

Based on these results, the maximum impacts predicted by the proposed plant by itself and together with other emission sources will ensure compliance and maintenance of PSD Class II increments.

PSD CLASS I INCREMENT CONSUMPTION

The maximum potential impacts from the proposed Hardee Unit 3 facility only predicted at the PSD Class I area of the Chassahowitzka NWA for SO_2, NO_2, and PM10 concentrations are presented in Table 5.6.1-9. The maximum impacts for each pollutant were compared to the NPS-recommended significant impact levels for PSD Class I areas. The results indicated that SO_2 is the only pollutant that is predicted to exceed the NPS-recommended significant impact levels. Based on these results, a PSD Class I impact assessment for SO_2 concentrations was performed with other PSD increment consuming sources to determine compliance with allowable PSD Class I increments.

The results of the Class I analysis for SO_2 concentrations are presented in Table 5.6.1-10. The results indicate the maximum PSD increment consumed at the PSD Class I areas is predicted to be above the allowable PSD Class I increments for 3-hour and 24-hour averaging periods.

The maximum predicted Class I increment consumption due to all increment consuming sources from the refined analysis is:

26.4 $\mu g/m^3$, HSH 3-hour average, or 106 percent of the allowable increment of 25 $\mu g/m^3$
6.4 $\mu g/m^3$, HSH 24-hour average, or 130 percent of the allowable increment of 5 $\mu g/m^3$
0.3 $\mu g/m^3$, annual average, or less than 15 percent of the allowable increment of 2 $\mu g/m^3$

Additional modeling was performed with the ISCST2 model to determine the number of potential violations of the 3-hour and 24-hour PSD Class I SO_2 increments and the proposed project's contribution to those predicted violations. A summary of the results that show the number of predicted violations and the project's predicted contributions to those violations is presented in Table 5.6.1-11. Based on these results, additional modeling was performed using the MESOPUFF II model for the proposed project and other PSD emission sources located more than 50 km from the PSD Class I area. These results were added to the ISCST2 model results for sources located within 50 km of the Class I area to produce the total PSD Class I increment consumption.

A summary of the maximum SO_2 concentrations predicted for the proposed Hardee Unit 3 plant at the PSD Class I area using the MESOPUFF II model is presented in Table 5.6.1-12. The MESOPUFF II results indicate that, for the periods during which the ISCST2 model predicted potential violations and the proposed project's contribution was greater than the NPS significant impact levels, the proposed project's impacts are less than the significant impact levels. When the proposed source was modeled for 1 year with the MESOPUFF II model, there was only one 24-hour period during which the proposed source was predicted to have a significant impact. When other sources were modeled for this period (i.e., using the MESOPUFF II model for the PSD emission sources located more than 50 km and the ISCST2 model for sources located within 50 km of the Class I area), the total impacts were predicted to be less than the PSD Class I increment.

Based on these results, the maximum impacts predicted by the proposed Hardee Unit 3 facility by itself and together with other emission sources will ensure compliance and maintenance of PSD Class I increments.

TOXIC AIR POLLUTANTS

The maximum impacts of regulated and nonregulated toxic air pollutants that will be emitted by the proposed Hardee Unit 3 plant are presented in Table 5.6.1-13. These impacts represent the highest impacts predicted from the screening analysis for the combined cycle operation at 100, 75, and 50 percent load and for ambient temperatures of 32°F and 95°F.

The maximum 8-hour, 24-hour, and annual concentrations are compared to the Florida NTLs. As shown, the predicted impacts are below the NTLs for all pollutants and averaging times, except for sulfuric acid mist for the 8-hour and 24-hour averaging periods. The NTLs are not environmental standards but, rather, evaluation tools to determine if an apparent threat to the public health may exist. For sulfuric acid mist, the maximum concentrations are predicted to occur during 75-percent and 50-percent operating loads at locations along the fenced property around the Hardee Unit 3 site. Since the emission estimates are based on conservative assumptions (more than 10 percent of the SO_2 is assumed to be converted to sulfuric acid mist) and impacts at locations off of SECI's property (where the public health would be of greatest concern) will be much lower than the NTLs, the predicted sulfuric acid mist impacts due to the proposed facility are not expected to pose a threat to public health. Therefore, the emissions from the proposed facility are not expected to pose a significant health risk to the public.

SUMMARY

Based on the results of the air quality modeling analyses, Hardee Unit 3 is expected to comply with applicable AAQS and PSD increments. Within the AAQS and PSD Class II areas, the maximum impacts of the proposed unit alone are predicted to be less than significant impact levels for CO and NO_2. As a result, the proposed unit will be in compliance with and maintain applicable AAQS and PSD Class II increments.

Because the proposed Hardee Unit 3 impacts are predicted to be greater than the significant impact levels for SO_2 and PM10, additional modeling was required to address the potential interaction of background sources with the proposed unit. As demonstrated by the air modeling analyses, when the proposed unit's impacts are greater than the significant impact levels, the maximum total PM10 and SO_2 air quality impacts will be in compliance with the applicable SO_2 and PM10 AAQS and PSD Class II increments.

The proposed Hardee Unit 3 impacts for PM10 and NO_2 are predicted to be less than the recommended NPS PSD Class I significant impact levels and, therefore, will be in compliance with and maintain the applicable PSD Class I increments. For SO_2, additional modeling was performed to address the potential interaction of the proposed unit with other PSD Class I sources. Based on these results, the impacts from the proposed unit and other sources will comply with and maintain the PSD Class I increments.

5.6.1.3 ADDITIONAL IMPACT ANALYSIS

The additional impact analysis considers the potential effects to soils, vegetation, wildlife, and visibility from Hardee Unit 3. A large number of elements and compounds may be emitted from the proposed facility (Table 5.6.1-13). Since the predicted levels of all elements and compounds are below the levels to cause biological effects, this analysis will focus on representative elements and compounds including SO_2, NO_x, CO, TSP, beryllium, and mercury.

SOILS

Many of the soils in the region and a large portion of the site have been disturbed and altered by phosphate mining. They were originally sandy, siliceous hyperthermic Haploquods with very strongly acid subsoils. The undisturbed soils of the Payne Creek floodplain have formed in unconsolidated loamy textured sediment influenced by calcareous material (Robbins *et al.*, 1984). They are mapped as coarse-loamy siliceous, hyperthermic Typic Ochraqualfs.

SO_2 and NO_2 that reach the soil by deposition from the air are converted by physical and biotic processes to sulfates and nitrates. (CO, particulates, and metals have no effect on soils at the levels predicted.) The effects can be beneficial to plants if either sulfates or nitrates in native soils are less than plant requirements for optimum growth. However, sulfates and nitrates can also increase acidity of unbuffered soils, causing adverse effects due to changes in nutrient availability and cycling. The predicted concentrations of SO_2 and NO_2 from stack emissions are not expected to have a significant adverse effect on soils in the vicinity because (1) the predicted concentrations of both gases are low, and (2) Payne Creek floodplain and other wetland soils contain organic matter and/or calcium carbonate nodules that buffer changes in acidity. Therefore, the predicted emissions from the Hardee Unit 3 facility are not expected to have a significant adverse impact on regional soils.

VEGETATION AND WILDLIFE

The response of vegetation and wildlife to atmospheric pollutants is influenced by the concentration of the pollutant, duration of exposure, and frequency of exposures. The pattern of pollutant exposure expected from the facility is that of a few episodes of relatively high ground-level concentration which occur during certain meteorological conditions interspersed with long periods of extremely low ground-level concentrations. If there are any effects of stack emissions on plants and animals they will be from the short-term, higher doses. A dose is the product of the concentration of the pollutant and duration of the exposure. The impact of the HPS facility including the Hardee Unit 3 facility on regional vegetation and wildlife was assessed by comparing pollutant doses that are predicted from modeling with threshold doses reported from the scientific literature which could adversely affect plant or animal species typical of those present in the region.

Sulfur Dioxide

Plants can be grouped into three levels of sensitivity to SO_2 based on concentration and exposure (EPA, 1982b). Sensitive crop species include legumes and blackberries. Ranges of concentrations reported to cause visible injury in sensitive species are 1,310 to 2,620 $\mu g/m^3$ (0.5 to 1.0 ppm) for 1-hour exposure and 790 to 1,570 $\mu g/m^3$ (0.3 to 0.6 ppm) for 3-hour exposures. Intermediate resistant species include many crops and garden species. Ranges of concentrations reported to cause visible injury in intermediate species are 2,620 to 5,240 $\mu g/m^3$ (1.0 to 2.0 ppm) for 1-hour exposure and 1,570 to 2,100 $\mu g/m^3$ (0.6 to 0.8 ppm) for 3-hour exposures. Resistant species include potato and corn. Ranges of concentrations reported to cause visible injury in intermediate species are $>$5,240 $\mu g/m^3$ ($>$2.0 ppm) for 1-hour exposure and $>$2,100 $\mu g/m^3$ ($>$0.8 ppm) for 3-hour exposures. Chronic effects to forest growth have been reported where SO_2 annual ambient concentrations averaged 45 or 115 $\mu g/m^3$ (0.02 or 0.05 ppm) (EPA, 1982b).

The maximum 1-hour, 3-hour, 24-hour average, and annual SO_2 concentrations predicted for Hardee Unit 3 within the modeling area of Hardee Unit 3 are 135, 65.1, 27.8, and 0.18 $\mu g/m^3$, respectively. These concentrations are predicted to occur within 1 km (0.62 mile) of the stacks and represent the concentrations that occur during worst-case meteorological conditions of the 5 years considered in the air dispersion modeling. By adding background concentrations developed from monitoring data (see Section 6.1.1 of the PSD application) to impacts from all sources (see Table 5.6.1-5), the total 1-hour, 3-hour, 24-hour, and annual average concentrations are predicted to be 458, 406, 138, and 29 $\mu g/m^3$, respectively. These predicted doses from operation of Hardee Unit 3 combined with background sources are much lower than doses known to cause a detrimental effect on vegetation and wildlife (Table 5.6.1-14).

Nitrogen Oxides

A review of the literature (EPA, 1982a) indicates greater variability in the NO_2 dose-response relationship in vegetation, and no threshold effect levels are supported. The NO_2 doses known to adversely affect some animals and plants are shown in Tables 5.6.1-14 and 5.6.1-15, respectively. The maximum predicted 3-hour and annual average NO_2 concentrations due to Hardee Unit 3 is predicted to be 206 and 0.59 $\mu g/m^3$, respectively. The predicted doses of NO_2 due to the proposed facility are far lower than the doses reported to injure vegetation and animals; therefore, the proposed facility's NO_2 emissions are not expected to have an adverse effect on vegetation and wildlife.

Combined Effects of Sulfur Dioxide and Nitrogen Dioxide

SO_2 in combination with NO_2 can cause vegetation effects although the studies are not as extensive as studies on single pollutant effects. Plants show varying sensitivities at various SO_2 and NO_2 concentration combinations for various exposure periods. A review of the literature (EPA, 1982a) indicates that a lower visible-injury threshold may occur at 2-hour SO_2 and NO_2 exposures of 1,310 $\mu g/m^3$ (0.5 ppm) and 940 $\mu g/m^3$ (0.5 ppm), respectively. Air dispersion modeling has shown that this threshold exposure condition does not occur.

Total Suspended Particulates

High deposition of particulates on plant leaves can reduce photosynthesis through shading and impede diffusion of gases. However, at least 5 g/m^2 leaf surface of particulates are required to cause these impacts (Thompson *et al.* 1984). This concentration is not expected due to the maximum predicted impacts from the HPS. The maximum 24-hour and annual average concentrations for modeled sources are predicted to be 31 and 4 $\mu g/m^3$, respectively. These concentrations are predicted to occur between 0.6 and 1 km to the north of the stacks. By adding background concentrations developed from monitoring data (see Section 6.1.1) to these modeled sources' impacts, the total 24-hour and annual average concentrations are predicted to be 101 and 24 $\mu g/m^3$, respectively. Predicted particulate levels are lower than reported effects levels in animals (Newman, 1975).

Carbon Monoxide

Soil microorganisms can use carbon monoxide as a carbon source and are a major sink for this pollutant (Bennett and Hill, 1975). Plants are not known to be injured by CO. The maximum predicted 1-hour and 8-hour average CO concentrations due to the facility are 380 and 168 $\mu g/m^3$, respectively. No adverse impacts to vegetation are expected from CO emissions from the Hardee Power Station. Predicted carbon monoxide levels are lower than levels known to affect animals (Newman, 1975).

Beryllium

The maximum 24-hour average Be concentration due to the proposed facility is predicted to be 0.0014 $\mu g/m^3$. Levels of Be greater than 2 $\mu g/g$ in nutrient solution have been found to reduce growth of experimental plants (Gough *et al.* 1979). Therefore, the low levels of Be predicted from plant operation are not expected to adversely affect vegetation. Inhalation of levels of Be greater than 35 $\mu g/m^3$ for 6 months produced respiratory changes in rats. These levels are significantly greater than predicted values, therefore no effects are predicted to occur (Newman, 1975).

Mercury

The maximum 24-hour average Hg concentration due to the proposed facility is predicted to be 0.0048 $\mu g/m^3$. Siegel *et al.* (1984) reported that 7 days of exposure to 50 $\mu g/m^3$ Hg vapor resulted in massive leaf abscission in 15 plant species and cultivars. This dose is orders of magnitude higher than the dose expected from operation of the Hardee Power Station. Therefore, the predicted Hg concentrations due to the proposed facility are not expected to adversely affect vegetation.

Of all the trace metals, only mercury is known to be a problem contaminant in Florida, particularly in the Everglades. Mercury readily biomagnifies at higher trophic levels. Mercury bioaccumulates more readily in animals than in plants and biomagnifies through both the terrestrial and aquatic food webs (Eisler, 1987). The sources of mercury contamination in Florida are not known. Potential sources include natural sources such as natural fires, volcanic activity, natural degassing from oceans, land surfaces, and other water bodies. Potential manmade sources include past use of mercuric pesticides and mercury-based paints, emissions from municipal and medical waste incinerators, and fossil fuel power plants. Regional and historical studies are presently being conducted in the state to define the sources, amount, and timing of mercury deposition and accumulation. Because of the uncertainty regarding the contribution of various mercury sources, the risk to local fish and wildlife from this facility cannot be precisely determined. Because the potential mercury emissions from Hardee Unit 3 are very low relative to other mercury-emitting sources (FDEP, 1992), no significant adverse effects to fish and wildlife are anticipated.

VISIBILITY

Potential impacts to local visibility due to the proposed power plant will be minimal. The proposed plant will meet all applicable emission standards including opacity.

5.6.1.4 AIR QUALITY RELATED VALUES ANALYSIS: VEGETATION, SOILS, AND WILDLIFE

The vegetation and soils components of the additional impacts analysis have been expanded to constitute an air quality-related values (AQRVs) analysis to assess the potential risk to AQRVs of the Chassahowitzka NWA due to the development of the Hardee Unit 3 project. Potential air quality impacts of the proposed project were predicted at the PSD Class I area portion of the Chassahowitzka NWA. The U.S. Department of the Interior (National Park Service) in 1978 administratively defined AQRVs to be:

> ...all those values possessed by an area except those that are not affected by changes in air quality and include all those assets of an area whose vitality, significance, or integrity is dependent in some way upon the air environment. These values include visibility and those scenic, cultural, biological, and recreational resources of an area that are affected by air quality.
>
> Important attributes of an area are those values or assets that make an area significant as a national monument, preserve, or primitive area. They are assets that are to be preserved if the area is to achieve the purposes for which it was set aside.

Except for visibility, AQRVs have not been specifically defined by the U.S. Fish and Wildlife Service (USFWS) for Chassahowitzka NWR. However, soil, flora, fauna, cultural resources, geological features, water, and climate potentially affected by air quality have been identified by land managers as general AQRVs to be addressed in these types of analyses. This AQRV analysis evaluates the effects of air quality on general vegetation types and wildlife found on the Chassahowitzka NWR.

Vegetation type AQRVs and their representative species types have been defined as:

Marshlands - black needlerush, saw grass, salt grass, and salt marsh cordgrass

Marsh Islands - cabbage palm and eastern red cedar

Estuarine Habitat - black needlerush, salt marsh cordgrass, and wax myrtle

Hardwood Swamp - red maple, red bay, sweet bay, and cabbage palm

Upland Forests - live oak, scrub oak, longleaf pine, slash pine, wax myrtle, and saw palmetto

Mangrove Swamp - red, white, and black mangrove

Wildlife AQRVs have been defined as endangered species, waterfowl, marsh and waterbirds, shorebirds, reptiles, and mammals.

A screening approach was used that compared the maximum predicted ambient concentration of air pollutants of concern in the Chassahowitzka NWR with effect threshold limits for both vegetation and wildlife as reported in the scientific literature. A literature search was conducted that specifically addressed the effects of air contaminants on plant species reported to occur in the NWR. While the literature search focused on such species as cabbage palm, eastern red cedar, and species of the hardwood swamplands and mangrove forest found in the Chassahowitzka NWR, no specific air quality citations were found that addressed these species. Therefore, studies on general vegetation effects and other similar Florida species can be used as indicators of effects. In conducting the assessment, both direct (fumigation) and indirect (soil accumulation/uptake) exposures were considered for flora, and direct exposure (inhalation) was considered for wildlife.

VEGETATION

The effects of air contaminants on vegetation occur primarily from SO_2, NO_2, O_3, and particulates. Effects from minor air contaminants such as fluoride, chlorine, hydrogen chloride, ethylene, ammonia, hydrogen sulfide, CO, and pesticides have been reported in the literature. However, most of these air contaminants have not resulted in major effects (e.g., crop damage).

As stated earlier, the effects of contaminants are dependent both on the concentration of the contaminant and the duration of the exposure. The term "injury," as opposed to damage, is commonly used to describe all plant responses to air contaminants and will be used in the context of this analysis. Air contaminants are thought to interact primarily with plant foliage, which is considered to be the major pathway of exposure. For purposes of this analysis, it is assumed that 100 percent of each air contaminant of concern is accessible to the plants. The maximum predicted impacts due to proposed project for the applicable 1-hour, 3-hour, 8-hour, 24-hour, and annual averaging periods are presented in Table 5.6.1-16.

Injury to vegetation from exposure to various levels of air contaminants can be termed acute, physiological, and chronic. Acute injury occurs as a result of a short-term exposure to a high contaminant concentration and is typically manifested by visible injury symptoms ranging from chlorosis (discoloration) to necrosis (dead areas). Physiological or latent injury occurs as the result of a long-term exposure to contaminant concentrations below that which results in acute injury symptoms. Chronic injury results from repeated exposure to low concentrations over extended periods of time, often without any visible symptoms but with some effect on the overall growth and productivity of the plant.

Effects of Sulfur Dioxide

SO_2 concentrations at elevated levels have long been known to cause injury to plants. Acute SO_2 injury usually develops within a few hours or days of exposure and symptoms include marginal, flecked, and/or intercoastal necrotic areas which appear water-soaked and dullish green initially. This injury generally occurs to younger leaves. Chronic injury usually is evident by signs of chlorosis, bronzing, premature senescence, reduced growth and possible tissue necrosis (EPA, 1982). Phytotoxic symptoms demonstrated by plants can occur as low as 88 $\mu g/m^3$ (U.S. Department of Health, Education, and Welfare, 1971). However, this occurs with the more primitive plants (i.e., mosses, ferns, lichens).

A study of native Floridian species (Woltz and Howe, 1981) demonstrated that cypress, slash pine, live oak, and mangrove exposed to 1,300 $\mu g/m^3$ SO_2 for 8 hours were not visibly damaged. This supports the levels cited by other researchers on the effects of SO_2 on vegetation. A corroborative study (McLaughlin and Lee, 1974) demonstrated that approximately 20 percent of a cross-section of plants ranging from sensitive to tolerant were visibly injured at 3-hour SO_2 concentrations of 920 $\mu g/m^3$.

Jack pine seedlings exposed to SO_2 concentrations from 470 to 520 $\mu g/m^3$ for 24 hours demonstrated inhibition of foliar lipid synthesis; however, this inhibition was reversible (Malhotra and Kahn, 1978). Black oak exposed to 1,310 $\mu g/m^3$ SO_2 for 24 hours a day for 1 week demonstrated a 48 percent reduction in photosynthesis (Carlson, 1979). By comparison of these levels, it is apparent that the maximum predicted 24-hour concentrations are well below the concentrations that cause damage in SO_2-sensitive plants.

Plants can be grouped into three levels of sensitivity to SO_2 based on concentration and exposure (EPA, 1982b). Sensitive crop species include legumes and blackberries. Ranges of concentrations reported to cause visible injury in sensitive species are 1,310 to 2,620 $\mu g/m^3$ (0.5 to 1.0 ppm) for 1-hour exposure and 790 to 1,570 $\mu g/m^3$ (0.3 to 0.6 ppm) for 3-hour exposures. Intermediate resistant species include many crops and garden species. Ranges of concentrations reported to cause visible injury in intermediate species are 2,620 to 5,240 $\mu g/m^3$ (1.0 to 2.0 ppm) for 1-hour exposure and 1,570 to 2,100 $\mu g/m^3$ (0.6 to 0.8 ppm) for 3-hour exposures. Resistant species include potato and corn. Ranges of concentrations reported to cause visible injury in intermediate species are >5,240 $\mu g/m^3$ (>2.0 ppm) for 1-hour exposure and >2,100 $\mu g/m^3$ (>0.8 ppm) for 3-hour exposures. Chronic effects to forest growth have been reported where SO_2 annual ambient concentrations averaged 45 or 115 $\mu g/m^3$ (0.02 or 0.05 ppm) (EPA, 1982b).

In order to assess the total air quality SO_2 impacts at the Class I area that can be compared to the reported effects levels, the predicted SO_2 impacts due to Hardee Unit 3 were added to applicable background concentrations. The background concentrations, assumed to be representative of impacts from sources not modeled, were developed from existing ambient monitoring data. In this analysis, the highest 3-hour, 24-hour, and annual concentrations of 335, 67, and 7 $\mu g/m^3$, respectively [collected in 1991 and 1992 from monitoring stations (Nos. 058-003-J02, 058-003-J09, and 058-005-J02) located about 20 km from the Class I area], were used to represent background concentrations. The 3-hour concentration of 335 $\mu g/m^3$ was also used to represent the 1-hour and 8-hour background levels since data for these averaging times were not available.

The maximum total 3-hour, 24-hour, and annual SO_2 concentrations of 336.9, 67.3, and 7.0 $\mu g/m^3$, respectively, that would be predicted within the Class I area represent levels which are lower than those known to cause damage to test species. The expected doses from operation of Hardee Unit 3 combined with background sources are much lower than doses known to cause a detrimental effect on vegetation AQRVs at Chassahowitzka NWR.

Effects of Nitrogen Dioxide

Acute NO_2 injury symptoms are manifest as water-soaked lesions, which first appear on the upper surface, followed by rapid tissue collapse. Low-concentration, long-term exposures do not induce the lesions associated with acute exposures but may still result in some growth suppression. A review of the literature (EPA, 1982a) indicates greater variability in the NO_2 dose-response relationship in vegetation, and no threshold effect levels are supported. The NO_2 doses known to adversely affect some plants are shown in Table 5.6.1-15.

The maximum predicted annual average NO_2 concentration due to Hardee Unit 3 is predicted to be 0.03 $\mu g/m^3$. No representative nearby NO_2 monitoring data are available to provide background conditions. The predicted doses of NO_2 in the Chassahowitzka NWA due to the proposed facility are far lower than the doses reported to injure vegetation and animals; therefore, the proposed facility's NO_2 emissions are not expected to have an adverse effect on vegetation AQRVs at Chassahowitzka NWA.

Combined Effects of Sulfur Dioxide and Nitrogen Dioxide

SO_2 in combination with NO_2 can cause vegetation effects below injury threshold for each of these pollutants individually. Plants show varying sensitivities at various SO_2 and NO_2 concentration combinations for various exposure periods. A review of the literature (EPA, 1982a) indicates that a lower visible-injury threshold may occur at 2-hour SO_2 and NO_2 exposures of 1,310 $\mu g/m^3$ (0.5 ppm) and 940 $\mu g/m^3$ (0.5 ppm), respectively. Air dispersion modeling has shown that this threshold exposure condition will not occur at Chassahowitzka NWA.

SOILS

Sulfur Dioxide

The majority of the soil in the Class I area is classified as Weekiwachee-Durbin muck. This is an euic, hyperthermic typic sufihemist that is characterized by high levels of sulfur and organic matter. This soil is flooded daily with the advent of high tide and the pH ranges between 6.1 and 7.8. The upper level of this soil may contain as much as 4 percent sulfur (USDA, 1991).

The greatest threat to soils from increased SO_2 deposition (in the form of sulfate) is a decrease in pH or an increase of sulfur to levels considered unnatural or potentially toxic. The ground deposition of sulfate from the proposed unit was calculated to be 2.69 g/ha/yr. The results from the Florida Acid Deposition Study (FADS) network for two sampling stations (Site 8 and Site 5) located to the north of the Class I area indicate that the average sulfate deposition ranges from 14.5 to 17.7 kg/ha/yr (Pollman, 1994). The predicted amount of sulfate deposited is inconsequential in light of the sulfate deposition measured in the area and the inherent sulfur content of the soils. The regular flooding of these soils by the Gulf of Mexico regulates the pH, and any rise in acidity would be buffered by this activity.

Trace Metals

The annual deposition (g/m^2) of lead, arsenic, beryllium, mercury, manganese, nickel, cadmium, chromium, copper, vanadium, selenium, antimony, barium, cobalt, and zinc were assumed to partition into the soil (bulk density of 1.25 g/cc) to a depth of 10 cm. From this soil concentration, it was assumed that equal partitioning would ensue into dry plant matter. These values are considered to be quite conservative due to the assumption that all of the elements would be 100 percent available for plant uptake and would be internalized in plant tissue at a concentration equal to that of the soil.

Maximum depositions were predicted using the ISCST2 model using particle size distribution for large, uncontrolled gas turbines firing distillate oil as presented in EPA's document, Compilation of Air Pollutant Emission Factors, AP-42. This distribution assumes that 100 percent of the particles have a diameter of 1 μm or less. The maximum depositions to the Class I area due to the proposed sources are described in the following section.

<u>Arsenic</u>

Naturally occurring levels of As in plants range from 0.01 to 5.0 μg/g (EPA, 1989). A concentration of 5 to 20 μg/g in plants is considered excessive (Gough *et al.*, 1979). The annual amount of 1.38×10^{-7} μg/g predicted for the Hardee Unit 3 to be absorbed by vegetation is 6.9×10^{-9} to 2.8×10^{-8} of the values that are considered excessive.

<u>Barium</u>

Naturally occurring levels of barium in plants range from 7.5 to 165 μg/g (Lawrey, 1978). The annual amount of 5.51×10^{-7} μg/g predicted for the proposed unit to be absorbed by vegetation is 3.3×10^{-9} to 7.4×10^{-8} of the values at which no phytotoxic observations were noted.

Beryllium

Toxicity of plants has been reported at concentrations of 2 μg/g in liquid culture (Gough *et al.*, 1979). The annual amount of $7.06x10^{-8}$ μg/g predicted for the proposed unit to be absorbed by vegetation is $3.6x10^{-8}$ of the value at which retardation of growth occurred.

Cadmium

Cadmium is a relatively rare element that resides in nature at levels of 0.15 to 0.2 μg/g. Generally, 3 to 5 μg/g retards the growth of plants (Gough *et al.*, 1979). The annual amount of $2.96x10^{-7}$ μg/g predicted for the proposed unit to be absorbed by vegetation is $5.9x10^{-8}$ to $9.9x10^{-8}$ of the values at which retardation of growth occurred.

Chromium

A soil concentration of 1,370 to 2,740 μg/g chromium was reported to cause chlorosis in citrus (Gough *et al.*, 1979), but liquid cultures that contained 150 μg/g were toxic to citrus seedlings. The annual amount of $1.34x10^{-6}$ μg/g predicted for the proposed unit to be absorbed by vegetation is $8.9x10^{-9}$ of the value at which toxic symptoms were observed.

Cobalt

Plant concentrations as high as 2,000 to 10,000 μg/g cobalt have been detected in leaves of persimmon and ash, respectively (Gough *et al.*, 1979). Cobalt was reported to cause chlorosis and stunting in a variety of plants at levels from 6 to 142 μg/g in soils (Aller *et al.*, 1990). The annual amount of $2.56x10^{-7}$ μg/g predicted for the proposed unit to be absorbed by vegetation is $1.8x10^{-9}$ to $4.3x10^{-8}$ of the values at which toxic symptoms were observed.

Copper

Copper is an essential element for plant growth. Vary few instances of toxicity have been reported, and copper deficiency is more often a problem than toxicity. Citrus seedlings that were exposed to approximately 150 μg/g of copper demonstrated appreciable chlorosis (Gough *et al.*, 1979). The annual amount of $3.67x10^{-5}$ μg/g predicted for the proposed unit to be absorbed by vegetation is $2.5x10^{-7}$ of the value at which toxic symptoms were observed.

Lead

Naturally occurring levels of lead in plants range from 0.1 to 10 μg/g with an average of 2.0 μg/g (Kabata-Pendias and Pendias, 1984). A lead soil concentration of 30 to 100 μg/g generally retards the growth of plants (Gough *et al.*, 1979). The annual amount of 1.64×10^{-6} μg/g predicted for the proposed unit to be absorbed by vegetation is 1.6×10^{-8} to 5.5×10^{-8} of the values at which growth retardation was observed.

Manganese

Manganese is another element that is essential for plant growth. However, toxicity does occur at elevated levels and a generally toxic concentration of manganese is reported to be greater than 400 to 500 μg/g (Gough *et al.*, 1979). The annual amount of 9.59×10^{-9} μg/g predicted for the proposed unit to be absorbed by vegetation is 2.4×10^{-8} of the level at which toxicity was observed.

Mercury

Although mercury compounds are toxic to bacteria and fungi, higher plants are relatively resistant to mercury poisoning. Tea plants growing above mercury-rich deposits contained as much as 3.5 μg/g without showing signs of toxicity. Apparently healthy spanish moss plants collected had a mercury content of 0.5 μg/g (Gough *et al.*, 1979). From the few studies available on the effects of mercury on plants, it seems as if mercury is not concentrated to a great extent (Gough *et al.*, 1979). The annual amount of 2.48×10^{-7} μg/g predicted for the proposed unit to be absorbed by vegetation is 7.1×10^{-8} to 5.0×10^{-7} of the values at which no signs of toxicity were observed.

Nickel

The general range of excessive or toxic amounts of nickel in most plant species varies from 10 to 100 ppm (Kabata-Pendias and Pendias, 1984). The annual amount of 3.39×10^{-5} μg/g predicted for the proposed unit to be absorbed by vegetation is 3.4×10^{-7} to 3.4×10^{-6} times the values at which growth retardation was observed.

Selenium

No recorded instances of naturally occurring selenium damage have been documented to date (Gough *et al.*, 1979). Plants absorb and accumulate selenium, but the general responses of these plants vary over such a wide range of concentrations, a level considered toxic to plants is hard determine (Gough *et al.*, 1979). Concentrations of selenium in plants are known to range from 3 to 4,190 μg/g. The annual amount of 6.61×10^{-7} μg/g predicted for the proposed unit to be absorbed by vegetation is 1.6×10^{-10} to 2.2×10^{-7} times the values at which no effects have been observed.

Vanadium

Plants absorb and accumulate vanadium differentially, with concentrations in various plants ranging from 20 to 700 μg/g (Gough *et al.*, 1979). However, phytotoxic responses were observed in some plants grown in soils at a concentration of 140 μg/g (Aller *et al.*, 1990). The annual amount of 1.96×10^{-6} μg/g predicted for the proposed unit to be absorbed by vegetation is 1.4×10^{-8} of the value at which phytotoxicity occurred.

Zinc

Zinc is another element that is essential for plant growth. However, toxicity does occur at elevated levels and a generally toxic concentration of zinc is reported to be greater than 300 μg/g (Fischer and Luttge, 1978). The annual amount of 4.46×10^{-5} μg/g predicted for the proposed unit to be absorbed by vegetation is 1.5×10^{-7} of the value at which toxicity was observed.

WILDLIFE

The predicted SO_2, NO_2, and particulate concentrations are well below the lowest observed effects levels in animals (Table 5.6.1-14). Given these conditions, the proposed source's emissions poses no risk to wildlife AQRVs at Chassahowitzka NWA. Because predicted levels are below those known to cause effect to vegetation, there is also no risk to their habitat.

A review of literature (U.S. Fish and Wildlife Service, 1985a, b; 1986; 1987; 1988a, b; and 1993) shows that the USFWS's recommended safety levels for As, Cd, chromium (Cr), Hg, Pb, Se, and Zn for threshold effects for these metals are several orders of magnitude higher than the concentrations predicted to occur in plants. Although these metals bioaccumulate, the predicted levels are so low that adverse effects to fish and wildlife of Chassahowitzka NWA through the food web are not expected.

SUMMARY

In summary, no toxic effects from proposed plant emissions are expected. Safety factors as great as 900 million have been demonstrated in this assessment. For the trace metal assessment, it is important to note that the elements were modeled with the assumption that 100 percent was available for plant uptake which is rarely the case in a natural ecosystem.

5.6.1.5 PSD CLASS I VISIBILITY ANALYSIS

The visibility analysis required by PSD regulations is directed primarily toward PSD Class I areas. The CAA amendments of 1977 provide for implementation of guidelines to prevent visibility impairment in mandatory Class I areas. The guidelines are intended to protect the aesthetic quality of these pristine areas from reduction in visual range and atmospheric discoloration caused by various pollutants. There are no PSD Class I areas located within 100 km of the Hardee Unit 3 facility. The nearest Class I area to the plant site is the Chassahowitzka NWA located approximately 130 km to the northwest of the plant site.

A Level-1 visibility screening analysis was performed to determine the potential adverse visibility effects using the approach suggested in the *Workbook for Plume Visual Impact Screening and Analysis* (EPA, 1988). The Level-1 screening analysis is designed to provide a conservative estimate of plume visual impacts (i.e., impacts higher than expected). The EPA model, VISCREEN, was used for this analysis. The PM, NO_x, and sulfuric acid mist (assumed to be sulfate) emissions from the proposed plant were used as input to the model.

As presented in Section 8.5 of Appendix 10.1.5 (Figure 8-1), the maximum visibility impacts caused by the proposed plant do not exceed the screening criteria inside or outside the Class I area. As a result, Hardee Unit 3 is predicted to have no adverse effects to visibility on the Class I area.

5.6.1.6 ULTIMATE SITE CAPACITY

Based on the results summarized in Sections 5.6.1.2, 5.6.1.3, 5.6.1.4, and 5.6.1.5, Hardee Unit 3 will comply with applicable AAQS and PSD increments; will not pose a significant health risk to the public relative to toxic air pollutant emissions; and will not adversely affect the soils, vegetation, wildlife, and visibility around the proposed plant site. The air quality modeling analyses were based on Hardee Unit 3 at a nominal electrical-generating capacity of 440 MW.

The modeling analyses also included the existing TPS plant at a nominal electrical-generating capacity of 295 MW.

If the nominal electrical-generating capacity of the existing TPS plant were increased by 145 MW to a total generating capacity of 440 MW (to account for the ultimate site capacity of 880 MW), the air quality impacts from Hardee Unit 3 and the future TPS plant would comply with currently applicable AAQS and PSD increments and not pose a significant adverse risk to public health, vegetation, soils, or wildlife. One combustion turbine, one heat recovery steam generator, and one steam turbine will be added at the TPS plant to generate the additional 145 MW of electricity. The combustion turbine is assumed to be fired with natural gas and fuel oil with the fuel oil having a maximum sulfur content of 0.05 percent (same sulfur content as proposed for Hardee Unit 3).

For AAQS analyses, the maximum PM10, NO_2, and CO impacts from Hardee Unit 3 were predicted to be less than the significant impact levels or, when other sources were also modeled, were well below the applicable ambient standard. As a result, the incremental impacts due to the future TPS plant (total of 440 MW generation capacity) are expected to be minimal and still maintain compliance with AAQS.

For SO_2 AAQS analyses, the maximum 3-hour, 24-hour, annual concentrations due to all modeled sources and background concentrations were predicted to be 406, 138, and 29 $\mu g/m^3$, respectively. As a result, the maximum predicted SO_2 concentrations will be in compliance with AAQS when the ultimate site capacity of 880 MW is reached. The incremental impacts due to the future TPS plant are expected to be minimal and still maintain compliance with AAQS.

Similar to the AAQS analyses for PSD Class II increment analyses, the maximum PM10 and NO_2 concentrations from Hardee Unit 3 were predicted to be less than the significant impact levels or, when other PSD sources were also modeled, were well below the applicable PSD increments. As a result, the incremental impacts due to the future TPS plant are expected to be minimal and still maintain compliance with AAQS.

For SO_2 PSD Class II analyses, the maximum 3-hour, 24-hour, and annual concentrations due to all modeled PSD sources were predicted to be 150, 45.4, and -4 $\mu g/m^3$, respectively. The incremental impacts due to the future TPS plant are expected to be minimal and still maintain compliance with PSD Class II increment. As a result, the maximum predicted SO_2 concentrations will be in compliance with the current PSD Class II increments when the ultimate site capacity is reached.

For PSD Class I analyses, the maximum PM10 and NO_2 impacts from Hardee Unit 3 were predicted to be less than the NPS significant impact levels. As a result, the maximum PM10 and NO_2 impacts from the future TPS units are also expected to be less than the NPS significant impact levels. Although initial modeling was performed for SO_2 concentrations for Hardee Unit 3 which indicated potential violations of the PSD Class I increment, additional modeling with the MESOPUFF II model indicated that Hardee Unit 3's impacts were less than significant during the potential violations. As a result, the maximum SO_2 impacts from the future TPS units are also expected to be less than the significant impact levels.

Based on these results, the air quality impacts associated with the ultimate site capacity of 880 MW (440-MW generation for Hardee Unit 3 and 440-MW generation for the future TPS plant) are expected to comply with currently applicable AAQS and PSD increments.

Table 5.6.1-1. SO2 Screening Analysis for the AAQS and PSD Class II Inventories for Hardee Unit 3

Facility Name	UTM Coordinates (km) E	UTM Coordinates (km) N	Relative Coordinate to proposed Hardee Unit 3 (km) X	Relative Coordinate to proposed Hardee Unit 3 (km) Y	Distance to Proposed Facility (km)	Direction (degrees)	Screening Emission Threshold (TPY)(a)	Maximum Allowable Emissions (TPY)	Included in AAQS and/or PSD Class II Modeling Analysis?
TPS Hardee Station (295 MW) (b)	404.8	3057.3	-0.2	-0.4	0.4	207	(c)	2,412	YES
TECO - Polk Power Station (b)	402.5	3067.4	-2.5	9.7	10.0	345	100	2,010	YES
Imperial Phosphate (Brewer)(b)	404.8	3069.5	-0.2	11.8	11.8	359	136	275	YES
Gardinier Fort Meade	415.3	3063.3	10.3	5.6	11.7	61	134	1,173	YES
IMC-Agrico Chem - S. Pierce (b)	407.5	3071.3	2.5	13.6	13.8	10	177	4,377	YES
Mobil Mining - Big Four Mine (b)	394.8	3067.7	-10.2	10.0	14.3	314	186	589	YES
Borden Hillsborough (b)	394.6	3069.6	-10.4	11.9	15.8	319	216	-225	YES
U.S. Agri-Chemicals Ft. Meade (b)	416.0	3069.0	11.0	11.3	15.8	44	215	3,438	YES
Central Florida Power	416.2	3069.2	11.2	11.5	16.1	46	222	38	NO
City of Wauchula	418.4	3047.0	13.4	-10.7	17.1	129	243	180	NO
Estech/Swift (b)	411.5	3074.2	6.5	16.5	17.7	22	255	-4,853	YES
FPC - Polk (b)	414.3	3073.9	9.3	16.2	18.7	30	274	859	YES
Dolime(b)	404.8	3069.5	-0.2	11.8	11.8	359	136	-355	YES
IMC-Agrico Chem - Pierce (b)	404.1	3079.0	-0.9	21.3	21.3	358	326	-1,645	YES
Mobil Electrophosphate (b)	405.6	3079.4	0.6	21.7	21.7	2	334	-1,441	YES
Farmland Industries Green Bay (b)	409.5	3079.5	4.5	21.8	22.3	12	345	4,087	YES
IMC Agrico Chem- New Wales (b)	396.6	3078.9	-8.4	21.2	22.8	338	356	13,921	YES
Mulberry Cogeneration (b)	413.6	3080.6	8.6	22.9	24.5	21	389	464	YES
IMC Agrico Chem - Noralyn Mine Road	414.7	3080.3	9.7	22.6	24.6	23	392	505	YES
CF Industries Bartow Bonnie Mine Road(b)	408.4	3082.4	3.4	24.7	24.9	8	399	4,982	YES
Kaplan Industries	418.3	3079.3	13.3	21.6	25.4	32	407	398	NO
American Orange Corp.	429.8	3047.3	24.8	-10.4	26.9	113	438	198	NO
IMC Agrico/Conserve (b)	398.4	3084.2	-6.6	26.5	27.3	346	446	1,593	YES
Mulberry Phosphates (Royster) (b)	406.8	3085.1	1.8	27.4	27.5	4	449	2,013	YES
Geologic Recovery	401.8	3085.8	-3.2	28.1	28.3	354	466	98	NO
Mobil Mining -Nichols (b)	398.4	3085.3	-6.6	27.6	28.4	347	468	2,304	YES
Cargill/Seminole Fertilizer Bartow (b)	409.8	3087.0	4.8	29.3	29.7	9	494	5,000	YES
IMC Fertilizer - Prairie	402.9	3087.0	-2.1	29.3	29.4	356	488	109	NO
Orange Co.	418.7	3083.6	13.7	25.9	29.3	28	486	26	NO
Imperial/Pavex Corp - W Bartow	413.0	3086.2	8.0	28.5	29.6	16	492	75	NO
US-Agri Chemicals Bartow (b)	413.2	3086.3	8.2	28.6	29.8	16	495	-1,579	YES
FPL - Manatee	367.2	3054.1	-37.8	-3.6	38.0	265	659	83,351	YES
Laidlaw Env. Services	424.7	3091.9	19.7	34.2	39.5	30	689	240	NO
Consolidated Minerals Plant City	393.8	3096.3	-11.2	38.6	40.2	344	704	809	YES
Citrus Hill	447.9	3068.3	42.9	10.6	44.2	76	784	411	NO
Cargill Citro-America	447.9	3068.3	42.9	10.6	44.2	76	784	223	NO
Ridge Cogeneration (b)	416.7	3100.4	11.7	42.7	44.3	15	785	480	NO
Lakeland City Power Larsen (b)	409.2	3102.8	4.2	45.1	45.2	5	805	5,024	YES
TECO - Big Bend (b)	361.9	3075.0	-43.1	17.3	46.4	292	829	237,854	YES
FPL-Avon Park	451.4	3050.5	46.4	-7.2	47.0	99	839	67	NO

Table 5.6.1–1. SO2 Screening Analysis for the AAQS and PSD Class II Inventories for Hardee Unit 3

Facility Name	UTM Coordinates (km)		Relative Coordinate to proposed Hardee Unit 3 (km)		Distance to Proposed Facility (km)	Direction (degrees)	Screening Emission Threshold (TPY)(a)	Maximum Allowable Emissions (TPY)	Included in AAQS and/or PSD Class II Modeling Analysis?
	E	N	X	Y					
Macasphalt Winter Haven	423.1	3101.5	18.1	43.8	47.4	22	848	48	NO
Cargill/Gardinier Riverview (b)	363.4	3082.4	−41.6	24.7	48.4	301	868	5,872	YES
Lakeland City Power McIntosh (b)	408.5	3105.8	3.5	48.1	48.2	4	865	30,567	YES
Auburndale Cogen (b)	420.8	3103.3	15.8	45.6	48.3	19	865	222	NO
Owens–Brockway	423.4	3102.8	18.4	45.1	48.7	22	874	120	NO
Coca Cola Auburndale	421.6	3103.7	16.6	46.0	48.9	20	878	709	NO
Adams Packing Aurburndale	421.1	3104.2	16.1	46.5	49.2	19	884	94	NO
SFE Processing	421.7	3104.2	16.7	46.5	49.4	20	888	188	NO
Hillsborough RRF	368.2	3092.7	−36.8	35.0	50.8	314	916	771	NO
Borden Polk (b)	414.5	3109	9.5	51.3	52.2	10	943	−184	NO
CLM/Pacific Chloride	361.8	3088.3	−43.2	30.6	52.9	305	959	702	NO
TECO – Gannon	360.0	3087.5	−45.0	29.8	54.0	304	979	93,265	YES
Gulf Coast Lead	364.0	3093.5	−41.0	35.8	54.4	311	989	1,498	YES
Alcoma Packing	451.6	3085.5	46.6	27.8	54.3	59	985	327	NO
Additional Sources Outside 55km Considered in Modeling Analysis									
Lafarge Corp.	357.7	3090.6	−47.3	32.9	57.6	305	1052	20,293	YES
TECO – Hookers Point	358.0	3091.0	−47.0	33.3	57.6	305	1052	13,524	YES
FPC – Bartow	342.4	3082.6	−62.6	24.9	67.4	292	1247	62,618	YES
FPC – Higgins	336.5	3098.4	−68.5	40.7	79.7	301	1494	19,619	YES
FPC – Intercession City (b)	446.3	3126.0	41.3	68.3	79.8	31	1496	17,667	YES

Note: All facilities with a total maximum allowable SO2 emissions of more than 20 TPY that are within 55 km of the proposed facility are included in the screening analysis.

(a) Screening emissions threshold is 20 x [Distance (km) to facility – 5km], based on North Carolina Screening Method.
A significant impact distance of 5 km was assumed in order to include additional facilities into the inventory.

(b) Indicates PSD sources at this facility
Proposed facility UTM coordinates (km 405 3057.7
Screening area is 55 km from the proposed facility.

(c) Sources within 5 km of the proposed facility are modeled without regard to the screening criteria.

Source: KBN, 1994

Table 5.6.1–2. PM Screening Analysis for the AAQS and PSD Class II Inventories for Hardee Unit 3

Facility/Source Name	UTM E (km)	UTM N (km)	Relative Location to Proposed Facility (km) X	Relative Location to Proposed Facility (km) Y	Distance to Proposed Facility (km)	Direction (degrees)	Screening Threshold Emissions (TPY) (a)	Maximum Allowable Emissions (TPY)	Included in AAQS and PSD Class II Modeling Analysis?
TPS Hardee Power Station (295 MW) (b)	404.8	3057.3	–0.2	–0.4	0.4	207	(c)	33	YES
TECO Polk (b)	402.5	3067.4	–2.5	9.7	10.0	346	100	438	YES
Gardinier Fort Meade	415.3	3063.3	10.3	5.6	11.7	61	134	132	NO
Imperial Phosphate (Brewer)	404.8	3069.5	–0.2	11.8	11.8	359	136	162	YES
IMC–Agrico Chemical South Pierce (b)	407.5	3071.3	2.5	13.6	13.8	10	177	858	YES
Mobil Big Four Mine	394.8	3067.7	–10.2	10.0	14.3	314	186	68	NO
US Agri–Chemicals Fort Meade (b)	416.0	3069.0	11.0	11.3	15.8	44	215	1,066	YES
Central Florida Power	416.2	3069.2	11.2	11.5	16.1	46	222	47	NO
Florida Privitization Inc	418.3	3048.0	13.3	–9.7	16.5	126	229	281	YES
City of Wachula	418.4	3047.0	13.4	–10.7	17.1	129	243	21	NO
Estech/Swift	411.5	3074.2	6.5	16.5	17.7	22	255	311	YES
FPC–POLK (b)	414.3	3073.9	9.3	16.2	18.7	30	274	149	NO
Estech–Duette Phosphate Mine	388.9	3047.2	–16.1	–10.5	19.2	237	284	751	YES
IMC Kingsford	398.2	3075.7	–6.8	18.0	19.2	339	285	417	YES
C & M Products Co	405.5	3079.1	0.5	21.4	21.4	1	328	162	NO
Farmland Industries Green Bay Plant (b)	409.5	3079.5	4.5	21.8	22.3	12	345	503	YES
IMC–Agrico New Wales	396.6	3078.9	–8.4	21.2	22.8	338	356	1,427	YES
Ewell Ind Bonnie Mine Rd	407.7	3080.9	2.7	23.2	23.4	7	367	96	NO
Mulberry Cogeneration (b)	413.6	3080.6	8.6	22.9	24.5	21	389	70	NO
IMC–Agrico Noralyn Mine	414.7	3080.3	9.7	22.6	24.6	23	392	1,690	YES
Ridge Pallets Inc	419.1	3078.1	14.1	20.4	24.8	35	396	96	NO
C F Industries Bartow Bonnie Mine (b)	408.4	3082.4	3.4	24.7	24.9	8	399	1,748	YES
Bio–Medical Service Corp of GA	413.9	3081.3	8.9	23.6	25.2	21	404	46	NO
Kaplan Industries	418.3	3079.3	13.3	21.6	25.4	32	407	53	NO
American Orange Corp	429.8	3047.3	24.8	–10.4	26.9	113	438	181	NO
Orange Cogen (b)	414.8	3083.0	9.8	25.3	27.1	21	443	44	NO
IMC–Agrico/Conserve (Nichols) (b)	398.4	3084.2	–6.6	26.5	27.3	346	446	1,598	YES
Mulberry Phosphates (Royster)	406.8	3085.1	1.8	27.4	27.5	4	449	1,394	YES
Kaiser Aluminum	408.3	3085.5	3.3	27.8	28.0	7	460	106	NO
Mobil Mining & Minerals Nichols	398.4	3085.3	–6.6	27.6	28.4	347	468	991	YES
Orange Co of Florida	418.7	3083.6	13.7	25.9	29.3	28	486	119	NO
IMC Fertilizer Prairie	402.9	3087.0	–2.1	29.3	29.4	356	488	288	NO
Purina Mills	402.0	3087.0	–3.0	29.3	29.5	354	489	88	NO
Pavex	413.0	3086.2	8.0	28.5	29.6	16	492	44	NO
Cargill/Seminole Fertilizer (b)	409.8	3087.0	4.8	29.3	29.7	9	494	544	YES

Table 5.6.1-2. PM Screening Analysis for the AAQS and PSD Class II Inventories for Hardee Unit 3

Facility/Source Name	UTM E (km)	UTM N (km)	Relative Location to Proposed Facility (km) X	Relative Location to Proposed Facility (km) Y	Distance to Proposed Facility (km)	Direction (degrees)	Screening Threshold Emissions (TPY) (a)	Maximum Allowable Emissions (TPY)	Included in AAQS and PSD Class II Modeling Analysis?
Ridge Pallets Inc.	418.6	3084.1	13.6	26.4	29.7	27	494	165	NO
US Agri-Chemicals Bartow (b)	413.2	3086.3	8.2	28.6	29.8	16	495	444	NO
Florida Rock Industries	416.8	3085.8	11.8	28.1	30.5	23	510	57	NO
Ewell Ind S Florida Ave	406.3	3092.9	1.3	35.2	35.2	2	604	348	NO
All Sun Products	413.5	3093.8	8.5	36.1	37.1	13	642	318	NO
FPL - Manatee	367.2	3054.1	-37.8	-3.6	38.0	265	659	40,765	YES
Manatee Scrap Processing	366.9	3053.8	-38.1	-3.9	38.3	264	666	108	NO
Sun Pac Foods	422.7	3092.6	17.7	34.9	39.1	27	683	62	NO
Lykes Pasco Packing	412.4	3096.5	7.4	38.8	39.5	11	690	48	NO
Consolidated Minerals Inc Plant City	393.8	3096.3	-11.2	38.6	40.2	344	704	749	YES
Pavers Incorporated	414.0	3098.2	9.0	40.5	41.5	13	730	479	NO
Schering Berlin Polymers	410.7	3098.9	5.7	41.2	41.6	8	732	30	NO
Rinker Cencon Corp	412.4	3099.0	7.4	41.3	42.0	10	739	159	NO
Quikrete of Florida	412.8	3099.0	7.8	41.3	42.0	11	741	253	NO
Zipperer S. Agape Mortuary Services	363.0	3064.7	-42.0	7.0	42.6	279	752	21	NO
Florida M&M	362.2	3066.2	-42.8	8.5	43.6	281	773	21	NO
Alumax Extrusions	385.6	3097.0	-19.4	39.3	43.8	334	777	172	NO
Ero Industries	427.5	3095.6	22.5	37.9	44.1	31	782	33	NO
Citrus Hill Mfg	447.9	3068.3	42.9	10.6	44.2	76	784	66	NO
Florida Brick & Clay Co	384.9	3097.1	-20.1	39.4	44.2	333	785	26	NO
Ridge Cogeneration (b)	416.7	3100.4	11.7	42.7	44.3	15	785	414	NO
Union Camp Corp	402.0	3102.0	-3.0	44.3	44.4	356	788	47	NO
Amcon Concrete	364.0	3075.0	-41.0	17.3	44.5	293	790	39	NO
Erly Juice Inc	399.0	3101.8	-6.0	44.1	44.5	352	790	117	NO
Florida Tile	405.4	3102.4	0.4	44.7	44.7	1	794	309	NO
C-Cure of Florida	386.0	3098.7	-19.0	41.0	45.2	335	804	21	NO
Lakeland City Power Larsen (b)	409.2	3102.8	4.2	45.1	45.3	5	806	107	NO
Monier Roof tile	414.0	3102.5	9.0	44.8	45.7	11	814	44	NO
Driggers Concrete	360.0	3065.9	-45.0	8.2	45.7	280	815	21	NO
Palm Harbor Homes	391.8	3101.5	-13.2	43.8	45.7	343	815	22	NO
Vigoro Industries	427.9	3097.4	22.9	39.7	45.8	30	817	136	NO
Westcon	375.3	3092.8	-29.7	35.1	46.0	320	820	21	NO
TECO Big Bend (b)	361.9	3075.0	-43.1	17.3	46.4	292	829	6,014	YES
Citrus World	441.0	3087.3	36.0	29.6	46.6	51	832	601	NO
IMC-Agrico Chemical Big Bend	362.1	3076.1	-42.9	18.4	46.7	293	834	195	NO

Table 5.6.1-2. PM Screening Analysis for the AAQS and PSD Class II Inventories for Hardee Unit 3

Facility/Source Name	UTM E (km)	UTM N (km)	Relative Location to Proposed Facility (km)		Distance to Proposed Facility (km)	Direction (degrees)	Screening Threshold Emissions (TPY) (a)	Maximum Allowable Emissions (TPY)	Included in AAQS and PSD Class II Modeling Analysis?
			X	Y					
Macasphalt	423.1	3101.5	18.1	43.8	47.4	22	848	70	NO
Florida Rock Industry	365.8	3085.0	-39.2	27.3	47.8	305	855	21	NO
Lakeland City Power McIntosh (b)	408.5	3105.8	3.5	48.1	48.2	4	865	15,151	YES
Auburndale Cogeneration (b)	420.8	3103.3	15.8	45.6	48.3	19	865	161	NO
Florida Mining & Materials Alabama Lan	420.8	3103.4	15.8	45.7	48.4	19	867	40	NO
Cargill/Gardinier Fertilizer Riverview	363.4	3082.4	-41.6	24.7	48.4	301	868	880	YES
Owens-Brockway Glass Container	423.4	3102.8	18.4	45.1	48.7	22	874	189	NO
Packaging Corp of America	423.4	3102.8	18.4	45.1	48.7	22	874	38	NO
Coca Cola	421.6	3103.7	16.6	46.0	48.9	20	878	387	NO
Adams Packing Association	421.1	3104.2	16.1	46.5	49.2	19	884	144	NO
Eger Concrete Lake Ida & 5th St	428.1	3102.0	23.1	44.3	50.0	28	899	49	NO
S I Lime Co Division of Longview Lime	362.9	3084.7	-42.1	27.0	50.0	303	900	48	NO
R C Martin Concrete Products	368.6	3092.1	-36.4	34.4	50.1	313	902	28	NO
Graves Enterprises Riverview	363.1	3085.3	-41.9	27.6	50.2	303	903	350	NO
The Florida Brewery	422.8	3104.7	17.8	47.0	50.3	21	905	121	NO
Hillsborough Co Resource Recovery	368.2	3092.7	-36.8	35.0	50.8	314	916	172	NO
John Carlos Florida	426.2	3104.1	21.2	46.4	51.0	25	920	29	NO
Reed Minerals Division	362.2	3085.5	-42.8	27.8	51.0	303	921	70	NO
Eastern Electric Apparatus Repair Cp	366.6	3092.0	-38.4	34.3	51.5	312	930	21	NO
Southeastern Galvanizing Division	368.5	3094.5	-36.5	36.8	51.8	315	937	21	NO
City of Tampa Dept.	364.0	3089.5	-41.0	31.8	51.9	308	938	48	NO
Kearney Development Company	368.7	3094.8	-36.3	37.1	51.9	316	938	21	NO
Gaylord Container Corp	366.3	3092.3	-38.7	34.6	51.9	312	938	108	NO
Southeastern Wire	368.3	3094.5	-36.7	36.8	52.0	315	939	21	NO
GAF Building Materials Corp	362.2	3087.2	-42.8	29.5	52.0	305	940	57	NO
Florida Rock Industries	428.0	3105.2	23.0	47.5	52.8	26	956	55	NO
Leisey Shell Corp	352.7	3064.8	-52.3	7.1	52.8	278	956	20	NO
Nitram	362.5	3089.0	-42.5	31.3	52.8	306	956	218	NO
GNB Inc (PAC CHL)	361.8	3088.3	-43.2	30.6	52.9	305	959	25	NO
Paktank Florida	360.8	3087.3	-44.2	29.6	53.2	304	964	178	NO
Florida Steel Corp	364.6	3092.8	-40.4	35.1	53.5	311	970	144	NO
Amcon Products	364.6	3092.8	-40.4	35.1	53.5	311	970	32	NO
Bay Concrete	365.1	3093.8	-39.9	36.1	53.8	312	976	37	NO
IMC Port Sutton Terminal	360.1	3087.5	-44.9	29.8	53.9	304	978	442	NO
TECO Gannon	360.0	3087.5	-45.0	29.8	54.0	304	979	5,855	YES

Table 5.6.1-2. PM Screening Analysis for the AAQS and PSD Class II Inventories for Hardee Unit 3

Facility/Source Name	UTM E (km)	UTM N (km)	Relative Location to Proposed Facility (km) X	Relative Location to Proposed Facility (km) Y	Distance to Proposed Facility (km)	Direction (degrees)	Screening Threshold Emissions (TPY) (a)	Maximum Allowable Emissions (TPY)	Included in AAQS and PSD Class II Modeling Analysis?
Florida Mega-Mix	364.5	3093.4	-40.5	35.7	54.0	311	980	22	NO
CSX Transportation Inc	361.0	3089.0	-44.0	31.3	54.0	305	980	404	NO
David J Joseph Co	364.0	3092.9	-41.0	35.2	54.0	311	981	123	NO
The Gibson-Homans	365.5	3094.8	-39.5	37.1	54.2	313	984	21	NO
Holman Inc	359.5	3087.3	-45.5	29.6	54.3	303	986	55	NO
Holman Inc	359.3	3087.1	-45.7	29.4	54.3	303	987	54	NO
Gulf Coast Lead	364.0	3093.5	-41.0	35.8	54.4	311	989	25	NO
Eastern Association Terminal	360.2	3088.9	-44.8	31.2	54.6	305	992	534	NO
Glen-Mar Concrete Products	363.2	3093.3	-41.8	35.6	54.9	310	998	22	NO
Additional Sources Outside 55 km Considered in the Modeling Analysis									
TECO Hooker's Point	358.0	3091.0	-47.0	33.3	57.6	305	1,052	107	NO
LaFarge Corp	357.7	3090.6	-47.3	32.9	57.6	305	1,052	1,207	YES
CF Industries Zephyrhills	388.0	3116.0	-17.0	58.3	60.7	344	1,115	1,006	NO
FPC - Bartow	342.4	3082.6	-62.6	24.9	67.4	292	1,247	9,244	YES
FPC - Higgins	336.5	3098.4	-68.5	40.7	79.7	301	1,494	1,082	NO
FPC - Intercession City (b)	446.3	3126.0	41.3	68.3	79.8	31	1,496	809	NO

Note: All sources with the potential to emit more than 20 TPY of PM, based on maximum allowable within 55km of the proposed facility are included in the screening analysis.
Proposed Facility UTM coordinate 405.0 3057.7
Screening area is a 55 km circle centered on the proposed facility.

(a) Screening emissions threshold is based on the North Carolina screening method, and is equal to 20 x [Distance (km) to facility - 5 km]. A significant impact distance of 5 km was assumed in order to include additional facilities into the inventory. The distance may change pending the final design of the proposed plant.
(b) PSD sources at this facility.
(c) Sources within 5 km of the proposed facility are modeled without regard to the screening criteria.

Source: KBN, 1994.

Table 5.6.1-3. Summary of Facilities Included in the PSD Class I SO2 Modeling Analysis for Hardee Unit 3

APIS ID #	Facility Description	UTM Location (km) East	UTM Location (km) North	Maximum SO2 Emissions (TPY)	Distance to Nearest Class I Receptor (km)
40TPA270024	Asphalt Pavers 3	359.9	3162.4	78	20
40TPA270015	Asphalt Pavers 4	361.4	3168.4	78	20
40TPA530221	Auburndale Cogeneration	420.8	3103.3	222	102
NA	Borden Hillsborough	394.6	3069.6	-225	110
NA	Borden Polk	414.5	3109.0	-184	93
40HIL290008	Cargill/Gardinier Riverview	363.4	3082.4	-8430	86
40TPA530046	Cargill/Seminole Bartow	409.8	3087.0	1794	105
40TPA530052	CF Industries Bartow Bonnie Mine Rd	408.4	3082.4	-24445	108
40HIL290005	CF Industries Zephyrhills	388.0	3116.0	-292	69
NA	CLM Chemical	361.8	3088.3	731	80
40TPA510066	Couch Const-Zephyrhills (Asphalt)	390.3	3129.4	123	62
40TPA510041	Couch Const-Odessa (Asphalt)	340.7	3119.5	252	46
	Dris Paving (Asphalt)	340.6	3119.2	8	47
NA	Dolime	404.8	3069.5	-355	116
NA	Estech/Swift Polk	411.5	3074.2	-4853	116
NA	Evans Packing	383.3	3135.8	7	52
40TPA270017	E R Jahna (Lime Dryer)	386.7	3155.8	29	47
40TPA530053	Farmland Industries - Green Bay Plant	409.5	3079.5	1167	111
NA	FDOC Boiler #3	382.2	3166.1	104	40
40TPA270021	FL Crushed Stone Kiln 1	360.0	3162.4	3421	20
40TPA270010	FL Mining and Materials Kiln	356.2	3169.9	50	15
40TPA090004	FPC - Crystal River	334.2	3204.5	-5402	21
30ORL640028	FPC Debary	467.5	3197.2	16213	125
30ORL490014	FPC Intercession City	446.3	3126.0	8162	113
NA	FPC Polk County Site	414.3	3073.9	859	118
NA	General Portland Cement #4	358.0	3090.6	-2190	77
NA	General Portland Cement #5	358.0	3090.6	-2409	77
40HIL290261	Hillsborough Cty RRF	368.2	3092.7	771	78
NA	Hospital Corp of America	333.4	3141.0	6	26
40TPA530057	IMC-Agrico/Conserve Nichols	398.4	3084.2	797	100
40TPA530059	IMC-Agrico New Wales	396.6	3078.9	5050	103
NA	IMC-Agrico Pierce	404.1	3079.0	-1645	108
40TPA530055	IMC-Agrico South Pierce	407.5	3071.3	1471	116
40TPA530080	Imperial Phosphate	404.8	3069.5	-670	116
NA	Kissimmee Utilities	447.7	3127.9	1022	114
30ORL490001	Kissimmee Utilites Exist	460.1	3129.3	1116	125
40TPA530003	Lakeland Utilities Larsen CT	409.2	3102.8	1012	93
40TPA530004	Lakeland Utilities McIntosh 3	408.5	3105.8	17384	91
NA	Lake Cogen	434.0	3198.8	175	93
40HIL290127	McKay Bay RRF	360.0	3091.9	745	76
40TPA530060	Mobil Electrophos Division	405.6	3079.4	-3334	108
40HIL290102	Mobil Big Four Mine /AMAX	394.8	3067.7	589	112
40TPA530047	Mobil-Nichols	398.4	3085.3	-428	99
NA	Mulberry Cogeneration	413.6	3080.6	464	112
40TPA530048	Mulberry Phosphates (Royster)	406.8	3085.1	-7714	104
NA	New Pt Richey Hospital	331.2	3124.5	3	42
NA	Oman Construction	359.8	3164.9	73	20
30ORL480137	Orlando Utilities Commission - Stanton	483.5	3150.6	24083	143
40TPA510028	Overstreet Paving (Asphalt)	355.9	3143.7	128	27
40TPA510056	Pasco Cty RRF	347.1	3139.2	490	27
NA	Pasco Cogen	385.6	3139.0	175	53
40PNL520117	Pinellas RRF	335.3	3084.4	2234	81
30ORL48109	Reedy Creek Energy Services- EPCOT	442.0	3139.0	127	105
30ORL480110	Reedy Creek Energy Services	443.1	3144.3	5	105

Table 5.6.1-3. Summary of Facilities Included in the PSD Class I SO2 Modeling Analysis for Hardee Unit 3

APIS ID #	Facility Description	UTM Location (km) East	UTM Location (km) North	Maximum SO2 Emissions (TPY)	Distance to Nearest Class I Receptor (km)
NA	Ridge Cogeneration	416.7	3100.4	480	101
40PNL520042	Stauffer Shutdown	325.6	3116.7	-2263	51
40HIL290039	TECO Big Bend	361.9	3075.0	-104320	93
NA	TECO Polk Power	402.5	3067.4	2009	116
40TPA250015	TPS - Hardee (295 MW)	404.8	3057.3	2412	126
40TPA530050	US Agri-Chem Bartow	413.2	3086.3	-1579	108
40TPA530051	US Agri-Chem Ft Meade	416.0	3069.0	-160	123

Source: KBN, 1994.

Table 5.6.1-4. Summary of Maximum Predicted Impacts for the Proposed Hardee Unit 3, Combined and Simple Cycle--Westinghouse 501F, Distillate Oil at 100 Percent, 75 Percent, and 50 Percent Operating Loads

Pollutant	Averaging Period	Maximum Predicted Impacts (ug/m³) 100 Percent Load 32 °F	100 Percent Load 95 °F	75 Percent Load 32 °F	75 Percent Load 95 °F	50 Percent Load 32 °F	50 Percent Load 95 °F	De Minimis Monitoring Concentration (ug/m³)	Significant Impact Level (ug/m³)
Combined Cycle									
Sulfur Dioxide	3-hour	31.9	48.5	62.1	65.1	60.3	61.7	NA	25
	24-hour	8.3	15.1	21.8	25.3	24.7	27.8	13	5
	Annual	0.16	0.17	0.18	0.17	0.15	0.15	NA	1
Nitrogen Oxides	Annual	0.57	0.39	0.59	0.39	0.52	0.35	14	1
Carbon Monoxide (a)	1-hour	62.4	91.0	137.9	148.6	249.9	255.3	NA	2,000
	8-hour	17.2	30.6	51.8	60.4	105.4	114.9	575	500
Particulate Matter	24-hour	5.5	10.0	14.6	17.3	19.0	21.5	10	5
	Annual	0.11	0.11	0.12	0.12	0.12	0.11	NA	1
Arsenic	24-hour	0.0008	0.0015	0.0021	0.0024	0.0024	0.0027	NE	NA
Beryllium	24-hour	0.0004	0.0007	0.0011	0.0012	0.0012	0.0014	0.001	NA
Sulfuric Acid Mist	24-hour	1.83	3.35	4.84	5.61	5.49	6.18	NM	NA
Simple Cycle									
Sulfur Dioxide	3-hour	9.3	18.6	29.7	36.9	44.4	47.0	NA	25
	24-hour	1.4	3.3	6.1	8.6	11.7	13.7	13	5
	Annual	0.02	0.02	0.02	0.03	0.04	0.05	NA	1
Nitrogen Oxides	Annual	0.07	0.04	0.06	0.06	0.13	0.11	14	1
Carbon Monoxide	1-hour	19.2	33.2	58.6	72.7	159.2	169.4	NA	2,000
	8-hour	3.2	6.3	12.4	16.5	37.6	43.1	575	500
Particulate Matter	24-hour	0.9	2.2	4.1	5.9	9.1	10.6	10	5
	Annual	0.01	0.01	0.01	0.02	0.03	0.04	NA	1
Arsenic	24-hour	0.0001	0.0003	0.0006	0.0008	0.0011	0.0013	NE	NA
Beryllium	24-hour	0.0001	0.0002	0.0003	0.0004	0.0006	0.0007	0.001	NA
Sulfuric Acid Mist	24-hour	0.21	0.51	0.93	1.32	1.80	2.10	NM	NA

Note: NA= not applicable; NM= no ambient measurement method; NE= nomonitoring method yet established.

(a) During power augmentation (80°F), the maximum 1-hour and 8-hour average concentrations are predicted to be 380 and 168 ug/m³, respectivelywith an emission rate of 313.4 lb/hr.

Source: KBN, 1994.

Table 5.6.1-5. Maximum Predicted SO_2 Concentrations Compared With AAQS--Refined Analysis

Averaging Time	Year	Concentration ($\mu g/m^3$) Total	Modeled Sources	Background	Receptor Location[a] Direction (degrees)	Distance (m)	Period Ending (YYMMDDHH)	Florida AAQS ($\mu g/m^3$)
Annual	1984	29	18	11	90	1,000	84--------	60
24-Hour HSH	1983	125	75.1	50	124	175	83020324	260
	1984	138	87.9	50	136	136	84032924	
	1985	138	88.3	50	120	196	85021224	
3-Hour HSH	1982	356	99.6	256	132	146	82011418	1,300
	1984	397	141	256	138	132	84032915	
	1985	406	150	256	16	217	85083121	

Note: YY = year.
MM = month.
DD = day.
HH = hour.
HSH = highest, second-highest.

[a] Relative to the midpoint between the locations of the two proposed HRSG stacks.

Source: KBN, 1994.

Table 5.6.1-6. Maximum Predicted PM10 Concentrations Compared With AAQS--Refined Analysis

Averaging Time	Year	Concentration ($\mu g/m^3$) Total	Modeled Sources	Background	Receptor Location[a] Direction (degrees)	Distance (m)	Period Ending (YYMMDDHH)	Florida AAQS ($\mu g/m^3$)
Annual	1984	24	4	20	336	1,000	84--------	50
	1986	24	4	20	352	1,000	86--------	
24-Hour HSH	1983	101	31	70	30	1,000	83041724	150
	1984	96	26	70	352	800	84030824	

Note: YY = year.
MM = month.
DD = day.
HH = hour.
HSH = highest, second-highest.

[a] Relative to the midpoint between the locations of the two proposed HRSG stacks.

Source: KBN, 1994.

Table 5.6.1-7. Maximum Predicted SO_2 Concentrations Compared with PSD Class II Increments--Refined Analysis

Averaging Time	Modeled Source Concentration ($\mu g/m^3$)	Receptor Location[a] Direction (degrees)	Receptor Location[a] Distance (m)	Period Ending (YYMMDDHH)	Allowable PSD Increment ($\mu g/m^3$)
Annual	-4	90	1,000	85--------	20
24-Hour HSH	45.4	360	203	85083124	91
3-Hour HSH	150	16	217	85083121	512

Note: YY = year.
MM = month.
DD = day.
HH = hour.
HSH = highest, second-highest.

[a] Relative to the midpoint between the locations of the proposed HRSG stacks.

Table 5.6.1-8. Maximum PM10 Concentrations Compared With PSD Class II Increments--Refined Analysis

Averaging Time	Concentration ($\mu g/m^3$)	Receptor Location[a] Direction (degrees)	Receptor Location[a] Distance (m)	Period Ending (YYMMDDHH)	Allowable PSD Increment ($\mu g/m^3$)
Annual	0.6	140	128	84----------	17
24-Hour HSH	14	136	136	84032924	30

Note: YY = year.
MM = month.
DD = day.
HH = hour.
HSH = highest, second-highest.

[a] Relative to the midpoint between the locations of the two proposed HRSG stacks.

Source: KBN, 1994.

Table 5.6.1–9. Summary of Maximum Predicted Impacts for Hardee Unit 3, Combined Cycle, at the PSD Class I Area–Westinghouse 501F, Distillate Oil at 100 Percent, 75 Percent, and 50 Percent Operating Loads

Pollutant	Averaging Period	Maximum Predicted Impacts (ug/m³) 100 Percent Load 32 °F	100 Percent Load 95 °F	75 Percent Load 32 °F	75 Percent Load 95 °F	50 Percent Load 32 °F	50 Percent Load 95 °F	Significant Impact Level (ug/m³)
Combined Cycle								
Sulfur Dioxide	3–hour	1.9	1.8	1.8	1.6	1.4	1.3	0.48
	24–hour	0.30	0.28	0.28	0.25	0.22	0.21	0.07
	Annual	0.012	0.011	0.011	0.010	0.008	0.008	0.025
Nitrogen Oxides	Annual	0.042 (a)	0.026	0.037	0.023	0.029	0.018	0.025
Particulate Matter	24–hour	0.20	0.19	0.19	0.17	0.17	0.16	0.33
	Annual	0.008	0.007	0.007	0.007	0.007	0.006	0.08

(a) Subsequent modeling was performed to account for fuel oil–firing for 1,500 hours and natural gas–firing for 7,260 hours, including 2,000 hours for power augmentation. The maximum annual impact was predicted to be 0.022 ug/m³ by adding: (0.042 ug/m³ x 1,500/8,760 hrs) [oil] + (0.016 ug/m³ x 5,760/8,760 hrs) [gas] + (0.019 ug/m³ x 2,000/8,760 hrs) [power augmentation]. The impacts for other temperatures and operating loads would be lower.

Source: KBN, 1994.

Table 5.6.1-10. Maximum SO_2 Concentrations Compared with PSD Class I Increments

Averaging Time	Concentration ($\mu g/m^3$)	Receptor Location[a] UTM-E (m)	Receptor Location[a] UTM-N (m)	Period Ending (YYMMDDHH)	Allowable PSD Increment ($\mu g/m^3$)
Annual	-0.4	341100	3183400	82--------	2
	-0.6	341100	3183400	83--------	
	0.3	343700	3178300	84--------	
	-0.4	340300	3165700	85--------	
	-0.3	342000	3174000	86--------	
24-Hour HSH	5.7	340700	3171900	82071524	5
	5.4	340300	3165700	83103024	
	5.4	342000	3174000	84061724	
	5.5	340300	3169800	85112724	
	6.4	343000	3176200	86053124	
3-Hour HSH	22.1	340300	3169800	82011724	25
	21.7	340300	3167700	83081006	
	18.4	340300	3169800	84071703	
	21.3	339000	3183400	85110806	
	26.4	341100	3183400	86111706	

Note: YY = year.
MM = month.
DD = day.
HH = hour.
HSH = highest, second-highest.

[a] All receptor coordinates are reported in Universal Transverse Mercator (UTM) coordinates.

Source: KBN, 1994.

Table 5.6.1–11. Predicted 3–Hour and 24–Hour Violations of the SO2 PSD Class I Increments and Source Contributions From Hardee Unit 3

Date Ending		Receptor UTM Location (km)		Predicted Impacts (ug/m³) (a)		
					Contribution from Hardee Unit 3	
Year	Date (MM/DD)	(E)	(N)	Total Impact	ISCST2	MESOPUFF 5.10 (b)
24–Hour						
1982	6/10	340300	3169800	5.45	0.232	0.004
1982	6/10	340300	3167700	5.08	0.216	0.004
1982	7/15	340700	3171900	5.65	0	NA
1982	9/9	340700	3171900	5.27	0.011	NA
1983	7/30	340300	3165700	5.12	0.005	NA
1983	7/30	340300	3167700	5.06	0.005	NA
1983	10/30	340300	3165700	5.39	0	NA
1984	3/23	340300	3169800	5.09	0.024	NA
1984	3/23	340300	3167700	5.20	0.03	NA
1984	6/17	342000	3174000	5.40	0	NA
1985	11/12	340300	3167700	5.48	0	NA
1985	11/12	340700	3171900	5.14	0	NA
1985	11/16	340300	3165700	5.54	0	NA
1985	11/27	340300	3169800	5.55	0	NA
1986	2/1	340300	3165700	5.72	0	NA
1986	2/1	340300	3169800	5.45	0	NA
1986	3/8	343000	3176200	5.11	0	NA
1986	5/31	343000	3176200	6.42	0.217	0.0001
1986	6/1	340700	3171900	5.32	0	NA
1986	6/1	342000	3174000	6.15	0	NA
1986	6/1	343000	3176200	5.56	0	NA
1986	6/14	340300	3167700	5.14	0.150	0.002
1986	6/24	340700	3171900	5.20	0.098	0.001
1986	7/5	342000	3174000	5.46	0.061	NA
1986	7/12	339000	3183400	5.14	0.19	0.0002
1986	9/27	340300	3169800	5.35	0	NA
1986	9/27	340700	3171900	5.22	0	NA
1986	11/5	340700	3171900	5.54	0	NA
1986	11/5	342000	3174000	5.16	0	NA
1986	11/7	340300	3165700	5.26	0.008	NA
1986	11/11	343700	3178300	5.13	0	NA
1986	12/19	342000	3174000	5.20	0.065	NA
1986	12/19	343000	3176200	5.69	0.065	NA
3–Hour						
1986	11/17	341100	3183400	26.4	0.788	0.0002

Note: The 3–hour and 24–hour PSD Class I increments are 25 and 5 ug/m ^3, respectively.

(a) Violations predicted by the ISCST2 model were for the 3–hour and 24–hour averaging times only. No annual violations were predicted.

(b) MESOPUFF results generated only for events where ISCST2 model predicted the proposed facility to have impacts greater than the National Park Service Recommended Significance Levels for the 3–hour (0.48 ug/m ^3) and 24–hour (0.07 ug/m ^3) averaging periods.

Source: KBN, 1994.

Table 5.6.1−12. Summary of PSD Class I SO2 Impacts for the Proposed Hardee Unit 3 and Other PSD Sources

Averaging Period	ISCST2 Model Results: Exceedances Number	Exceedances Periods	Violations Number	Violations Periods	Violations with Sig. Impact from Proposed Unit: Number	Periods	Total (ug/m^3)	Proposed (ug/m^3)	MESOPUFF Modeling for ISCST Periods(a) (Violations and Prop. Sig. Imp.) Proposed Only(b) (ug/m^3)
24−hour									
1982	9	5	4	3	2	1	5.08	0.216	0.004
							5.45	0.232	0.004
1983	8	5	3	2	0	0	NA	NA	NA
1984	9	5	3	2	0	0	NA	NA	NA
1985	8	4	4	3	0	0	NA	NA	NA
1986	30	14	19	13	4	4	6.42	0.217	0.0001
							5.14	0.150	0.002
							5.20	0.098	0.001
							5.14	0.190	0.0002
3−hour									
1982	2	1	0	0	0	0	NA	NA	NA
1983	0	0	0	0	0	0	NA	NA	NA
1984	0	0	0	0	0	0	NA	NA	NA
1985	5	1	0	0	0	0	NA	NA	NA
1986	4	3	1	1	1	1	26.4	0.79	0.0002

(a) The periods in MESOPUFF included 3 days before and 2 days after the violation period identified in ISCST.
(b) For 1986, the proposed source was also modeled in MESOPUFF for the entire year.
The proposed source was predicted to have a significant impact for one 24−hour period (0.099 ug/m^3) and no 3−hour periods.
By modeling all sources for that one 24−hour period, the highest impact was predicted to be −5.4 ug/m^3
(modeling was based on ISCST2 model results for sources within 50 km, MESOPUFF results for sources beyond 50 km of the Class I area).

Table 5.6.1–13. Toxic Air Pollutant Impact Analysis for Hardee Unit 3––Maximum Concentrations

Constituent	Averaging Period	Predicted Impacts (ug/m³) Base Load 32 °F	Base Load 95 °F	75 Percent Load 32 °F	75 Percent Load 95 °F	50 Percent Load 32 °F	50 Percent Load 95 °F	Florida NTL (ug/m³)
Generic	Annual	6.50E–02	7.80E–02	8.80E–02	9.70E–02	1.03E–01	1.15E–01	NA
	24–hour	3.27E+00	7.03E+00	1.07E+01	1.46E+01	1.68E+01	2.17E+01	NA
	8–Hour	7.51E+00	1.60E+01	2.39E+01	3.15E+01	3.57E+01	4.44E+01	NA
Arsenic	Annual	1.58E–05	1.61E–05	1.73E–05	1.63E–05	1.45E–05	1.42E–05	2.30E–04
	24–hour	7.95E–04	1.45E–03	2.10E–03	2.45E–03	2.37E–03	2.68E–03	4.80E–01
	8–Hour	1.83E–03	3.31E–03	4.70E–03	5.28E–03	5.04E–03	5.48E–03	2.00E+00
Beryllium	Annual	8.07E–06	8.24E–06	8.80E–06	8.30E–06	7.44E–06	7.24E–06	4.20E–04
	24–hour	4.06E–04	7.42E–04	1.07E–03	1.25E–03	1.21E–03	1.37E–03	4.80E–03
	8–Hour	9.33E–04	1.69E–03	2.39E–03	2.69E–03	2.58E–03	2.80E–03	2.00E–02
Fluoride	Annual	1.05E–04	1.07E–04	1.14E–04	1.08E–04	9.68E–05	9.43E–05	NA
	24–hour	5.27E–03	9.65E–03	1.39E–02	1.62E–02	1.58E–02	1.78E–02	6.00E+00
	8–Hour	1.21E–02	2.20E–02	3.10E–02	3.50E–02	3.36E–02	3.64E–02	2.50E+01
Mercury	Annual	2.84E–05	2.90E–05	3.09E–05	2.92E–05	2.62E–05	2.55E–05	3.00E–01
	24–hour	1.43E–03	2.61E–03	3.76E–03	4.40E–03	4.28E–03	4.81E–03	1.20E–01
	8–Hour	3.28E–03	5.95E–03	8.40E–03	9.49E–03	9.09E–03	9.85E–03	5.00E–01
Sulfuric acid	Annual	3.64E–02	3.71E–02	3.97E–02	3.74E–02	3.36E–02	3.27E–02	NA
	24–hour	1.83E+00	3.35E+00	4.83E+00	5.63E+00	5.48E+00	6.18E+00	2.40E+00
	8–Hour	4.21E+00	7.63E+00	1.08E+01	1.21E+01	1.16E+01	1.26E+01	1.00E+01
Antimony	Annual	7.06E–05	7.19E–05	7.69E–05	7.25E–05	6.50E–05	6.33E–05	3.00E–01
	24–hour	3.55E–03	6.48E–03	9.35E–03	1.09E–02	1.06E–02	1.19E–02	1.20E+00
	8–Hour	8.15E–03	1.48E–02	2.09E–02	2.35E–02	2.25E–02	2.44E–02	5.00E+00
Barium	Annual	6.31E–05	6.43E–05	6.87E–05	6.48E–05	5.81E–05	5.66E–05	5.00E+01
	24–hour	3.17E–03	5.79E–03	8.36E–03	9.75E–03	9.47E–03	1.07E–02	1.20E+00
	8–Hour	7.29E–03	1.32E–02	1.87E–02	2.10E–02	2.01E–02	2.18E–02	5.00E+00
Cadmium	Annual	3.39E–05	3.46E–05	3.70E–05	3.48E–05	3.12E–05	3.04E–05	5.60E–04
	24–hour	1.71E–03	3.12E–03	4.50E–03	5.24E–03	5.09E–03	5.74E–03	1.20E–01
	8–Hour	3.92E–03	7.10E–03	1.00E–02	1.13E–02	1.08E–02	1.17E–02	5.00E–01
Chlorine	Annual	8.21E–05	8.36E–05	8.95E–05	8.43E–05	7.56E–05	7.36E–05	4.00E–01
	24–hour	4.13E–03	7.54E–03	1.09E–02	1.27E–02	1.23E–02	1.39E–02	3.60E+00
	8–Hour	9.48E–03	1.72E–02	2.43E–02	2.74E–02	2.62E–02	2.84E–02	1.50E+01

Table 5.6.1–13. Toxic Air Pollutant Impact Analysis for Hardee Unit 3––Maximum Concentrations

Constituent	Averaging Period	Predicted Impacts (ug/m³) Base Load 32 °F	Base Load 95 °F	75 Percent Load 32 °F	75 Percent Load 95 °F	50 Percent Load 32 °F	50 Percent Load 95 °F	Florida NTL (ug/m³)
Chromium	Annual (a)	2.63E–05	2.68E–05	2.86E–05	2.70E–05	2.42E–05	2.36E–05	8.30E–05
	24–hour	7.72E–03	1.41E–02	2.03E–02	2.37E–02	2.30E–02	2.60E–02	1.20E–01
	8–Hour	1.77E–02	3.21E–02	4.54E–02	5.12E–02	4.90E–02	5.31E–02	5.00E–01
Cobalt	Annual	2.93E–05	2.98E–05	3.19E–05	3.01E–05	2.70E–05	2.63E–05	NA
	24–hour	1.47E–03	2.69E–03	3.88E–03	4.52E–03	4.40E–03	4.96E–03	1.20E–01
	8–Hour	3.38E–03	6.13E–03	8.67E–03	9.76E–03	9.34E–03	1.01E–02	5.00E–01
Copper	Annual	4.20E–03	4.28E–03	4.58E–03	4.31E–03	3.87E–03	3.77E–03	NA
	24–hour	2.11E–01	3.86E–01	5.57E–01	6.49E–01	6.31E–01	7.11E–01	4.80E–01
	8–Hour	4.85E–01	8.80E–01	1.24E+00	1.40E+00	1.34E+00	1.45E+00	2.00E+00
Formaldehyde	Annual	1.31E–03	1.33E–03	1.43E–03	1.34E–03	1.20E–03	1.17E–03	7.70E–02
	24–hour	6.58E–02	1.20E–01	1.73E–01	2.02E–01	1.96E–01	2.21E–01	2.88E+00
	8–Hour	1.51E–01	2.74E–01	3.87E–01	4.36E–01	4.18E–01	4.53E–01	1.20E+01
Manganese	Annual	1.10E–03	1.12E–03	1.20E–03	1.13E–03	1.01E–03	9.85E–04	4.00E–01
	24–hour	5.52E–02	1.01E–01	1.46E–01	1.70E–01	1.65E–01	1.86E–01	1.20E+01
	8–Hour	1.27E–01	2.30E–01	3.25E–01	3.66E–01	3.50E–01	3.80E–01	5.00E+01
Nickel	Annual (a)	6.63E–04	6.76E–04	7.23E–04	6.82E–04	6.11E–04	5.95E–04	4.20E–03
	24–hour	1.95E–01	3.56E–01	5.14E–01	6.00E–01	5.82E–01	6.56E–01	2.40E+00
	8–Hour	4.48E–01	8.11E–01	1.15E+00	1.29E+00	1.24E+00	1.34E+00	1.00E+01
Polycyclic Organic Matter	Annual	8.98E–07	9.15E–07	9.79E–07	9.22E–07	8.27E–07	8.06E–07	NA
	24–hour	4.52E–05	8.25E–05	1.19E–04	1.39E–04	1.35E–04	1.52E–04	NA
	8–Hour	1.04E–04	1.88E–04	2.66E–04	2.99E–04	2.87E–04	3.11E–04	NA
Selenium	Annual	7.56E–05	7.71E–05	8.25E–05	7.77E–05	6.97E–05	6.79E–05	NA
	24–hour	3.81E–03	6.95E–03	1.00E–02	1.17E–02	1.14E–02	1.28E–02	2.00E+00
	8–Hour	8.74E–03	1.58E–02	2.24E–02	2.52E–02	2.41E–02	2.62E–02	4.80E–01
Vanadium	Annual	2.24E–04	2.29E–04	2.45E–04	2.31E–04	2.07E–04	2.01E–04	2.00E+01
	24–hour	1.13E–02	2.06E–02	2.98E–02	3.47E–02	3.37E–02	3.80E–02	1.20E–01
	8–Hour	2.59E–02	4.70E–02	6.65E–02	7.49E–02	7.16E–02	7.78E–02	5.00E–01
Zinc	Annual	5.10E–03	5.20E–03	5.57E–03	5.24E–03	4.70E–03	4.58E–03	NA
	24–hour	2.57E–01	4.69E–01	6.77E–01	7.89E–01	7.66E–01	8.64E–01	NA
	8–Hour	5.89E–01	1.07E+00	1.51E+00	1.70E+00	1.63E+00	1.77E+00	NA

(a) Based on firing fuel oil for 1,500 hours (for other pollutants, fuel oil was assumed to be fired for entire year).

Source: KBN, 1994

Table 5.6.1-14. Examples of Lowest Observed Effect Levels of Air Pollutants

Pollutant	Reported Effect	Concentration ($\mu g/m^3$)	Exposure
Sulfur Dioxide	Respiratory stress in guinea pigs	427 to 854	1 hour
	Respiratory stress in rats	267	7 hours/day[a]; 5 day/week for 10 weeks
	Decreased abundance in deer mice	13-157	continually[b] for 5 months
Nitrogen Dioxide	Respiratory stress in mice	1,917	3 hours
	Respiratory stress in guinea pigs	95 to 950	8 hr/day for[a] 122 days

[a] Used to compare as a range between 3-hour and 24-hour averaging times.
[b] Used to compare with annual averaging times.

Source: Adapted from Newman (1981) and Newman and Schreiber (1988)

Table 5.6.1-15. NO_2 Doses Reported to Affect Plant Species Similar to Vegetation in the Region of Hardee Unit 3

Species	Dose and Effect	Reference
Ryegrass	39.5 $\mu g/m^3$ for 6 minutes had no effect on shoot weight	Lane and Bell, 1984
Citrus	470 $\mu g/m^3$ for 290 days injured trees	Thompson *et al.*, 1970
Sphagnum	11.7 $\mu g/m^3$ averaged over 18 months compared with control of 4.8 $\mu g/m^3$ (exceeded 15 $\mu g/m^3$ 4 times) reduced growth	Press *et al.*, 1986

Source: KBN, 1994.

Table 5.6.1-16. Summary of Maximum Predicted Impacts for Hardee Unit 3 at PSD Class I Area for the AQRV Analysis

		Maximum Predicted Impacts ($\mu g/m^3$)		
Pollutant	Averaging Period	Project Only	Background Concentration	Total
Combined Cycle				
Sulfur Dioxide	1-Hour	2.9	335	337.9
	3-Hour	1.9	335	336.9
	8-Hour	1.0	335	336.0
	24-Hour	0.30	67	67.3
	Annual	0.012	7	7.0
Nitrogen Dioxides	Annual	0.042	NA	NA
Particulate Matter	24-Hour	0.20	NA	NA
	Annual	0.008	NA	NA

Source: KBN, 1994.

5.6.2 MONITORING PROGRAMS

5.6.2.1 POST-CONSTRUCTION AMBIENT AIR QUALITY MONITORING

Post-construction ambient air quality monitoring is not anticipated to be required for this project since the air quality analyses demonstrate that the proposed project will comply with all applicable ambient standards.

5.6.2.2 CONTINUOUS AIR EMISSIONS MONITORING

The Hardee Unit 3 Project will be subject to 40 CFR 60, GG. Continuous monitoring of fuel consumption and ratio of water to fuel oil being fired in the turbines will be conducted as requested by Subpart GG, Section 60.334(b). Initial performance testing of the CTs for NO_x and SO_2 emissions will be conducted as stipulated by Subpart GG, Section 60.335.

Initial and periodic performance testing of pollutants emitted by the facility will be conducted pursuant to FDEP and federal requirements. FDEP test methods are specified in Chapter 17-297, F.A.C.

Continuous emission monitoring for NO_x and SO_2 is required for the project because the combustion turbines are defined as new units in EPA's Acid Rain Program. The Acid Rain Program was delineated in Title IV of the CAA Amendments and required EPA to develop the program. EPA's final regulations were promulgated on January 11, 1993, and included permit provisions (40 CFR Part 72), allowance system (Part 73), continuous emission monitoring (Part 75), excess emission procedures (Part 77), and appeal procedures (Part 78).

Under 40 CFR Part 75, specific provisions for monitoring SO_2 emissions (Part 75.11) and NO_2 emissions (Part 75.12) are identified for gas-fired and oil-fired (nonpeaking) units. When an SO_2 CEM is selected to determine mass SO_2 emissions, a flow monitor is also required. Alternatively, SO_2 emissions may be determined using procedures established in Appendix D, Part 75 (flow proportional oil sampling or manual daily oil sampling). For determining NO_x emission, a diluent gas monitor in the NO_x monitoring system may measure either O_2 or CO_2 concentration in the flue gases. CO_2 emissions must also be determined either through a continuous emission monitoring (as a diluent for NO_x monitoring) or calculation. Alternate procedures, test methods, and quality assurance and control procedures are specified in Part 75, Appendices A through I. New units are required to meet the requirements by January 1, 1995, or not later than 90 days after the unit commences commercial operation. The expected inservice date for Hardee Unit 3 is January 1, 1999.

5.7 NOISE IMPACTS

5.7.1 IMPACTS TO ADJACENT PROPERTIES

The noise monitoring data collected during the onsite field sampling effort were utilized in the noise impact analysis at the proposed property boundaries. The impact analysis was performed using NOISECALC (NYDPS, 1986), a sound propagation computer program. (See Appendix 11.7 for a brief discussion of NOISECALC's modeling criteria and data output.)

EPA has developed indoor and outdoor noise level criteria for various land use categories that were promulgated as a guideline for protecting public health and welfare (Table 5.7.1-1). These criteria are related to short-term sound pressure level (SPL) measurement periods, i.e., 24-hour equivalent SPL [L_{eq} (24)] and day-night average SPL (L_{dn}). The L_{eq} is the equivalent constant SPL that would be equal in sound energy to the varying SPL over the same period of time. The L_{dn} is the 24-hour average SPL calculated for the two daily time periods, i.e., day and night, with a 10 dBA weighting added to the 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: L_d = daytime L_{eq} for the period from 0700 to 2200 hours, and
L_n = nighttime L_{eq} for the period from 2200 to 0700 hours.

EPA recommends an outdoor L_{eq}(24) of 70 dBA for general unpopulated lands and an outdoor L_{dn} of 55 dBA for residential areas. As stated in Section 2.3.8, neither Polk County nor Hardee County has a noise standard applicable to the receiving lands adjacent to the Hardee Unit 3 site.

Table 5.7.1-2 presents the proposed facility's octave band input data, based upon preliminary engineering design information, that was used in the NOISECALC program. Noise impacts were predicted at each of the receiver sites depicted in Figure 5.7.1-1. The program calculated SPLs due to the proposed facility, utilizing the onsite background and minimum L_{eq} noise levels, (Tables 5.7.1-3 and 5.7.1-4, respectively). As indicated, the maximum calculated SPL impact with the background levels taken into account was 64.6 dBA at Receiver Site B for background L_{eq} and 64.5 dBA at Receiver Site B for minimum background. The minimum predicted SPL impacts occurred at Receiver Site F (residences) with a value of 47.2 dBA for minimum and L_{eq} background.

The overall predicted noise impacts of the proposed facility at the property boundary are below the EPA guideline value of 70 dBA. Since attenuation factors, such as ground cover, foliage, etc., were not used in determining the noise impacts, the actual impact of the proposed facility at the property boundary will most likely be less than predicted by the model.

Predicted noise levels at the nearest residential area are expected to be slightly above background levels. Assuming a noise level of 47.2 dBA for daytime and nighttime, the corresponding calculated L_{dn} value is 53.6 dBA, which is below the EPA guideline of 55 dBA for residential areas.

Table 5.7.1-1. EPA-Recommended Noise Criteria

		Indoor			Outdoor		
	Measure[a]	Activity Inter-ference	Hearing Loss Considera-tion	To Protect Against Both Effects (b)	Activity Inter-ference	Hearing Loss Considera-tion	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)

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 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., no greater than an L_{eq} of 60 dB.

[a] L_{dn} is the day-night average A-weighted equivalent sound level, with a 10-decibel weighting applied to nighttime levels. L_{eq} (24) is the equivalent A-weighted sound level over 24 hours.

Source: EPA, 1974.

Table 5.7.1-2. Summary of Sound Power Levels of Major Noise Sources for Use in the Noise Impact Analysis

Source	Source Location[a] X (m)	Source Location[a] Y (m)	Source Height[b] (m)	Sound Power Level (dB) for Octave Band Center Frequency (Hz) 31.5	63	125	250	500	1K	2K	4K	8K	Overall Sound Power Level (dBA)
Transformer (North CT)	70.8	47.7	3.1	102	108	110	105	107	99	94	89	82	106.4
Transformer (Steam Turbine)	70.1	0.0	3.1	102	108	110	105	107	99	94	89	82	106.4
Transformer (South CT)	70.1	-29.8	3.1	102	108	110	105	107	99	94	89	82	106.4
HRSG (North)	-12.5	40.8	13.3	140	134	132	125	121	114	113	117	108	124.3
HRSG (South)	-12.9	-37.5	13.3	140	134	132	125	121	114	113	117	108	124.3
CT Air Inlet (North)	52.8	30.5	12.2	116	114	112	102	106	108	107	103	105	113.1
CT Air Inlet (South)	52.9	-46.0	12.2	116	114	112	102	106	108	107	103	105	113.1
Generator (North CT)	55.2	48.0	1.5	107	115	122	109	101	108	103	99	98	112.1
Generator (Steam Turbine)	45.7	0.0	1.5	107	115	122	109	101	108	103	99	98	112.1
Generator (South CT)	52.8	-30.5	1.5	107	115	122	109	101	108	103	99	98	112.1
CT Enclosure (North)	32.6	40.3	8.8	111	109	102	96	102	92	95	105	98	107.7
CT Enclosure (South)	34.7	-38.5	8.8	111	109	102	96	102	92	95	105	98	107.7
Mechanical Package (North CT)	38.4	47.4	1.5	110	109	111	102	100	97	97	98	92	104.9
Mechanical Package (South CT)	38.4	-30.0	1.5	110	109	111	102	100	97	97	98	92	104.9
Steam Turbine	33.5	0.0	4.6	113	117	118	115	114	116	114	114	113	121.4
Water Treatment Building	121.3	81.8	6.1	91	99	89	95	87	71	69	60	49	88.7
Circulating Water Pump	-562.5	109.3	4.9	98	103	102	101	100	99	101	97	92	105.9

Note: Data based on representative values for base design equipment.

[a] Relative to a grid center location at the general services building.
[b] Represents the noise source height used for noise modeling purposes.

Sources: Black & Veatch, 1994.
KBN, 1994.

Table 5.7.1-3. Impact Results Using Average L_{eq} Background Values (all values dBA)

Receiver Site	Description	Background[a]	Proposed Facility w/o Background	Proposed Facility w/Background
A	North Boundary of Proposed Site	47.2	64.2	64.3
B	East Boundary of Proposed Site	48.7	64.5	64.6
C	Southeast Boundary of Proposed Site	48.7	56.5	57.2
D	South Boundary of Proposed Site	42.0	54.7	55.0
E	West Boundary of Proposed Site	42.0	57.5	57.6
F	South of Proposed Site (@ Residences)	43.9[b]	44.4	47.2

[a] Average values of collected data.
[b] Background value based on a previous analyses for predicted noise levels due to the existing Hardee Power Station.

Source: KBN, 1994.

Table 5.7.1-4. Impact Results Using Average Minimum Background Values (all values dBA)

Receiver Site	Description	Background[a]	Proposed Facility w/o Background	Proposed Facility w/Background
A	North Boundary of Proposed Site	44.4	64.2	64.3
B	East Boundary of Proposed Site	45.8	64.5	64.5
C	Southeast Boundary of Proposed Site	45.8	56.5	56.9
D	South Boundary of Proposed Site	39.6	54.7	54.9
E	West Boundary of Proposed Site	39.6	57.5	57.6
F	South of Proposed Site (@ Residences)	43.9[b]	44.4	47.2

[a] Average values of collected data.
[b] Background value based on a previous analyses for predicted noise levels due to the existing Hardee Power Station.

Source: KBN, 1994.

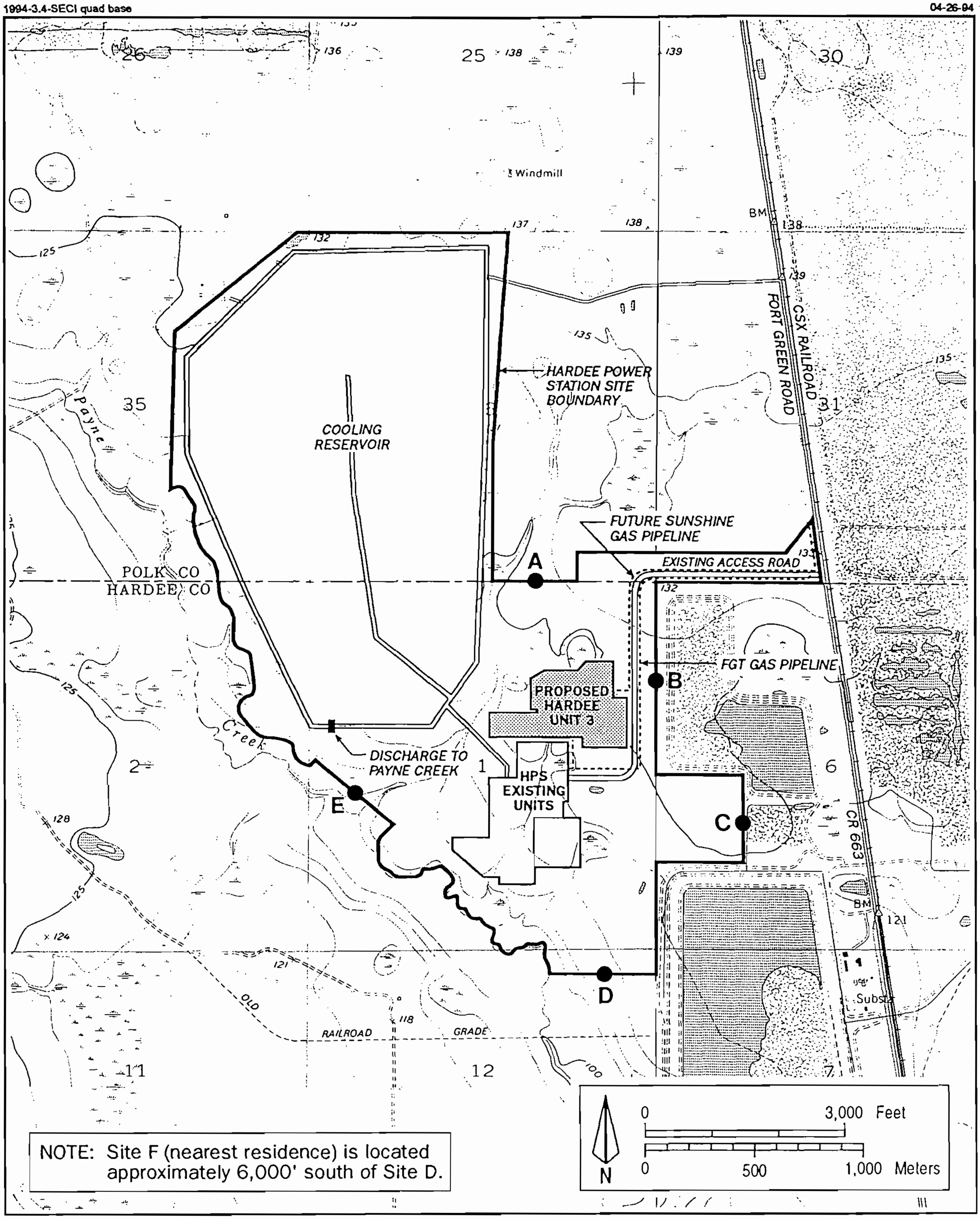

Figure 5.7.1-1
Receiver Sites Used for the Operational Noise Impact Analysis

Sources: USGS, 1987; KBN, 1994.

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5.7.2 IMPACT TO BIOTA

The projected noise from plant operation will not have any effect on surrounding biota. Wildlife species in the area have been exposed to similar noise conditions from mining, from operation of the HPS facility, and from other industrial activities in this region for years.

5.8 CHANGES TO NON-AQUATIC SPECIES POPULATION

5.8.1 FLORA

Potential impacts to onsite and regional vegetation due to plant operation are limited since the proposed facility will use the existing cooling reservoir for condenser cooling and the facility will be constructed on previously impacted and cleared land.

Operation of the condenser cooling system for the proposed facility will not require any significant changes in the current operational procedures for the existing cooling reservoir. The frequency and duration of discharges from the cooling reservoir will not be altered as a result of the Hardee Unit 3 Project. No additional impacts to onsite or regional vegetation or wetlands will result from the condenser cooling system for the proposed facility. The circulation water pipeline will cross the unnamed tributary immediately west of the proposed facility but will be elevated above ground level and will not significantly impede water flow. Vegetation immediately adjacent to the circulating water pipelines will be maintained at a maximum height of 46 cm (18 inches) in the wetland.

Non-contact stormwater runoff from the Hardee Unit 3 facility will be directed to the stormwater detention pond for treatment prior to discharge to the unnamed wetland tributary to Payne Creek. The point of discharge from the detention pond will be constructed (e.g., weir, riprap, etc.) and operated in a manner that controls erosion and scouring of the adjacent wetlands. Impacts to the unnamed tributary and adjacent wetlands associated with the discharge of non-contact stormwater runoff will be minimal. This tributary will serve as a drainageway during preconstruction activities and will continue to function in the same manner following construction of the proposed facility. Offsite wetlands will not be affected by operation of the Hardee Unit 3 facility.

The temperature of the cooling reservoir will increase slightly as a result of the thermal input from the proposed facility. Average temperatures on the cool side of the reservoir will not change significantly from current conditions. The maximum worst-case monthly discharge condition is predicted to be 35.4°C (95.7°F). Levitt (1972) reported that many species can endure temperatures of 35 to 45°C (96 to 113°F) but are killed by a temperature of 45 to 46°C (113 to 115°F). The effects of heated effluent on wetland vegetation have been reported by researchers at the Savannah River Plant in South Carolina. *Ludwigia leptocarpa*, a herbaceous semi-aquatic species, exhibited higher seed production and shoot height in thermally altered sites than in a control site. Under controlled temperatures in a growth chamber, shoot height and plant biomass were higher at 32°C (89.6°F) and lower at 42°C (107.6°F) than the 22°C (71.6°F) control plants (Christy and Sharitz, 1980). Donovan *et al.* (1988) studied growth of bald cypress, water tupelo, black willow, and button bush seedlings under various water temperature and flooding regimes. Growth with water temperatures about 5°C (9°F) higher than ambient temperatures was similar to growth with ambient water temperatures. However, growth in saturated or flooded conditions with water temperatures about 10°C (18°F) higher than ambient temperatures [ranging from 28 to 45°C (82 to 113°F) throughout the year] resulted in detrimental effects to all species. Since the water temperature in a limited section (mixing zone) of Payne Creek during high-flow conditions is not expected to exceed 35.4°C (95.7°F) even under worst-case conditions, no damage to floodplain vegetation is expected from the discharge from the cooling reservoir.

Discharge pipes crossing the unnamed tributary will transport circulating water to and from the condenser cooling system and treated low-volume plant wastewater. Both the circulating water pipes and the low-volume wastewater pipes will be elevated above the tributary and associated wetland and will not restrict water flow.

The circulating water pipes are planned to consist of 84-inch-diameter prestressed concrete cylinder pipe. The concrete cylinder pipe will be provided with a concrete-encased 16-gage steel cylinder core. Individual segments of the concrete pipe will be joined using O-rings and then grouted to ensure the integrity of the joint. Studies of the reliability of the proposed prestressed concrete pipe show this material to be very durable and the potential for failure to be extremely low. The practice of grouting the joints will provide sufficient protection against corrosion, and the placement of the pipes aboveground at the tributary crossing will allow for visual inspection on a regular basis.

The wastewater piping will be constructed of 10-inch-diameter fiberglass reinforced pipe (FRP), "Bondstrand 2000" or equivalent. This material was specifically selected to eliminate the possibility of corrosion and is the same material used for the wastewater piping for the HPS existing units. The wastewater piping for the Hardee Unit 3 facility will be installed aboveground and will be provided with expansion joints at required intervals to account for thermal expansion.

The aboveground placement of the wastewater pipes will allow visual inspection on a regular basis.

The selection of the noncorrosive FRP construction material for the wastewater piping, combined with the use of expansion joints and the ability for visual inspection of the pipe, effectively eliminates the potential for a significant impact to the onsite wetland crossing. All wastewater will be treated prior to being routed to the cooling reservoir. In the unlikely event a leak is detected in one of the circulating pipes or the low-volume wastewater pipe, appropriate measures will be taken to stop the leak and prevent damage to the tributary and its associated wetlands.

5.8.2 FAUNA

The existing cooling reservoir is used for foraging and resting habitat by wading birds and other avian species as well as mammals, reptiles, and amphibians. No adverse impacts will occur to fauna utilizing the cooling reservoir as a result of the additional thermal loading from Hardee Unit 3.

Operational activities within the fenced area of the Hardee Unit 3 facility will preclude wildlife from the immediate area. Wildlife associated with the unnamed tributary to Payne Creek will have access to the tributary from the north since all facilities associated with the Hardee Unit 3 Project will be located south of the tributary.

5.9 TRANSPORTATION IMPACTS AND OTHER PLANT OPERATION EFFECTS

The construction activities associated with the Hardee Unit 3 site are expected to be completed in early 1999, and the commencement of the plant operation activities will take place immediately thereafter. The analysis of transportation impacts on the surrounding roadway network was conducted to reflect 1999 conditions.

Operation of Hardee Unit 3 will require approximately 35 employees working three shifts daily. Similar to the construction effort, it is anticipated that most of the operating jobs will be filled by people residing within commuting distance of the plant. Eighty-five percent of the operational workforce is expected to reside in areas north of the plant with the remaining 15 percent commuting from areas south of the plant site.

For determining the operational traffic impact area (TIA), a vehicle occupancy rate of 1 employee per vehicle was assumed. It was also assumed that two shifts were arriving and departing simultaneously during the p.m. peak hour. The total number of vehicles arriving or departing the site is estimated to be 24. The same methodology as identified in Section 4.6.3 was used to determine the project TIA. The results of the analysis are listed in Table 5.9.0-1. Only two roadway links are located in the operational TIA:

Fort Green Road

Polk County Line (HPS Site Entrance) to CR 630

CR 663

Hardee County Line (HPS Site Entrance) to SR 62

To analyze the affected links, existing traffic counts were projected to reflect 1999 traffic volumes. As discussed in Section 4.6.3, a 2.1 percent annual growth rate compounded annually was added to the current traffic counts to reflect the 1999 estimates. After the background traffic was calculated, traffic expected to use these links as identified in the TECO and FPC project documents was added to the background traffic. The project's operational workforce traffic was subsequently added to the background traffic to obtain the 1999 projected conditions with project traffic. The results of this analysis are listed in Table 5.9.0-2. The affected links are expected to operate at LOS A.

The two intersections associated with these links were also analyzed as previously described in Section 4.6.3, and the results are provided in Table 5.9.0-3. Both intersections are expected to operate at an acceptable LOS (i.e., LOS C or higher).

In addition to the peak-hour evaluation, total project operational trip generation data were calculated for the Hardee Unit 3 Project. Table 5.9.0-4 identifies the total number of daily trip ends associated with the project.

As previously identified in Section 2.2.2, only Polk County currently has a formal concurrency determination review process. A copy of the completed minor traffic review application required in Polk County Ordinance 92-10 is included in Appendix 10.13 for informational purposes. Since no formal review process exists in Hardee County at the current time, this discussion in conjunction with FPPSA will demonstrate compliance with Hardee County's concurrency requirements.

Table 5.9.0-1. Percent of Project Traffic on the Operation Traffic Impact Area

Roadway	Hardee County[a] LOS C	Polk County LOS C	FDOT LOS C	Project Traffic	Percent of LOS C Impact
CR 663					
HPS Entrance to SR 62	460	NA	NA	4	0.9
Fort Green Road					
HPS Entrance to CR 630	NA	540	NA	24	4.4

[a] For peak-hour roadway capacities, Hardee County uses FDOT's Generalized Roadway Planning Capacities.

Sources: FDOT, 1992.
Polk County, 1992.
KBN, 1994.

Table 5.9.0-2. Peak-Hour p.m. Link Analysis for Operation Traffic

Link	1999 Background Traffic	FPC Traffic	TECO Traffic	Project Traffic	Total Traffic	Level of Service
POLK COUNTY						
Fort Green Road						
HPS to CR 630	72	0	4	24	100	A
HARDEE COUNTY						
CR 663						
HPS to SR 62	126	0	0	4	130	A

Sources: TECO, 1992.
FPC, 1992.
HCS, 1985.
KBN, 1994.

Table 5.9.0-3. 1999 Operation--p.m. Peak-Hour Intersection Analysis

Intersection	Lowest LOS per Intersection Movement 1999 Background Level of Service	 1999 Project Level of Service
POLK COUNTY		
CR 630 and Fort Green Road	B	C
HARDEE COUNTY		
CR 663 and SR 62	A	A

Note: All intersections were analyzed using non-signalized intersection methodology.

Sources: Transportation Research Board/National Research Council, 1985.
KBN, 1994.

Table 5.9.0-4. Estimated Operation Project Average Daily Traffic

Traffic Type	Trip Rate	Daily Trip Ends
Employees (35)	2.35 trips per Employee[a]	83
Fuel Oil Trucks (13)	2.0 trips per Truck	26
TOTAL		109

[a] Trip generation rate obtained from FPC and TECO studies referencing a Kimley-Horn Report for FPL power plant in Martin County, Florida.

Source: KBN, 1994.

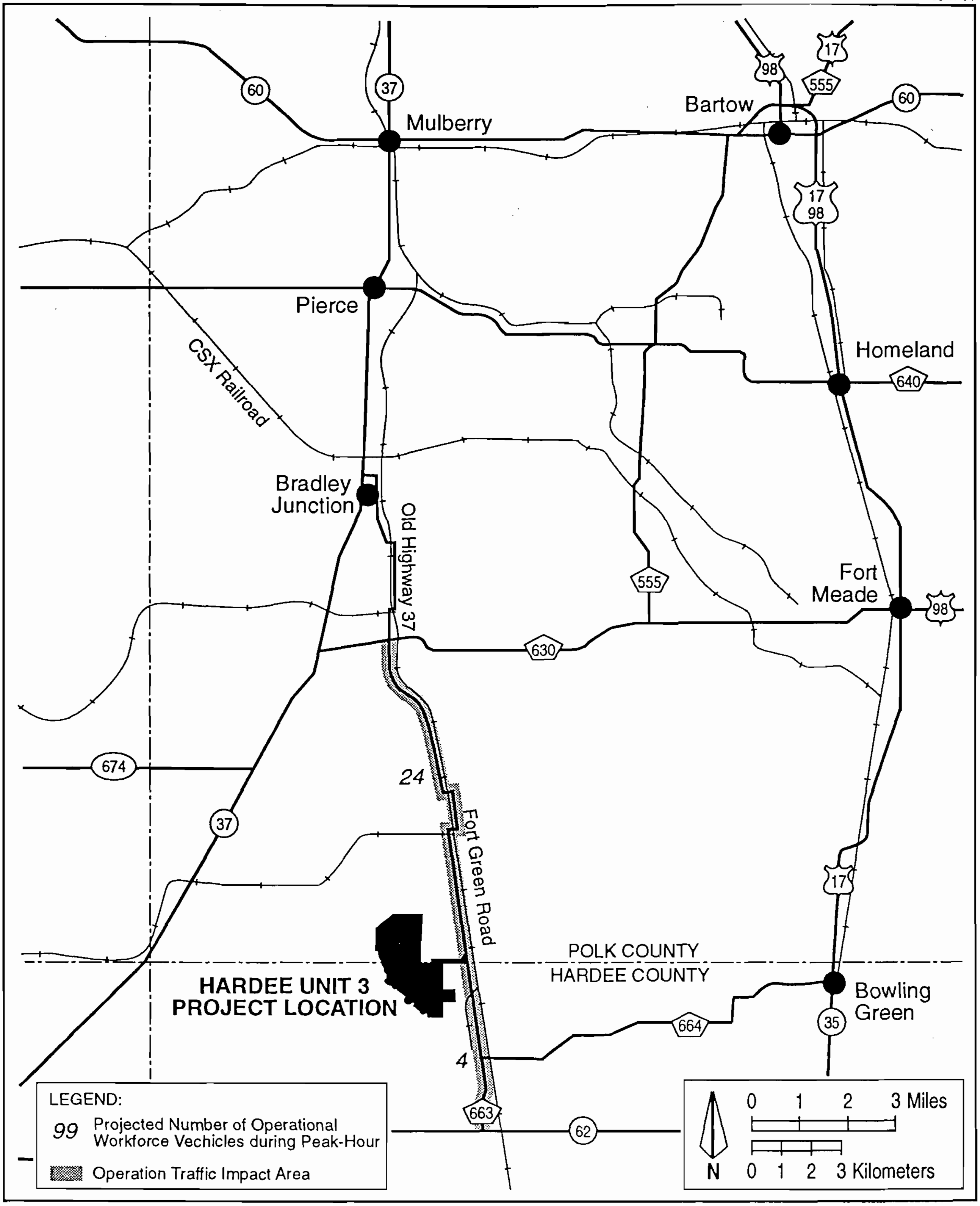

Figure 5.9.0-1
Hardee Unit 3 Peak-Hour Operation Traffic

Source: KBN, 1994.

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5.10 ARCHAEOLOGICAL SITES

No significant archaeological and historic site or sites recommended for preservation occur on the HPS site (see Section 2.2.6). In addition, DHR has been contacted regarding this project and concluded that the project can proceed without any further involvement with DHR and no additional studies are required (see Appendix 10.6).

Because of the lack of archaeological sites within the HPS site and the opinion of DHR, no active, onsite post-construction monitoring is planned. However, if any cultural resources are discovered, the Applicant will implement the "chance-find" procedures described in Section 4.8.

5.11 RESOURCES COMMITTED

The major irreversible and irretrievable commitments of national, state, and local resources due to operation of Hardee Unit 3 are the use of land and the consumption of water, natural gas, and fuel oil.

The land areas used by the Hardee Power Station have mostly been mined and reclaimed to pasture. The Hardee Unit 3 project will use those previously mined lands for energy production.

Some groundwater and surface water will be consumed (i.e., evaporated) in the operation of the cooling reservoir (see Section 5.3). However, no additional groundwater allocation will be required for operation of Hardee Unit 3. No short- or long-term impacts to local surface water and groundwater resources or water users are anticipated from the proposed water use by the Hardee Unit 3 Project.

Natural gas and fuel oil will be consumed as fuel. The amounts are described in Chapter 3.0. This is an irreversible and irretrievable commitment of national energy resources for the production of electricity for the state of Florida.

5.12 VARIANCES

A mixing zone and zone of discharge will be required for specific surface water and groundwater parameters, as discussed in Sections 5.1.1 and 5.2.1, consistent with the previously approved mixing zone and zone of discharge for the HPS site. No variances will be required for the operation of Hardee Unit 3.

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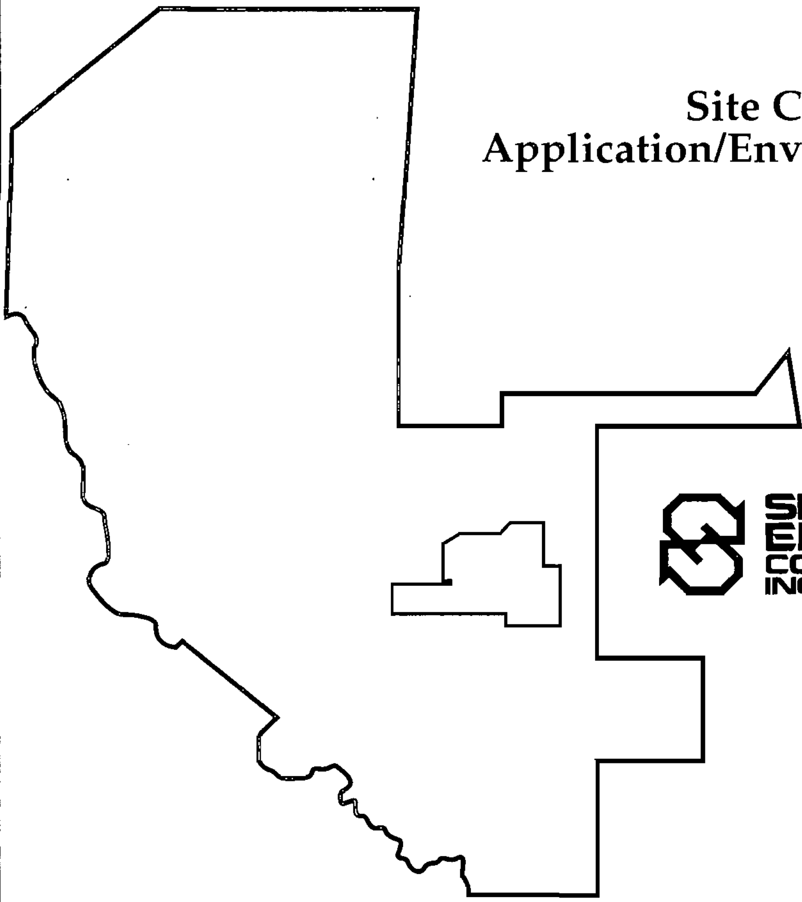
HARDEE UNIT 3

Site Certification Application/Environmental Analysis



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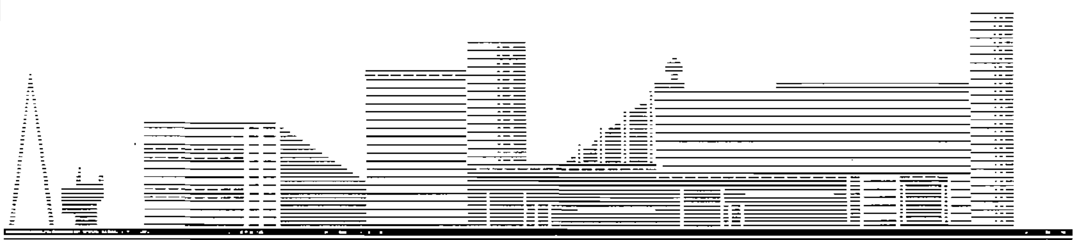


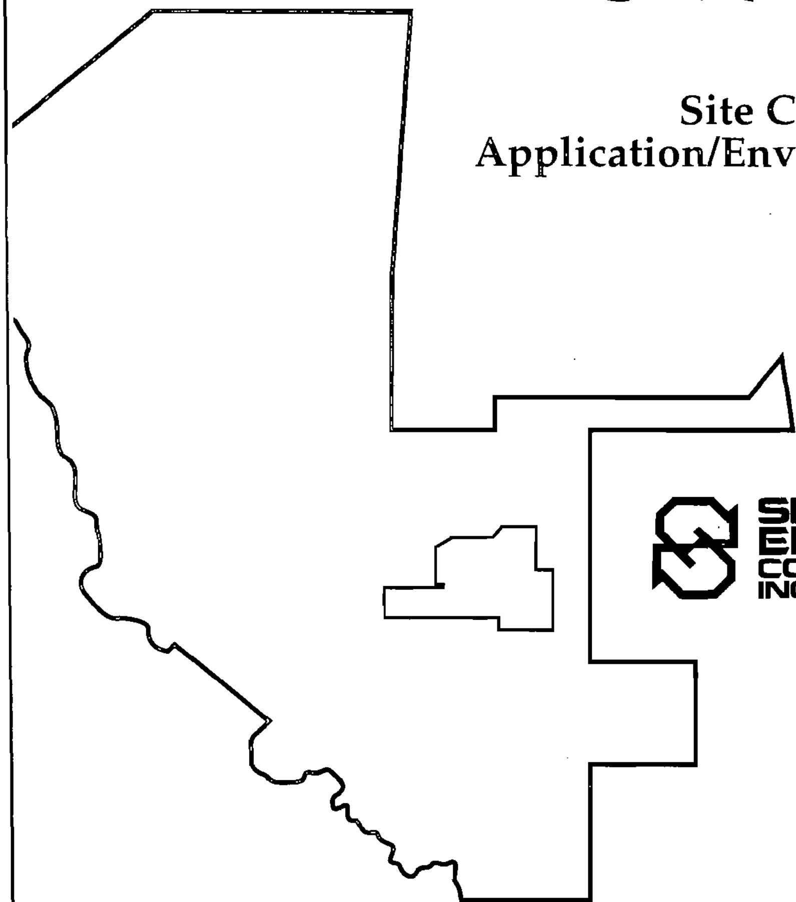
Chapter 6.0

6.0 TRANSMISSION LINES AND OTHER LINEAR FACILITIES

There are no transmission lines or other linear facilities associated with Hardee Unit 3.

HARDEE UNIT 3

Site Certification Application/Environmental Analysis



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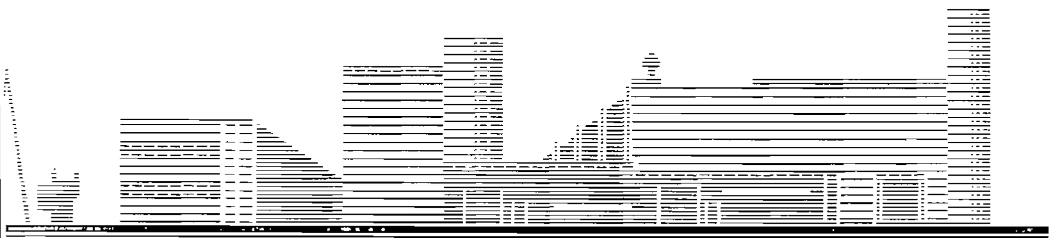


Chapter 7.0

7.0 ECONOMIC AND SOCIAL EFFECTS OF PLANT CONSTRUCTION AND OPERATION

TABLE OF CONTENTS

7.1 SOCIO-ECONOMIC BENEFITS

The purpose of this chapter is to:

1. Identify the economic and social effects of construction and operation of the addition to the existing Hardee Power Station (HPS); and
2. Quantify the project benefits and costs to the groups affected in the area surrounding Hardee Unit 3 as well as other people and businesses in Hardee County, the Central Florida Region, and the state.

The Central Florida Region, as defined in Section 2.2.7-1, includes DeSoto, Hardee, Highlands, Okeechobee, and Polk counties.

Socio-economic 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 socio-economic costs and 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 and benefits involving the construction and operation personnel's use of private and public services in the vicinity of the site. Baseline data supporting this section are contained in Section 2.2.

For purposes of the economic analysis, a 30-year operating life for the 440-MW generating unit was assumed. However, it is recognized that the actual operating life may be longer, thereby extending the economic benefits as well.

7.1.1 DIRECT SOCIO-ECONOMIC BENEFITS

7.1.1.1 TAX REVENUES

Both direct and indirect tax benefits will accrue as a result of the construction and operation of the Hardee Unit 3 Project. Local revenues will be derived from property taxes paid on the property and the onsite facilities. State taxes will accrue in the form of taxes levied on the construction and operating supplies required to construct the facility.

Assuming a 30-year life for operation, it is estimated that approximately $82 million (nominal dollars) in ad valorem property taxes will be paid to Hardee County over the life of the facility. These taxes will be spilt between the Hardee County general fund (52.6 percent of total), the Hardee County school district (44.9 percent), and the Southwest Florida Water Management District (SWFWMD) and Peace River Basin Taxing Authority (2.6 percent).

Direct benefits of plant construction will result from the purchase of materials and equipment and construction contracts. Materials, equipment, and contracts for construction of the additional unit will cost about $189.8 million (1997 dollars), with 9.5 percent, or about $18 million, for goods purchased regionally.

7.1.1.2 EMPLOYMENT

Among the primary direct benefits of the facility will be the increase in job opportunities within the region associated with both plant construction and operation. As noted in Section 2.2.7.1, Polk and Hardee counties are labor surplus areas: a situation which is reflected in unemployment rates that are among the highest in the state and the country. While the region's population is expected to grow at a slower rate than employment opportunities over the next several years, many women and older persons are entering the labor market, thus increasing the workforce competing for the jobs. Employment opportunities provided at the proposed facility will not solve the unemployment problem in this area; however, they will directly contribute to lowering the unemployment rates.

An average of 229 workers will be employed over the 24-month construction period required for this facility. Employment is expected to peak at approximately 450 workers. The total construction payroll for this facility is estimated at $70.2 million.

Operation of the additional unit will employ approximately 35 persons who will work in three shifts with an annual payroll of $2.7 million.

Equal employment opportunities for all persons has been identified as a major priority of the Central Florida Regional Planning Council (CFRPC) Comprehensive Policy Plan. Seminole Electric Cooperative Incorporated (SECI) maintains full compliance with all applicable federal, state, and local regulations regarding equal employment opportunity and affirmative action.

operation-phase employees and their dependents spend that income in the Central Florida Region, the demand for goods and services will increase.

Direct income increases are composed of construction wages, which total $70.2 million. In addition to construction wages, there will be wages paid to operating personnel. These wages amount to $1.3 million the first year of operation in 1999 and average $2.7 million annually over the next 29 years for a total of $79.6 million. The project workforce will likely be drawn from an area that includes Hillsborough County and the Central Florida Region. For construction and operational employees, due to current population characteristics it is assumed for this analysis that 85 percent reside in Polk and Hillsborough counties, with the remainder commuting from other counties in the Central Florida Region. With these workforce origin assumptions, the direct income increase from the project attributable to the Central Florida Region is estimated at $14.2 million over the construction and operation periods.

Indirect income induced from construction was estimated using the RIMS II model's regional earnings multiplier for electric power plant construction. Based on a total construction budget of $260 million and the RIMS II regional household earnings multiplier of 0.5669, the total indirect increase in income from construction of the project is estimated at $147.4 million. By deducting the total direct construction income estimate of $70.2 million for construction labor, the indirect income is estimated to be $77.2 million over the construction period.

Indirect income induced from operation was also estimated using the RIMS II model's regional earnings multiplier for electric power plant operations. Based upon an average annual operation and maintenance (O&M) expenditure of $5,237,000 and the RIMS II regional household earnings multiplier of 0.1789 for the Central Florida Region, the total induced income increase assignable to the operation of the additional unit is estimated to be about $936,899 in 1999. By deducting the total direct operations income estimate of $463,988 and assuming 30 percent of the induced income would occur in the Central Florida Region, indirect income increases are estimated at $472,901 in 1999.

7.1.2 INDIRECT SOCIO-ECONOMIC BENEFITS

7.1.2.1 EMPLOYMENT

The Central Florida Region employment will increase due to the Hardee Unit 3 Project for two reasons. First, there will be a direct employment increase of workers during construction and operation of the additional unit. Second, there will be induced employment from increased demand for goods and services in Hardee and Polk counties and, to a lesser extent, central Florida.

Employment increases resulting from the Hardee Unit 3 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 35.1 total jobs per $1 million in construction expenditures. Since the total construction budget including payroll is $260.0 million (1997 dollars), the total number of jobs created statewide by the Hardee Unit 3 Project is estimated to be 9,126 (i.e., 35.1 x 260.0). Of these jobs, 7,696 are considered direct employment, and the remaining jobs (1,430) are indirectly related to the project's construction.

Indirect benefits, in the form of increased spending and sales taxes paid on goods and services purchased privately by members of both the construction and operating workforce for the facility, will also add to the state and local economy. Since construction and operations workers are expected to be hired from areas within commuting distance of the site and will not require relocation for this project, their spending patterns within stores and service facilities are already established. Direct and indirect income generated from the construction of the Hardee Unit 3 Project is expected to be $98.8 million. Consequently, it is not anticipated that spending patterns in the local area will change to any noticeable extent or that this increase in local revenues will create any significant new demands on the local economy.

7.1.2.2 INCOME

Income in the Central Florida Region is expected to increase due to the Hardee Unit 3 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 Hardee Unit 3 Project. Second, there will be an induced component to the income increases. As the construction- and

ENHANCEMENT OF RECREATIONAL OR ENVIRONMENTAL VALUES

Construction and operation of this facility will utilize land previously mined for phosphate ore. The use of mined lands for the Hardee Unit 3 Project enhances land conservation by combining multiple industrial uses of the same land area. The site property will not be available for public use.

CREATION OR IMPROVEMENT OF LOCAL TRANSPORTATION FACILITIES

Offsite improvements to local roads, waterways, or other transportation facilities are not required.

7.2 SOCIO-ECONOMIC COSTS

7.2.1 <u>TEMPORARY EXTERNAL COSTS</u>

According to the Florida Department of Labor and Employment Security (FDLES), over 75,000 construction workers reside within the Central Florida Region. Since a more than adequate labor supply exists within commuting distance, and since a labor surplus exists within Hardee and Polk counties, it is anticipated that many workers will be hired from within the region, with minimal relocation required. Consequently, construction should have no effect on permanent housing or other public services within the region.

As is typical with longer construction projects, some workers commuting from the longer distances may choose to drive recreational vehicles to the area and reside temporarily near the site on a weekly basis, returning to their permanent homes and families on weekends. Several campgrounds providing various amenities and over 1,000 full hookups for recreational vehicles are located within the region which could serve these weekly commuters. Since commuting is not anticipated to be a problem, the number of workers who utilize the campground facilities is not expected to cause a change in usage patterns of normal users of these facilities.

Since workers will be commuting and not relocating permanently into the site region, it is not anticipated that construction workers will create any new or unusual impacts or demands on public facilities or services.

On-site construction activities should have no impact on area residents. The site is surrounded by mining operations on the north, east, southeast and west [(see Figure 2.2.3-1 for existing land use within 8 kilometers (km) (5 miles) of the site)]. That portion of the site boundary to the south and southwest not adjacent to the mines abuts Payne Creek and its associated wooded wetlands. Given the extensive buffers surrounding the site and the distance of more than 1.6 km (1 mile) to the nearest residences, onsite construction activities will not be generally visible and noise will be minimal at the property boundary (see Section 5.7.1).

7.2.2 LONG-TERM EXTERNAL COSTS

The facility impacts are minimal and localized. It is not on or near any public or private facilities utilized for recreational purposes. Consequently, Hardee Unit 3 will not cause any impairment to recreational values, result in any deterioration of aesthetic and scenic values, restrict access to areas of scenic or other values, displace persons from the land, cause loss of income, or result in significant costs to local government.

In addition, since the operational workforce is expected to be approximately 35 employees and all are assumed to be residing within commuting distance to the plant, impacts to local services (i.e., schools, police, fire, etc.) are expected to be minimal.

7.2.3 AESTHETICS

The Hardee Unit 3 site is located entirely within the existing HPS site which is approximately 1.6 km (1 mile) west of County Road (CR) 663 in Hardee County, just south of the Polk County line. Most of the site has been mined for phosphate and has recently been reclaimed as pasture. Adjacent industrial facilities include the HPS existing units and the IMC-Agrico phosphate facilities. The existing generating facilities are located southwest of the Hardee Unit 3 site. The 570-acre [230-hectares (ha)] cooling reservoir is located north and northwest of the Hardee Unit 3 site. The existing transmission lines exit the power station and follow Fort Green Road (CR 663) (east of the site) to the north and south, respectively. The site is located in a remote location away from areas of high viewer frequency and sensitivity.

The new generating facilities to be located onsite will include combustion turbines, steam turbines, and heat recovery steam generators (HRSGs) that will be located outside of an environmental enclosure (see Figure 3.2.0-2). The tallest structures located onsite will be the stacks associated with the HRSGs at 27 meters (m) [90 feet (ft)] and the bypass stack at 23 m (75 ft). The service building and warehouse will be at 11 m (36 ft) and 6 m (20 ft), respectively. The demineralizer and service/fire water tanks will be the tallest tanks at 14 m (45 ft) each, and the fuel oil storage tank will be 16 m (53 ft) high (see Table 3.2.0-1).

The exterior of the main plant buildings will be neutral colors to absorb and not reflect sunlight. The stacks will also be a neutral or dark color so as not to attract attention to the plant facilities.

To determine the potential visibility of the facility and the consequent visual impact, a series of "sight lines" were drawn from the center point of the stacks to locations of human habitation or visitation (roads). Because of the minimal area accessible to the general population in the vicinity of the Hardee Unit 3 site, site lines were drawn out to reasonably accessible locations within an approximate 8-km (5-mile) radius. Also, a windshield survey was conducted to determine the aesthetic impacts associated with the existing HPS facility.

The visual analysis found that from almost all accessible locations to the south, southwest, southeast, and east toward the facility (with the exception of Fort Green), area topography and vegetation will effectively block or screen views of the Hardee Unit 3 Project. The site is partially screened from traffic by dense stands of trees. Tree stands are present west, south, and east of the proposed site. Highway plantings also cover a 0.5-mile (0.8-km) stretch on the west side of CR 663 east of the site. Mining reclamation activities are in progress north and northeast of the site. The project facilities should only be visible to persons in vehicles traveling south on Fort Green Road in Polk County, north of the site, through a southwesterly viewing corridor. Vegetation in this corridor consists only of brush and scattered trees. Persons traveling north on CR 663 in Hardee County, south of the site, will only see the upper portion of the stacks, and possibly some structural steel, due to a dense tree screen to the south and east and phosphate pond containment berms east of the site.

In the small community of Fort Green a portion of the stacks may be visible. The stacks will be viewed from a distance of about 3.2 km (2 miles). In addition, they will be viewed through a mix of mining activities in the middleground of the view. The effect of the inclusion of the mined areas and the existing HPS facilities in the view will minimize the importance of the stacks and they should appear as just another industrial structure on the horizon. Once mining is completed the stacks will be a more dominant feature of the landscape. However, while some views of the tops of the stacks may be possible from Fort Green, the new structures will be in conformance with the previously established industrial character (existing HPS facility).

No views of the facility should be possible from the unincorporated community of Fort Green Springs which is located among citrus groves and on the back side of gently sloping ground leading to the Shirttail Branch of Payne Creek. Between the site and Fort Green Springs is Payne Creek and its associated wooded wetlands. The location of Fort Green Springs' residences among groves and the location of a considerable area of wooded wetlands in the middleground of the view will serve to effectively block views.

The only other areas likely to observe the plant on a regular basis are the county roads. With minor exceptions, the Hardee Power Station will be either blocked or screened from view by area vegetation and natural and manmade (berms around tailing ponds) topography. In addition, from those few location where views of the facility will be possible, the distance between the stacks and the viewer will minimize its importance and will also allow for the inclusion of numerous mining areas which will play a more dominant role in the view. In conclusion, like the Hardee Power Station, the Hardee Unit 3 Project is ideally located from a visual perspective. It is in conformance with the already dominant use of the area and will be screened or blocked from a large majority of the areas within 8 km (5 miles) which are accessible to the public.

The facility is not on or near any areas of noted scenic, historic, cultural, natural, or archaeological value. Consequently, Hardee Unit 3 will have no visual effect on such properties.

7.3 REFERENCES

The following references were used in developing data for Chapter 7.0:

1992 Florida Statistical Abstract. University of Florida Press: Gainesville, 1992.

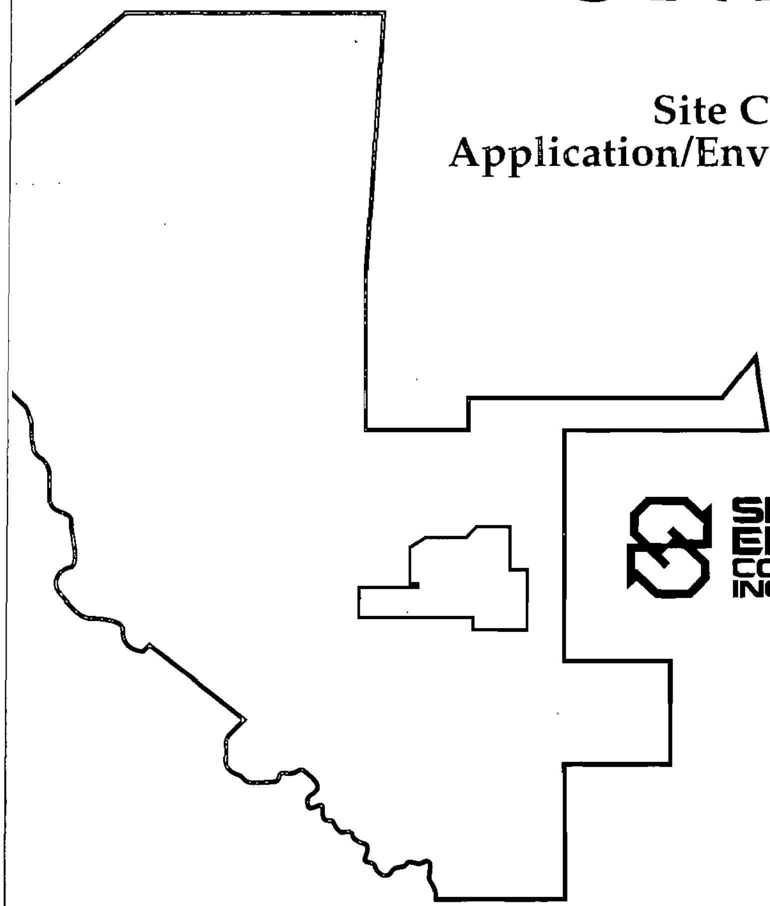
Florida Population: Census Summary 1990. Bureau of Economic and Business Research, College of Business Administration, University of Florida, Gainesville, Florida, 1991.

U.S. Department of Commerce Bureau of Economic Analysis. 1992. Regional Multipliers: A User Handbook for the Regional Input-Output Modeling System (RIMS II). U.S. Government Printing Office, Superintendent of Documents, Washington, DC.

U.S. Department of Commerce Bureau of Economic Analysis. 1992. 39-Industry by 39-Industry Multipliers for Output (Dollars). Regional Economic Analysis Division. Washington, DC, 1992.

HARDEE UNIT 3

Site Certification Application/Environmental Analysis



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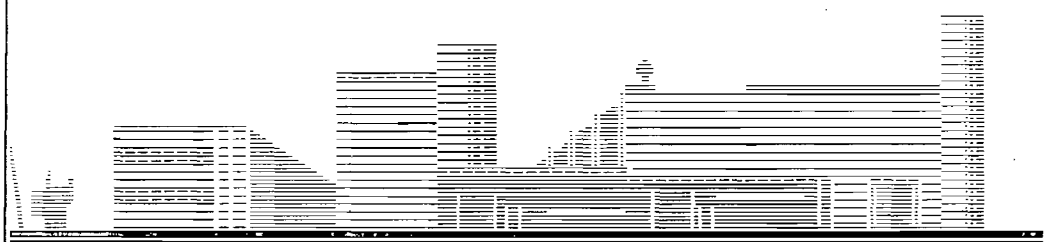

Chapter 8.0

8.0 SITE AND DESIGN ALTERNATIVES

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

8.1 ALTERNATIVE SITES

The following section is provided for compliance with National Environmental Policy Act (NEPA) regulations; the analysis is intended for use in the environmental analysis and supplemental environmental impact statement (EIS) to be prepared by Rural Electrification Administration (REA) and other cooperating federal agencies.

The Hardee Unit 3 Project represents an incremental increase in the overall generating capacity of the previously certified Hardee Power Station (HPS). The HPS site was selected based on the results of a site selection study to locate, evaluate, and recommend areas that were suitable for the construction and operation of an electric-generating facility. The site selection study was conducted to comply with the regulatory provisions of NEPA, REA requirements and guidelines for the siting and assessment of environmental impacts of power-generating facilities, and Florida Electric Power Plant Siting Act (FEPPSA). This study, referred to as the Combined Cycle Plant Site Selection Study [Environmental Science and Engineering, Inc., (ESE) 1988] was summarized in the original Site Certification Application/Environmental Assessment (SCA/EA) for the HPS [TECO Power Services/Seminole Electric Cooperative Inc. (TPS/SECI), 1989].

Because the proposed facility is an incremental increase to the previously sited HPS, a formal siting study was not conducted for the Hardee Unit 3 Project. Construction and operation of the Hardee Unit 3 facility at the existing HPS site ensures the beneficial use of the resources at the site and minimizes overall environmental and land use impacts associated with development of the additional generating capacity.

Specific benefits of locating the Hardee Unit 3 facility at the HPS site include:

1. Use of a previously impacted area. The HPS site has been used for both phosphate mining and power plant development.
2. Use of potentially shared facilities. The Hardee Unit 3 project will share a number of facilities with the HPS existing units including the existing cooling reservoir, transmission lines, access road, Floridan aquifer wells, and switchyard.
3. Construction of the Hardee Unit 3 project at a previously developed site, such as the HPS site, will result in fewer impacts than development of a green-field site.

4. Additional transmission lines will not be required to support the Hardee Unit 3 facility.
5. Utilization of existing facilities, such as the cooling reservoir, will increase the overall beneficial use of dedicated resources.

8.2 PROPOSED SITE DESIGN ALTERNATIVES

One of the most significant design alternative decisions relating to the steam portion of the proposed combined cycle unit is the selection of the preferred heat rejection system. This system is fundamental in the transfer and/or rejection to the atmosphere of waste heat from the condensation of the turbine exhaust steam. Optimization of the heat rejection system can serve to minimize plant capital and operation costs and environmental impacts.

HPS was originally certified for the construction and operation of a 230-hectare (ha) (570-acre) cooling reservoir with makeup from the Floridan aquifer for once-through condenser cooling. A Water Alternatives Study (see Appendix 10.11) was conducted for the Hardee Unit 3 Project to identify and evaluate all reasonable water sources within a 10-mile [16-kilometer (km)] radius of HPS. Results of this study showed that all condenser cooling needs for the Hardee Unit 3 Project could be met by the existing cooling reservoir. Furthermore, the previously certified groundwater allocation for both the reservoir makeup water and plant process water are adequate to meet the requirements of the entire 880-megawatt (MW) facility, including the incremental increase due to Hardee Unit 3.

Other potential water sources, including treated wastewater and water cropping, were identified by the Water Alternative Study, but none were found to be superior to the previously certified use of groundwater from the Floridan aquifer. A detailed description of all water sources evaluated and the ranking system used to identify the optimum water source is presented in Appendix 10.11.

Other project systems including fuel, generating technology, and disposal options proposed for the Hardee Unit 3 project are consistent with those described in the original HPS certification.

8.3 ALTERNATIVE FUELS

The primary fuel for the combustion turbines will be natural gas with No. 2 fuel oil being used as a secondary fuel when natural gas is unavailable. If these fuels become either uneconomical or unavailable, alternative fuels such as synthetic gas may serve as fuel sources. The Hardee Unit 3 will have the ability to utilize medium-British-thermal-unit (Btu) gas derived from advanced coal gasification technologies. The plant layout has been designed to allow the potential construction of a coal gasification plant. If fuel supplies or prices made this type of facility economical, a gasification plant could be separately permitted and constructed as an associated facility of HPS. Recent design enhancements of coal gasification processes allow the environmentally acceptable use of medium-Btu synthetic gas in combustion turbines.

This section briefly describes gasification technologies available to the project and potential environmental impacts of these technologies. Where possible, the environmental impacts were performed using quantitative assessment techniques; however, qualitative techniques were used as necessary.

8.3.1 GASIFICATION OVERVIEW

8.3.1.1 GENERAL STATEMENT

Several gasification technologies exist at various levels of development and demonstration to convert coal to medium-Btu synthetic gas (syngas). Three basic designs exist: fixed-bed, fluidized-bed, and entrained-flow gasifiers. Coal gasification is, simply, reacting coal in a reducing (oxygen-deficient) atmosphere with steam or water and oxygen or air to produce a product syngas composed primarily of hydrogen (H_2) and carbon monoxide (CO). The sulfur in the coal is converted to hydrogen sulfide (H_2S) and carbonyl sulfide (COS). Although the gasification process affects the overall plant design, the gasification step is only one part of the overall gasification plant. Other steps include syngas cooling and cleanup.

The gasifier most widely used throughout the world is a fixed-bed design. Most recent research and development of gasifiers for electrical power generation in the United States, however, has focused on the entrained-flow designs (i.e., those by Texaco, Shell, and Destec). The following section briefly describes features, advantages, and disadvantages of each of the three basic designs (fixed-bed, fluidized-bed, entrained-flow). Following the description of the basic designs, the processes of coal gasification are defined and potential impacts are discussed.

8.3.1.2 TYPES OF GASIFIERS

Fixed-Bed Gasifiers

Fixed-bed gasification is typically represented by the Lurgi gasifier, first successfully operated over 40 years ago and widely proven commercially. Coal is fed into the top of the gasifier while air or oxygen plus steam are added from the bottom.

Fixed-bed gasifiers have several advantages:

- High thermal efficiency by counter current mode of operation,
- High direct methane yield for high-Btu syngas production, and
- Low oxygen requirement.

Disadvantages of fixed-bed gasifiers include:

- Strict feed coal requirements in size and caking tendency,
- Excessive steam requirement for control of ash clinkering,

- Extensive wastewater treatment required by formation of coal tar and other hydrocarbons, and
- Relatively low throughput per gasifier.

Fluidized-Bed Gasifiers

In a fluidized-bed gasifier, a stationary bed of coal is suspended by oxygen and steam moving through the bed at a rate sufficient to lift the coal particles. This fluidizing action allows the coal, oxidant, and combustion gases to mix thoroughly. Temperature control is important in a fluidized bed gasifier to prevent bed slumping due to ash fusion. This type of gasifier is best suited to highly reactive coals (lignites or brown coals).

Advantages of fluidized-bed gasification are:

- Wide range of coal quality and fines can be used,
- Throughput is high compared to the fixed bed gasifiers,
- Operation is flexible,
- Reliability and safety are good because of simplicity and high solid inventory,
- Mixing of bed material alleviates local overheating,
- Gasifier configuration and operation is simple,
- Introduction and withdrawal of solids from gasifier are easy, and
- Raw gas contains no tars.

Disadvantages of fluidized-bed gasification are:

- High sensible heat loss due to high exit gas temperature,
- High fines carry over,
- High carbon content in ash,
- Large volume of fluidizing media is required, and
- Caking coal must be pretreated.

Entrained-Flow Gasifiers

Coal particles fed into an entrained-flow gasifier are entrained (carried away) by the reacting gases. Partial oxidation occurs faster and at higher temperatures and pressures than in the other two major types of gasifiers. Hence, the entrained-flow gasifiers are small in size. Combustion efficiency in terms of carbon conversion can be substantially increased when pure oxygen is used as the oxidant instead of air. The high operating temperature in an entrained-flow gasifier yields good carbon conversion. Due to high operating temperatures, heavy tars, oils, and phenols are not produced, reducing concern for byproduct storage and wastewater treatment. The ash material melts to form a glass-like slag which is collected and removed from the bottom of the gasifier. Gasification is followed by heat recovery to increase efficiency of the process.

Raw syngas exits the gasifier and is cooled and cleaned of particulate matter. Particulates entrained in the raw syngas stream leaving the gasifier are removed by either scrubbing with a wet spray-type scrubber or by filtering with ceramic filters. Following cooling and particulate removal, the syngas passes to an acid-gas removal unit where gaseous sulfur compounds, primarily H_2S and COS, are absorbed from the syngas by a solvent. The clean syngas is transferred to the gas turbine combustors. The sulfur compounds absorbed by the solvent pass to a Claus unit which converts them to elemental sulfur to be stored or sold as a byproduct. Tail gas from the Claus unit passes to a tail gas treatment system for further sulfur recovery. Treated tail gas is then routed to a tail gas incinerator.

Entrained flow coal gasifiers have been demonstrated to be the most technologically advanced method of coal gasification applicable to the power industry for electrical generation. This type of gasifier design has also been proven to be the most environmentally sound with the least amount of byproduct generation.

8.3.1.3 PROCESS DESCRIPTION--ENTRAINED FLOW

This subsection discusses processes associated with coal gasification which are applicable to entrained flow coal gasifiers. Figure 8.3.1-1 presents a simplified block diagram of a typical entrained flow coal gasification plant coupled with a combined cycle power plant.

Coal is delivered to the gasifier by the coal-water slurry or as dry pulverized coal through a pneumatic feed system. The gasifier design and operation varies between the Texaco, Shell, and Destec Company processes. Basically, the gasifier is a vessel with combustion burners where coal, oxygen, and steam are injected in controlled proportions. Partial combustion with oxygen occurs at pressures of 25 to 42 kilograms per square centimeter (kg/cm^2) (375 to 600 pounds per square inch) gauge and high temperatures [1,260 to 1,540 degrees celsius (°C) (2,300 to 2,800 degrees Fahrenheit (°F))] to produce a medium-Btu raw syngas consisting mainly of CO,

H_2, some carbon dioxide (CO_2), and methane (CH_4). Oxygen must be supplied to the gasifier in relatively pure form. For purposes of reliable purity of product, as well as economics, a cryogenic air separation plant is utilized for oxygen production. Typically, gasifiers require 95 percent pure oxygen. Hot raw syngas produced during coal gasification is cooled to facilitate conventional syngas cleaning prior to combustion. The syngas is cooled by generating steam in syngas coolers which can be used for the gasification process and to generate power through a steam turbine generator.

The effluent water from the gasification process consists of purge streams removed from the process to limit the buildup of dissolved gases (particularly ammonia) and suspended solids. Major sources of wastewater from coal gasification include the gray waste stream from the wet particulate removal system and ammonia-laden condensate produced during syngas cooling. Minor sources of process wastewater are the acid-gas removal system and the Shell-Claus Offgas Treatment (SCOT) system.

Gaseous compounds present as various acid or sour gases [H_2S, COS, hydrocyanic acid (HCN)] are removed from the raw syngas prior to being sent to the combustion turbine using readily available commercial processes. These processes rely on chemical or physical absorption to remove these gases from the raw syngas. The acid gases are directed to a sulfur recovery unit, which converts the sulfur compounds to liquid elemental sulfur that can be stored or sold as a byproduct. Remaining unconverted sulfur compounds in the tail gas from the sulfur recovery unit are further cleaned in the SCOT tail gas treatment system. Vent gas from the SCOT unit are routed to an incinerator and burned. Overall sulfur removal rates from raw syngas by the desulfurization process generally range from 95 to 99 percent.

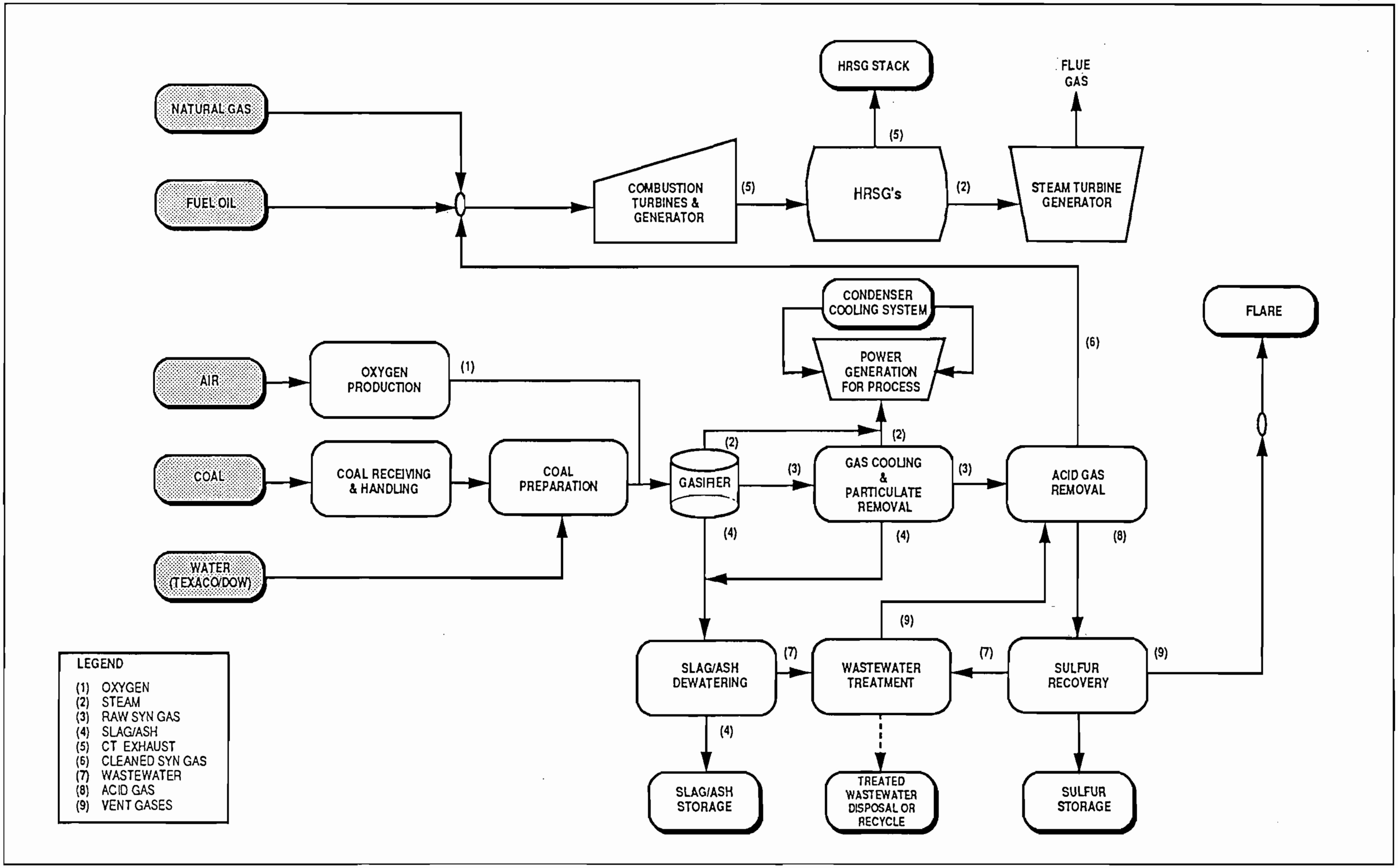

Figure 8.3.1-1
Block Diagram of Entrained Flow Coal Gasification Plant and Combined Cycle Power Plant

Source: KBN, 1994.

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8.3.2 DESIGN AND ENVIRONMENTAL CHARACTERISTICS

8.3.2.1 DESIGN BASIS

Several coal gasification technologies could be utilized for the project. As discussed previously, recent research and development, as well as demonstration projects, for electric power production using combustion turbines has focused on entrained flow designs, which are offered by Texaco, Shell and Destec. Such designs provide quality combustion turbine fuel, flexibility in using a wide variety of coals, high thermal efficiency, and acceptable environmental discharge. For the purpose of this characterization, it was assumed that an entrained flow gasification process would be constructed.

Preliminary design and environmental parameters are presented in Table 8.3.2-1 and are based on data published by the Electric Power Research Institute (EPRI) and the Cool Water Coal Gasification Program (CWCGP). The data sources are the most currently available and represent the approximate characteristics of a gasification plant that would be constructed. Details of actual design analysis will be presented at the time of submission of the permit application to construct and operate the coal gasification facility. Figure 8.3.2-1 presents a conceptual layout of the coal gasification facility at the site.

8.3.2.2 AIR EMISSIONS

Sources of air emissions for a coal gasification plant would include the plant flare stack, tail gas incinerator stack, process fugitive gas emissions, and fugitive dust emissions. Typical emission estimates from these sources have been quantified in Table 8.3.2-1.

The tail gas incinerator is used to oxidized the treated gas from the tail gas treatment system. The plant flare would be used during start-up, shutdown, emergency relief, and upset conditions. Start-up and shutdown experience at CWCGP indicate that flare operation is intermittent and of short duration (i.e., 1 to 4 hours about 8 to 12 times a month). If a process upset or emergency condition arises the flare would incinerate any gas remaining in the process trains; meanwhile, the gasifier would be shut down under such conditions.

Process fugitive gas emissions would result from numerous albeit small leaks from equipment (i.e., valves, pumps, compressors, and connections). Fugitive dust emissions would result from coal unloading, storage and preparation, and from slag/ash handling and storage.

Air emissions would continue to be emitted from the combustion turbines when firing clean synthetic gas. Sulfur dioxide (SO_2) emissions would be about the same or less than when firing No. 2 fuel oil. The sulfur removal efficiencies of the unit process typically range from 95 to 99 percent. Other emissions would be typical of natural gas firing.

8.3.2.3 WASTEWATER

The wastewater streams of a gasification plant primarily consist of gray water from slag/ash quenching and particulate removal, and condensates from the gasification process, raw gas cooling process, and sulfur recovery processes. Typical contaminants reported in wastewaters include ammonia, sulfide, chloride, fluoride, formate (high oxygen demand), cyanide and trace metals. A summary of the raw wastewater characteristics observed at CWCGP are presented in Table 8.3.2-2.

8.3.2.4 BYPRODUCTS

The physical and chemical characteristics of the gasifier slag will be a function of the type of coal selected and the gasification process. Insight into the physical and chemical characteristics of these byproducts can be acquired from the results obtained CWCGP existing data.

The physical characteristics of the slag suggest that the slag can be used for various road and building applications. The general chemical characteristics of CWCGP slag from trace element and leachate analyses show that the slag and the leachate are non-hazardous.

The Hardee Power Station would require a byproduct storage facility of approximately 22 ha (54 acres) based on a capacity factor of 100 percent over 30 years. Ideally, the applicant would attempt to sell the byproduct. Byproduct material would be placed in a storage area using the best management practices for utility solid byproducts storage sites.

Table 8.3.2-1. Typical Design Data for Gasification Plant Potentially Constructed at the Hardee Power Station (Page 1 of 2)

Design Category	Design Data	Basis for Estimate
UNIT SIZE & FUEL USE		
Net Generation (kW)	440,000	See Note 1
Heat Input (MMBtu/hr)	3,960	See Note 2
Coal Utilization (TPD)	4,320	See Note 3
Coal Delivery (rail cars/week)	288	See Note 4
COAL CHARACTERISTICS		
Heat Content HHV (Btu/lb)	11,000	Reference 1
Ash Content (%)	10.00	Reference 1
Sulfur Content (%)	4.50	Reference 1
PERFORMANCE		
Net Plant Heat Rate (Btu/kW)	9,000	See Note 5
AIR EMISSIONS		
1. Tail Gas Incinerator Stack		
NO_x (lb/hr)	6.3	Reference 2
CO (lb/hr)	5.32	Reference 2
SO_2 (lb/hr)	31.75	See Note 6
H_2SO_4 Mist (lb/hr)	0.49	See Note 7
Particulate Matter (lb/hr)	1.30	Reference 2
Hg (lb/hr)	0.0079	Reference 2
Be (lb/hr)	0.0004	Reference 2
Pb (lb/hr)	0.0025	Reference 2
2. Process Fugitive Emissions		
H_2S (lb/day)	5.50	Reference 3
SO_2 (lb/day)	11.01	Reference 3
CO (lb/day)	52.30	Reference 3
H_2SO_4 Mist (lb/hr)	2.75	Reference 3
Hydrocarbons (lb/day)	11.01	Reference 3
Hg (lb/hr)	2.75E-07	Reference 3
Be (lb/hr)	5.50E-05	Reference 3
Pb (lb/hr)	1.10E-03	Reference 3
3. Fugitive Dust		
Coal Handling & Storage - TSP (lb/day)	172	See Note 8
Coal Handling & Storage - PM10 (lb/day)	129	See Note 8
Slag/Ash Handling & Storage - TSP (lb/day)	112	See Note 8
Slag/Ash Handling & Storage - PM10 (lb/day)	96	See Note 8

Table 8.3.2-1. Typical Design Data for Gasification Plant Potentially Constructed at the Hardee Power Station (Page 2 of 2)

Design Category	Design Data	Basis for Estimate
WATER MAKEUP REQUIREMENTS		
Cooling System (gpd)	529,800	See Note 12
Process (gpd)	518	Reference 4
WASTEWATER DISCHARGE		
Treated Effluent (gpm)	288	Reference 3
Demineralizer Regenerant (gpm)	36	Reference 3
Misc. (gpm)	11	Reference 3
SOLID WASTE BY-PRODUCTS		
Slag/Ash (acre ft/yr)	72	See Note 9
Sulfur (TPD)	191	See Note 10
Water Treatment Sludges (acre ft/yr)	0.3	See Note 11

References:
1. ESE, 1988.
2. EPRI, December 1990.
3. EPRI, March 1989.
4. EPRI, January 1989.

Notes:
1. Assumes net plant output does not change when combined cycle plant is converted to a coal gasification combined cycle plant.
2. Calculated based on net generation and net plant heat rate.
3. Calculated based on heat input and coal heat content.
4. Calculated based on 105 tons/rail car.
5. Assumed heat rate based on References 3 and 4.
6. Calculated based on 98 percent sulfur removal and 99.9 percent sulfur recovery.
7. Calculated based on assuming 1 percent of the SO_2 is converted to H_2SO_4.
8. Calculated from maximum coal utilization and site layout.
9. Calculated based on ash content, a 90% slag/10% fly ash split, a density for slag and fly ash of 110 lb/ft^3 and 55 lb/ft^3 respectively, and a 100% capacity factor.
10. Calculated based on 98 percent sulfur removal.
11. Calculated based on 1 ton per day (Reference 3), or sludge density of 60 lb/ft^3 and a 100% capacity factor.
12. Calculated based on gasification plant size and cooling water use.

Sources: TPS/SECI, 1989.
Black & Veatch, 1994.
KBN, 1994.

Table 8.3.2-2. Summary of Raw Wastewater Characteristics from CWCGP

Chemical Parameter	Concentration by Wastewater Stream (mg/L)			
	Grey Water	Gasification Condensate	SCOT Condensate	Selexol Condensate
Alkalinity	990	39,000	9,545	19,900
Ammonia	721	13,630	3,325	7,815
COF	677	160	852	17,200
Cyanide	6	36	25	302
Sulfide	ND	170	644	3,254
Fluoride	9	4	3	24
Phenolics	<5	<5	<5	<5
TOC	448	447	107	2,809
Inorganic Carbon	15	6,313	1,919	3,186
Chloride	135	2	2	6
TDS	1,500	68	225	71
Calcium	150	<0.5	<0.5	<0.5
Sodium	200	7	13	1
Boron	58	<1.0	<1.0	<1.0
Arsenic	0.026	<0.02	<0.02	<0.02
Barium	0.63	<0.001	0.056	<0.02
Cadmium	<0.001	<0.001	<0.001	<0.001
Chromium	<0.005	0.038	<0.005	<0.005
Lead	0.0066	<0.005	<0.005	0.0059
Mercury	<0.001	0.001	0.008	0.008
Selenium	0.15	0.053	<0.008	0.13
Silver	<0.05	<0.05	<0.05	<0.05

Source: Zeien et al., 1986

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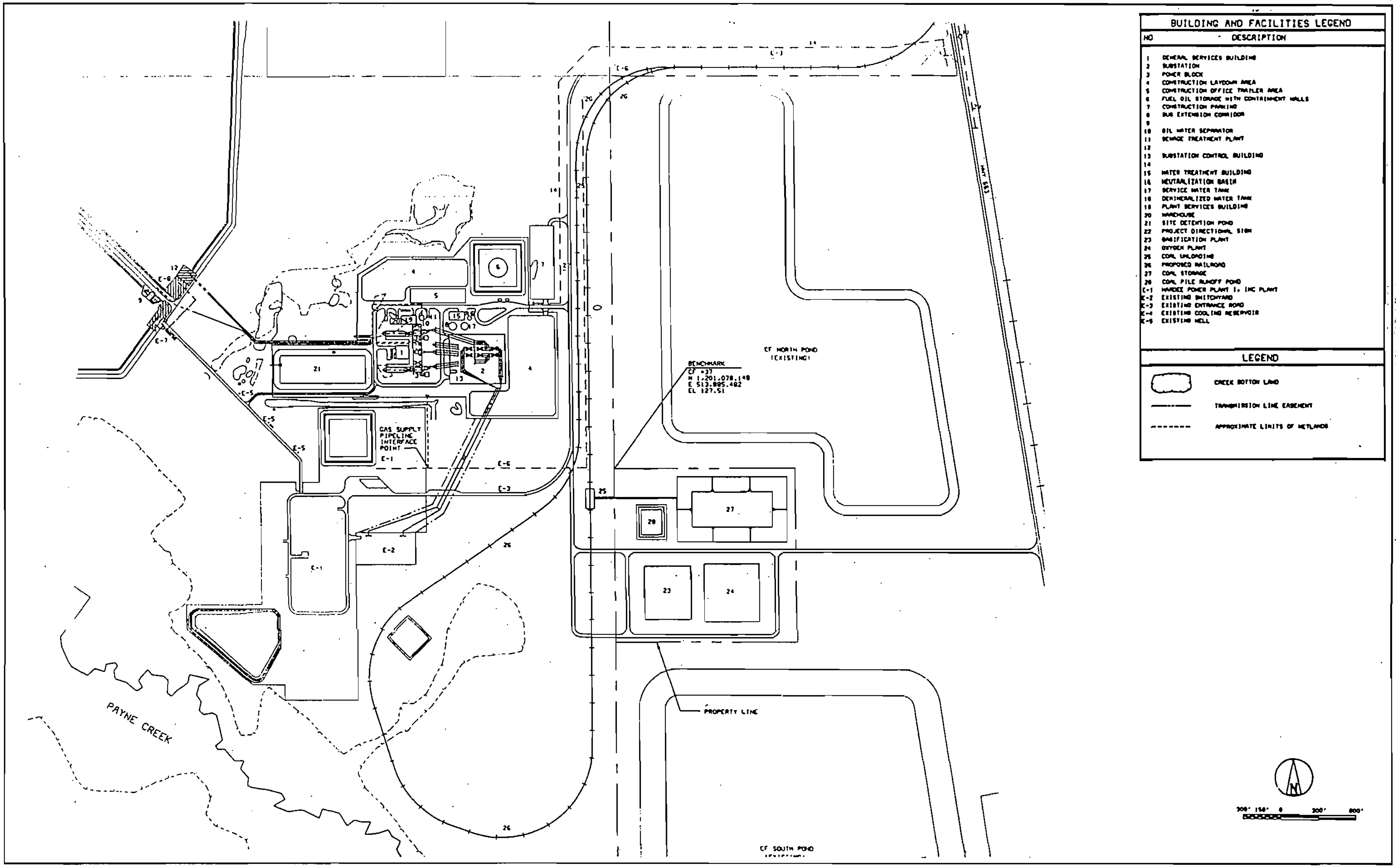

Figure 8.3.2-1
Conceptual Layout of a Coal Gasification Facility at the Site

Source: Black & Veatch, 1994.

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8.3.3 POTENTIAL ENVIRONMENTAL IMPACTS

The potential environmental impacts associated with a gasification plant are related to the air emissions, cooling water requirements, wastewater generated, and byproducts storage. The subsections that follow discuss the potential impacts of these factors, as well as control technologies that would likely be installed. These subsections present potential impacts in general terms since a specific coal and gasification process has not been made.

8.3.3.1 AIR EMISSIONS IMPACTS

The potential air quality impacts from a coal gasification plant are primarily associated with the tail gas incinerator. The plant also produces an intermittent source of air emissions which results from start-up and emergency conditions where raw synthetic gas would be incinerated by the plant flare. Air pollutant emissions from the combined cycle plant using medium-Btu coal gas would be similar to using distillate fuel oil; therefore, these impacts were previously addressed in Section 5.6.

The maximum potential impacts are predicted to occur during start-up and emergency conditions. As previously discussed in Subsection 8.3.2.2 these conditions are infrequent. Availability data for the acid-gas removal and sulfur recovery processes were stated by EPRI (1989) to be 99.17 percent and 99.13 percent, respectively. Thus, flaring of raw synthetic gas or acid gas having high sulfur contents would be unlikely during normal operations.

The maximum predicted impacts for those sources which operate continuously are expected to be less than the Prevention of Significant Deterioration (PSD) increments and ambient air quality standards (AAQS). Indeed, the majority of the impacts are less than the promulgated significant impact levels.

8.3.3.2 COOLING RESERVOIR PERFORMANCE WITH GASIFIER THERMAL LOADING

The thermal loading associated with cooling water from the coal gasification unit would increase the overall temperature and rate of evaporation in the existing cooling reservoir. Based on the results of the thermal modeling conducted for Hardee Unit 3 (see Section 5.1.1), additional heat dissipation and makeup water would be required for the coal gasification unit. Additional heat dissipation could be obtained through the use of cooling towers or supplemental cooling techniques in the reservoir. Additional cooling water makeup could be obtained from one of the potential sources identified in the Water Alternatives Study (see Appendix 10.11).

8.3.3.3 WASTEWATER TREATMENT

There would be three major sources of process wastewater from the gasification process; gray water blow down, stripped condensate, and slag/ash sump water. The combined flow from these sources would be a maximum of 290 gallons per minute (gpm) or 0.42 million gallons per day (mgd). The quality of raw wastewater is not known but can be expected to be a function of both the coal source and the gasification process used.

Treatment of these wastewaters would likely be necessary. The class of parameters requiring treatment include oxygen demanding compounds (primarily formate), ammonia, inorganic suspended solids (with occasionally high concentrations of various metals), and the dissolved fraction of several metals. Examples of the alternative treatment systems which may be employed to treat the above constituents are discussed below.

Oxygen demanding compounds can be removed from wastewater streams either by biological or chemical processes. Given the probable nature of the gasifier wastewater, it is likely that a biological treatment unit (and, specifically an activated sludge unit) would be used at the HPS site. The activated sludge process will create an excess biological mass (i.e., sludge) which must be treated prior to disposal. Typical sludge treatment includes anaerobic digestion (for the removal of organic compounds) followed by dewatering and drying. The digested sludge will be disposed of either by land application or land filling (depending on sludge quality).

Removal of ammonia from wastewater streams is usually accomplished by air stripping. Removal of inorganic suspended solids is typically achieved through a physico-chemical treatment process (e.g., coagulation, flocculation and sedimentation). Removal of dissolved metals is accomplished using a process similar to the physico-chemical treatment used for inorganic suspended solids. The difference is that for dissolved metals, the dissolved fraction must be precipitated after which it can be coagulated and settled.

Treatment of the wastewater generated would likely include a series of several treatment processes. The final sequencing of the treatment units would be dependent on the waste stream characteristics specific to the selected gasification process and coal characteristics. Such characteristics include oxygen demand, pH, and organic content of the settleable solids. Given the high degree of treatment, the quality of the treated effluent is expected to meet state and federal water quality standards and could be recycled in the process.

8.3.3.4 SOLID BYPRODUCT IMPACTS

Solid byproducts produced by the coal gasification plant would include slag, ash, and sulfur. Sulfur will be produced in liquid form by the Claus sulfur removal system. Sulfur will be sold as a marketable byproduct; however, it will need to be temporarily stored prior to transport from the site. Liquid sulfur will be stored in concrete-lined retention basins which will be enclosed with no potential for exposure to the environment.

Slag and ash are marketable byproducts for use as road building material and for other purposes. However, it was assumed that provisions would be required to store all slag and ash generated by the gasification of coal at or near the site. The byproduct storage facility will require a land area of approximately 22 ha (54 acres) over a lifetime expectancy of 30 years for the gasification facility. Roughly 392,100 kilograms (kg) (432 tons) per day of slag and ash would be generated, which translates to a maximum of 245 cubic meters (m^3) [8,640 cubic feet (ft^3)] per day. These calculations are based on anticipated plant syngas requirements and physical characteristics for maximum dry density and interconnected porosity of slag material.

EPA (1986) data have demonstrated that slag byproducts from entrained-flow coal gasifiers are non-hazardous based on Resource Conservation and Recovery Act (RCRA) criteria. In addition, results of leachate testing performed at CWCGP indicate that the leachate is also non-hazardous based on RCRA criteria.

8.3.4 ASSESSMENT OF TECHNOLOGY

Currently available gasification plant designs are technically feasible as an alternative fuel source for combustion turbines and can be constructed and operated at the HPS site in an environmental suitable manner. Any site specific environmental constraints could be overcome by proper design.

8.4 REFERENCES

The following references are cited in Chapter 8.

Black & Veatch. 1994. Data on Facility Design. Overland Park, KS.

Electric Power Research Institute (EPRI). 1989. Baltimore Gas and Electric Company's Study of a Shell-Based GCC Power Plant. Palo Alto, CA.

Environmental Science and Engineering, Inc. (ESE). 1988. Combined Cycle Plant Site Selection Study. Gainesville, FL.

KBN Engineering and Applied Sciences, Inc. (KBN). 1994. Data Collected and Analyzed for the Seminole Electric Cooperative Inc. Hardee Unit 3 Site Certification Application/Environmental Assessment. Gainesville, FL.

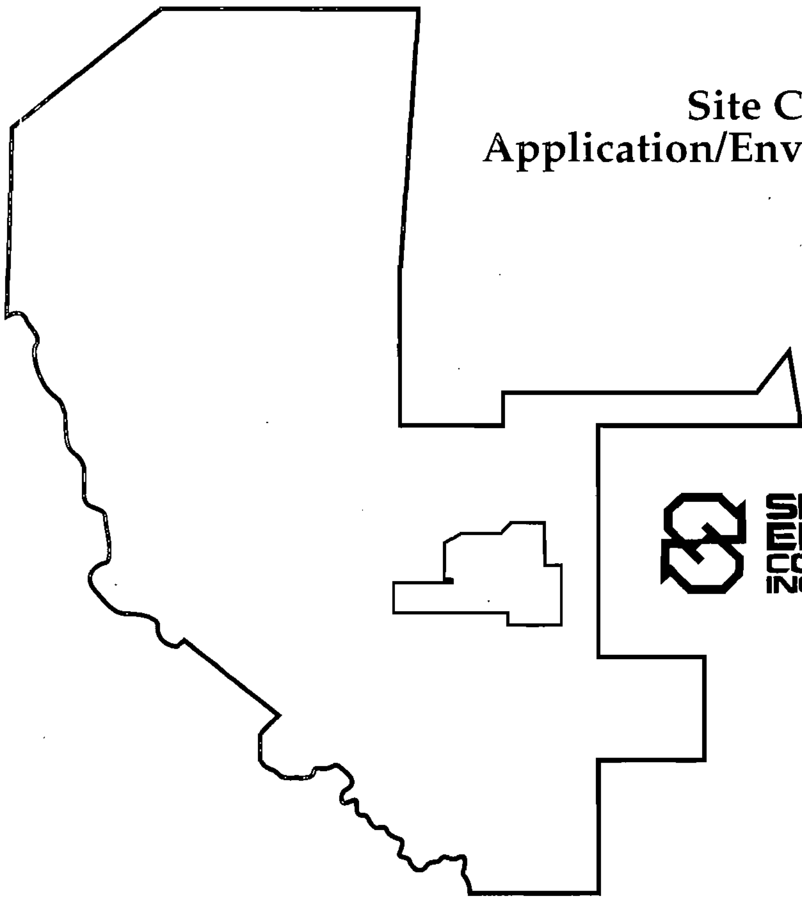
TECO Power Services/Tampa Electric Company/Seminole Electric Cooperative Inc. (TPS/SECI). 1989. Hardee Power Station Site Certification Application/Environmental Assessment.

U.S. Environmental Protection Agency (EPA). 1986. Coal Gasification Environmental Data Summary: Solid Wastes and By-Product Tars. Air and Energy Engineering Research Laboratory, Research Triangle Park, NC. EPA/600/57-86/015C.

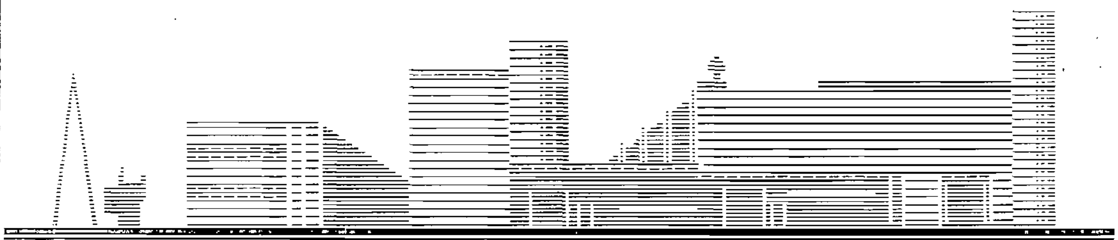
Zeien, C.T. *et al.* 1986. Treatment Studies on Coal Gasification Waste Waters. Presented at 6th EPRI Coal Gasification Contractors Conference, 15-16 October 1986, Palo Alto, CA.

HARDEE UNIT 3

Site Certification Application/Environmental Analysis



SEMINOLE ELECTRIC COOPERATIVE INCORPORATED



Chapter 9.0

9.0 COORDINATION

Federal, state, regional, and local agencies as well as the general public were contacted to provide input for the Hardee Unit 3 Project. These contacts involved both formal, multi-agency meetings and workshops, individual agency meetings and discussions, as well as meetings with public organizations. The following is a list of formal multiple-agency meetings and workshops.

- Florida Department of Environmental Protection (FDEP) Interagency Meeting:
  December 17, 1993: Tallahassee, Florida
  Purpose: To seek comment on proposed project, in particular, the Plan of Study.
- FDEP Interagency Meeting:
  December 8, 1993: Wauchula, Florida
  Purpose: To seek comment on proposed project, in particular, the Plan of Study.
- Public Workshops:
  March 9 and 10, 1994: Wauchula and Fort Meade, respectively
  Purpose: Provide information to local agency representatives and the public on the Hardee Unit 3 Project.

The following table presents an overall list of agency and public organization contacts.

Date	Agency	Purpose	Contact(s)
04/16/93	PSC	Introduce Hardee Unit 3 Project	Thomas Ballinger
04/29/93	Hardee County Commissioners	Introduce Hardee Unit 3 Project	V. Tomlinson
07/19/93	EPA	NPDES permitting requirements	Jim Patrick
10/08/93	Hardee County	Discussed zoning and land use designations for the site	R. Stauers
10/27/93	FDOT	Obtained FDOT traffic counts for local roadway network	J. Cranford
10/27/93	Hardee County	Obtained Hardee County traffic counts	Hardee County Staff
10/27/93	Polk County	Obtained Polk County traffic counts	Polk County Staff
10/28/93	USACE	Examined flagged USACE wetland line	Perry Horner
11/16/93	FDEP	Introduce Hardee Unit 3 Project	Mike Hickey
11/16/93	FDOT	Discussed turning movement counts for local roadway network	Steve Brown
11/22/93	CFRPC	Introduce Hardee Unit 3 Project	B. Sodt
11/22/93	FDOT	Discussed FDOT traffic counts	Joe Cranford

Date	Agency	Purpose	Contact(s)
12/07/93	DCA	Scoping meeting for POS	Paul Darst
12/07/93	FDEP	Scoping meeting for POS	Don Kell
12/07/93	FDEP	Scoping meeting for POS	Kevin Petrus
12/07/93	FDEP	Scoping meeting for POS	Scott Savery
12/07/93	FDEP	Scoping meeting for POS	Jan Mandrup-Poulsen
12/07/93	FDEP	Scoping meeting for POS and other communications	Buck Oven
12/07/93	FDEP	Scoping meeting for POS	Steve Partney
12/07/93	FDEP	Scoping meeting for POS	Doug Outlaw
12/07/93	FDEP	Scoping meeting for POS	Syed Arif
12/07/93	FDEP	Scoping meeting for POS	Craig Wiltz
12/07/93	FDEP	Scoping meeting for POS	Al Rushanan
12/07/93	FDEP	Scoping meeting for POS and other communications	Tom Rogers
12/07/93	FDEP	Scoping meeting for POS	Cleve Holladay
12/07/93	FDEP	Scoping meeting for POS	Steve Palmer
12/07/93	FDOT	Scoping meeting for POS	Sandra Whitmire
12/07/93	FDOT	Scoping meeting for POS	Cindy Price
12/07/93	FDOT	Scoping meeting for POS	Dawn Wolfe
12/07/93	REA	Scoping meeting for POS	Robert Quigel
12/08/93	EPA	Scoping meeting for POS	Ted Blisterfield
12/08/93	Polk County Planning	Scoping meeting for POS and other communications	Celeste Deardorff

Date	Agency	Purpose	Contact(s)
12/13/93	Wauchula City Commission	Introduce Hardee Unit 3 Project	Commission Members
12/14/93	Bowling Green City Commission	Introduce Hardee Unit 3 Project	Commission Members
01/11/94	FDEP	Conversation to discuss adjacent reclamation project.	Vicki Sharpe
01/12/94	SWFWMD	Meeting to discuss POS	Brian Starford
01/12/94	SWFWMD	Meeting to discuss POS	Howard Knight
01/12/94	SWFWMD	Meeting to discuss POS	P. Scott Laidlaw
01/12/94	SWFWMD	Meeting to discuss POS	Dawn Turner
01/12/94	SWFWMD	Meeting to discuss POS	William A. Hartman
01/12/94	SWFWMD	Meeting to discuss POS	Bob Vertel
01/18/94	Wauchula Kiwanis Club	Introduce Hardee Unit 3 Project	Club Members
01/19/94	SWFWMD Tampa/Brooksville	Introduce Hardee Unit 3 Project	M. Farrell
01/20/94	Wauchula Lions Club	Introduce Hardee Unit 3 Project	Club Members
01/27/94	Hardee County School Board	Introduce Hardee Unit 3 Project	School Board
01/28/94	FDEP	Conversation to discuss permitting requirements.	Robin Trindell
02/02/94	Polk County Water Resource Division	Introduce Hardee Unit 3 Discuss water reuse	J. Spence

Date	Agency	Purpose	Contact(s)
02/04/94	City of Bowling Green	Police protection	B. Brown
02/04/94	Hardee County	Fire Protection	M. Choate
02/04/94	Hardee County Sheriff	Police Protection	C. Harris
02/04/94	Hardee County	Solid Waste	Hardee County Staff
02/04/94	Hardee County	Potable/Wastewater	Hardee County Staff
02/04/94	Hardee County	Police protection	J. Brock
02/04/94	Polk County	Potable/wastewater supply	Doug Allen
02/07/94	SWFWMD (Bartow)	Wetland delineation SHW determination	M. Hurst
02/07/94	SWFWMD	Examined flagged SWFWMD wetland line	Mark Hurst
02/08/94	SWFWMD	Contact for data base search for construction file and water use fee file	Renetta Thompson
02/10/94	City of Fort Meade	Potable/Wastewater	L. Messer
02/10/94	Polk County	Fire Protection	Monroe
02/10/94	Polk County	Solid Waste	Polk County Staff
02/14/94	FDEP	Preapplication meeting to discuss material needed for SCA submittal	Trudy Bell
02/15/94	FDEP	Examined flagged wetland line and proposed mitigation site	Greg Colianni

Date	Agency	Purpose	Contact(s)
02/25/94	Hardee County Planning, Zoning Department	Introduce Hardee Unit 3 Discuss zoning, Comprehensive Plan	R. Stauers J. Latch